Proposed ECE scheme for 2014 batch

First Semester

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1.	UMA 001	Mathematics – I	3	1	0	3.5
2.	UPH 001	Applied Physics	3	1	2	4.5
3.	UES 002	Solid Mechanics	3	1	2	4.5
4.	UHU 001	Business and Technical Communication	2	0	2	3.0
5.	UTA 001	Engineering Graphics	2	4	0	4.0
6.	UTA003	Computer Programming	3	0	2	4.0
7.	UEC 101	Introduction to Electronics Engineering	2	0	0	2.0
		Total	**18**	**7**	**8**	**25.5**

Second Semester

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1.	UMA 002	Mathematics-II	3	1	0	3.5
2.	UCB 001	Applied Chemistry	3	1	2	4.5
3.	UTA 002	Manufacturing Process	2	0	3	3.5
4.	UES001	Electrical and Electronic Science	3	1	2	4.5
5.	UES 003	Engineering Thermodynamics	3	1	0	3.5
6.		Elective - I	3	1	0	3.5
		Total	**17**	**5**	**7**	**23.0**

Elective – I

1. Biological Application in Engineering
2. Introduction to Industrial Design
3. Electronics Measurements
4. Nuclear Physics for engineers
5. Mathematical Physics for engineers
6. Chemistry for life
7. Physics for Materials
8. Quantum Physics

Third Semester

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1	UHU 031	Organizational Behavior	3	1	0	3.5
2	UEC 301	Semiconductor Devices	3	1	2	4.5
3	UEC 402	Analog Communication Systems	3	1	2	4.5
4		Electromagnetic Field Theory and Transmission Lines	3	1	0	3.5
5	UEC 303	Signals and Systems	3	1	2	4.5
6	UEC 304	Network Analysis and Synthesis	3	1	0	3.5
		Total	**18**	**6**	**6**	**24**

Fourth Semester

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1.	UHU 081	Engineering Economics	3	1	0	3.5
2.	UEC 401	Digital Signal Processing	3	1	2	4.5
3.	UMA 032	Numerical and Statistical Methods	3	1	2	4.5
4.		Engineering Design (includes project with 8 self effort hours)	2	0	4	8.0
5.	UEC 404	Analog Electronics Circuits	3	1	2	4.5
6.	UEC 405	Digital Electronic Circuits	3	1	2	4.5
		Total	**17**	**5**	**12**	**29.5**

Fifth Semester

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1.	UHU 003	Human Values, Human Rights and IPR	2	1	0	2.5
2.		Digital Communication Systems	3	1	2	4.5
3.		Microprocessors and Microcontrollers	3	1	2	4.5
4.		VLSI Design	3	1	2	4.5
5.		Microwave Engineering	3	1	2	4.5
6.		Computer Architecture	3	1	0	3.5
		Total	**17**	**6**	**8**	**24**

1.		Six Weeks Summer Training	0	0	2	4.0

Sixth Semester

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1.	UMA 031	Optimization techniques	3	1	0	3.5
2.		Antenna and Wave Propagation	3	1	2	4.5
3.		Linear Integrated Circuit Analysis	3	1	2	4.5
4.	UCS 406	Data Structures and Analysis	3	0	2	4.0
5.		Embedded Systems	3	1	2	4.5
6.		Capstone Project: Part A(START, WITH 2 HOURS SELF EFFORT)	0	0	2	2.0
7.		Innovations & Enterpreneurship (5 Self Effort Hours)	1	0	2	4.5
		Total	**16**	**4**	**12**	**27.5**

Seventh Semester

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1.	UEC 702	Fiber Optic Communication	3	1	2	4.5
2.	UEC 703	Modern Control Systems	3	1	0	3.5
3.	UEC704	Wireless and Mobile Communication	3	1	2	4.5
4.	UEC 701	ASICs and FPGAs	3	0	0	3.0
5.		Department Elective - I	3	1	2	4.5
6.		Capstone Project: Part B (CONTINUED, WITH 8 Hours Self Effort)	0	0	4	6.0
		Total	**15**	**4**	**10**	**26.0**

Eighth Semester

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1.	UEC 891	Project Semester	-	-	-	16.0
		Total				**16.0**

OR

Eighth Semester

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1.		Department Elective –II	3	0	0	3.0
2.		Department Elective –III	3	0	0	3.0
3.	UEC 892	Project	0	0	0	10.0
		Total	**6**	**0**	**0**	16.0

List of Electives

Elective –I

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1.	UEC 611	Digital System Design	3	1	2	4.5
2.	UEC 721	Analog IC Design	3	1	2	4.5
3.	UEC 722	DSP Processors	3	1	2	4.5
4.	UEC 723	Soft Computing Techniques	3	1	2	4.5

Elective –II

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1.	UEC 812	Telecommunication Engineering	3	0	0	3
2.	UEC 813	Wireless Sensor Networks	3	0	0	3
3.	UEC 814	Power Electronics	3	0	0	3
4.	UEC 815	Audio and Speech Signal Processing	3	0	0	3

Elective –III

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1	UEI 717	Bio-Medical Engineering	2	0	2	3
2.	UEI 718	Virtual Instrumentation	2	0	2	3
3.	UCH 715	Alternate Energy Sources	3	0	0	3
4.	UPH 062	Nano-Science and Nano-Materials	3	0	0	3
5.	UMA 062	Graph Theory and Applications	3	0	0	3
6.	UTA 004	Information Technology	2	0	2	3
7	UEC 821	Video Signal Processing	3	0	0	3

UEC301: SEMICONDUCTOR DEVICES

L	T	P	Cr
3	1	2	4.5

Course objective: Students will be able to study and analyze the output characteristics of semiconductor devices viz. PN junction diode, Zener diode, Tunnel diode, Schottky Barrier diode, Diode Photo and LED. Students will also be able to study the Input and output characteristics of Bipolar, FET, MOSFET Students will also able to check the response of biasing circuits, switching characteristics and high frequency analysis for hybrid T-model and π model of Bipolar transistors

Semiconductor Physics: Energy bands in solids(Metals, Semiconductor, Insulators), Drift current, Diffusion Currents, Intrinsic, Extrinsic semiconductor, Mass action law, Charge densities, Conductivity of metals and semiconductors, Concept of Fermi levels in Intrinsic and Extrinsic semiconductor, Concept of degenerative doping, Compensated semiconductor.

Semiconductor Devices: p- n junction diode: Ideal diode, V-I characteristics of diode, Diode small signal model, Diode switching characteristics, Zener diode, Tunnel diode, Schottky Barrier diode, Diode Photo, LED, JFET, MOSFET, MESFET, Their construction, Operation and Characteristics.

Bipolar Junction Transistor: Operation of transistor and its current components, Transistor circuit configuration: CB, CE, CC (Relationship between α, β, γ), Input-output characteristics, Concept of Q point and load line, DC and AC analysis, Ebers-Moll Model, Biasing circuits and stability criterion, Switching characteristics of transistor, The h-parameter model of CE, CB and CC configurations, Inter-conversion of hybrid parameters, Analysis of BJT Amplifier using h-parameters.

High frequency analysis of transistor: High frequency hybrid T-model for CB and π model for CE transistor, High frequency capacitances, fα, fβ and fT-parameters in terms of current gain, Transistor amplifier parameters using re model.

Field Effect Transistors: Biasing of JFET and MOSFET, Load line, Equivalent circuits of the device and analysis of FET amplifiers, High frequency model of MOSFET amplifier, MESFET and its characteristics.

Power Supplies: Half-wave and Full wave p-n diode rectifier, Bridge rectifier, Filter circuits, Zener diode as a Voltage Regulator, Series Voltage Regulators and I.C., Voltage Regulators.

Laboratory work :

Familiarity with CRO and Electronic Components.

1. Diodes characteristics (P-N Junction and Zener diode).
2. Characteristics of Schottkey barrier diode and comparison with ordinary p-n diode.
3. Input-Output characteristics BJT in Common Emitter Configuration.
4. Switching Characteristics of Diode and Transistor.
5. MOSFET characteristics, and evaluation of μ, gm and rd. verify μ= gm * rd.
6. Zener diode as voltage regulator.
7. Transistorized Series voltage regulator.
8. Half-wave and Full wave Rectifiers with filter and without filter and Estimation of ripple factor.
9. Bridge rectifier and Estimation of ripple factor.

Course learning outcome (CLO): The students will be able to

1. introduce basic physics of semiconductor

2 study and analyze the output characteristics of semiconductor devices

3. study the output characteristics of bipolar and mosfet
4. study the response of biasing circuits, switching characteristics and high frequency analysis for hybrid t-model and π model
5. have comparative study of output response for power supplies

Text Books

1. Milliman, J. and Halkias, C.C., Electronic Devices and Circuits, Tata McGraw Hill (2007) 2nd ed.

2. Boylestad, R.L. and Nashelsky, L., Electronic Devices & Circuit Theory, Perason Education (2007) 9th ed.

Reference Books

1. Malvino, L., Electronic principles, Tata McGraw Hill (1998) 5th ed.
2. Milliman, J. and Halkias, C. C., Intergrated Electronics, Tata McGraw Hill (2007) 2nd ed.

Evaluation Scheme:

SNo.	Evaluation Elements	Weight age (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UEC402- ANALOG COMMUNICATION SYSTEMS

L	T	P	Cr
3	**1**	**2**	**4.5**

Course objective: The main objectives of this course are to acquire knowledge about analog communication systems. To learn the operation of AM transmission and reception techniques. Moreover, to learn about FM and PM transmission and reception techniques. To acquire knowledge about pulse modulation techniques which are used to transmit the analog information signal using digital transmission techniques and knowledge about noise how it causes the distortion in analog communication systems.

Analog Modulation Techniques and AM Transmission: Introduction to analog modulation, Theory of amplitude modulation, AM power calculations, AM modulation with a complex wave, Concepts of angle modulation, Generation of Amplitude Modulation, Low level and high level modulation, Basic principle of AM generation, Square law modulation, Amplitude modulation in amplifier circuits, Suppressed carrier AM generation (Balanced Modulator) ring Modulator, Product Modulator/balanced Modulator.

AM Reception: Tuned Ratio Frequency (TRF) Receiver, Super heterodyne Receiver, RF Amplifier, Image Frequency Rejection, Cascade RF Amplifier, Frequency Conversion and Mixers, Tracking & and Alignment, IF Amplifier, AM detector, AM detector with AGC, Double hetro-dyne receiver, AM receiver using a phase locked loop (PLL), AM receiver characteristics.

SSB Transmission: Introduction, Advantages of SSB Transmission, Generation of SSB, The Filter method, The Phase Shift Method, The Third Method, AM Compatible SSB Modulation, Pilot Carrier SSB, Independent Side-band Systems (ISB), Vestigial Side-band Modulation (VSB), VSB-SC, Application of AM and FM in TV transmission.
SSB Reception: SSB Product Demodulator, Balanced Modulator as SSB Demodulator, Pilot Carrier SSB Receiver, Compatible SSB (CSSB) Receiver, ISB/Suppressed Carrier Receiver, Modern Communication Receiver.

FM/PM Transmission: Theory of frequency modulation, Mathematical analysis of FM, Spectra of FM signals, Narrow band FM, Wide band FM, Phase modulation, Phase modulation obtained from frequency modulation, FM allocation standards, Generation of FM by direct method, Varactor diode Modulator, Indirect generation of FM, The Armstrong method RC phase shift method, Frequency stabilized reactance FM transmitter, FM stereo transmitter, Noise triangle. Comparison of AM, FM and PM

FM/PM Reception: Direct methods of Frequency demodulation, Travis detector/frequency discrimination (Balanced stop detector), Foster seely of phase discriminator, Ratio detector, Indirect method of FM demodulation, FM detector using PLL, Zero crossing detector as a Frequency Demodulator, Preemphasis / deemphasis, Limiters, The FM receiver, RF Amplifier, FM stereo receiver, Square, Triangular, Sinusoidal FM generation Voltage controlled oscillator

Analog Pulse Modulation: Introduction, Pulse amplitude modulation (PAM), Natural PAM Frequency Spectra for PAM, PAM Time Multiplexing Flat-top PAM, PAM Modulator Circuit, Demodulation of PAM Signals, Pulse Time Modulation (PTM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), PPM Demodulator, Spectra of pulse modulated signals, SNR calculations for pulse modulation systems**.**

Noise: Noise, Resistor noise, Multiple resistor noise sources, Noise Temperature, Noise bandwidth, Effective input noise temperature, Spot and integrated Noise figure and equivalent noise temperature of a Cascade, Bandpass noise representation, Noise calculation in Communication Systems, Noise in Amplitude Modulated System, Noise in angle modulated systems, SNR calculation for AM and FM**.**

Laboratory work : Study of AM modulators / demodulators: (Balanced modulator, Ring modulator) / (Balanced modulator Super heterodyne Receiver), Study of FM/PM modulators/demodulators: (direct method, Varactor diode Modulator, Indirect generation of FM) / (Balanced stop detector, Foster seely of phase discriminator, Ratio detector), FM stereo receiver,

Course learning outcome (CLO): The students will be able to

1. acquired knowledge about communication systems
2. have knowledge about AM transmission and reception techniques
3. learn FM and PM transmission and reception techniques
4. acquired knowledge about pulse modulation techniques
5. acquired knowledge about noise

Text Books:

1. Kennedy, G., Electronic Communication Systems, McGraw-Hill (2008) 4th ed.
2. Lathi.B.P., Modern Digital and Analog Communications Systems 3rd ed.

Reference Books:

1. *Taub, H., Principles of Communication Systems, McGraw-Hill (2008) 3rd ed.*
2. *Haykin, S., Communication Systems, John Willey (2009) 4th ed.*
3. *Proakis, J. G. and Salehi, M., Fundamentals of Communication Systems, Dorling Kindersley (2008) 2nd ed.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC303: SIGNALS AND SYSTEMS

L	T	P	Cr
3	1	2	4.5

Course objective: Aim of this subject is to develop analytical capability of students, by which they would be able to handle real-time signal processing related problems and projects. The knowledge of various transforms will help students to work in multi-disciplinary fields of engineering in group activities.

Representation of Signals and Systems: Signals, Basic continuous time signals, Energy and power signals, System modeling concepts, Linear time invariant systems, Representation of signals in terms of impulses, Discrete time LTI systems continuous time LTI systems, Properties of LTI systems, Systems described by differential and difference equations, Introduction to Sampling theorem of sinusoidal and random signals, Quantization.

Fourier Analysis: Continuous and discrete time Fourier series, Trigonometric & exponential Fourier series, Properties of Fourier series, Parseval's theorem, Line spectrum, Rate of conversion of Fourier spectra, Continuous and discrete time Fourier transforms and its properties, Analysis of discrete time signals and systems, Correlation, Autocorrelation, Relation to Laplace transform.

The Z-Transform: Definition of Z-transform and Z-transform theorems, Relation between Z.T. and F.T., Transfer function, Inverse Z-transform, Discrete time convolution, Stability, Time domain and frequency domain analysis, Solution of difference equation.

Introduction to Fast Fourier Transforms: Discrete Fourier transform, Properties of DFT, Fast Fourier transforms, Divide and Conquer Approach, Decimation in time and decimation infrequency, Radix-4 FFT, Linear Convolution, Circular Convolution, Power spectrum and correlation with FFT.

Random Signals: Probability, Random variables, Gaussian distribution, Transformation of random variables, Random processes, Stationary processes, Correlation and Covariance Functions, Regularity and Ergodicity, Gaussian Process, Transmission of deterministic and undeterministic signals through a linear time invariant system, Spectral density.

Laboratory Work: Signal generation, Solving difference equation, Calculating Z-transform, Linear and Circular convolution, Correlation, DFT/IDFT, FFT algorithms using Matlab.

Course learning outcome (CLO): The students will be able to

1. development of analog as well as discrete signal generation and applications; and to learn the physical significance of random signals and its applications in the emerging field of communication engineering
2. development of linear as well as nonlinear techniques for the conversion of discrete-time signals and systems to digital signals and systems
3. application of fourier series and fourier transform in the field of communication and signal processing
4. application of z-transform in the field of communication and signal processing
5. application of laplace transform in the field of control system engineering
6. application of laplace transform in the field of control system engineering
7. ability to use fft/ifft for implementation in vlsi signal processing

Text Books:

1. *Oppenheim, A.V. and Willsky, A.S., Signal & Systems, Prentice Hall of India (1997) 2nd ed.*
2. *Proakis, J.G. and Manolakis, D.G., Digital Signal Processing Principles Algorithm &Applications, Prentice Hall (2007) 4th ed.*

Reference Books:

1. *Lathi, B.P., Modern Digital and Analog Communication Systems, Oxford Univ. Press (1998)3rd ed.*

2. *Papoulis, A., Probability Random Variables and Stochastic Processes, McGraw Hill (2008)2nd ed.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC304: NETWORK ANALYSIS AND SYNTHESIS

L	T	P	Cr
3	**1**	**0**	**3.5**

Course objective:

At the end of the course the student should be able to analyze complex electrical circuits using Kirchoff's voltage and current laws. He should be able to obtain transient and steady state values of electrical quantities from the given circuit parameters. The student should be able to apply network theorems to reduce complex circuits to a simpler form and identify cut-sets, tie sets and forward paths in an equivalent graph.

Introduction: Introduction to Active and Passive Circuit components, Voltage and Current sources, Dependent and Independent sources, KCL, KVL, Mesh and Nodal analysis, Duality, Introduction to graph theory.

Network Theorems and Two Port Network Descriptions: Thevenins theorem, Nortons theorem, Maximum power transfer theorem, Superposition theorem, Reciprocity theorem, Two port description in terms of open circuit impedance Parameters, Short circuit admittance parameters, Hybrid parameters, ABCD parameters, Image parameters, Inter-connection of two port network, Reciprocity and Symmetry conditions in two port networks.

Time domain analysis: Transient and Steady state analysis of networks using differential equation methods and Laplace Transform methods, concepts of time constants and initial conditions.

Network functions: Driving point Impedance and Admittance function, Properties of driving point impedance and transfer function, Minimum Function , Poles & Zeros of network functions, Restrictions on poles and zeros locations for driving point and transfer functions. Reliability of one port Networks, Positive real function (PRF), Graphical Interpretation of positive realness, Properties of PRF, Even & Odd parts of Polynomials, Necessary & Sufficient Condition for a function to be positive real function, Hurwitz polynomials, Hurwitz polynomials test,

Network Synthesis: Network synthesis procedure, Synthesis of one port networks with two kinds of elements, Realization of LC driving point function, Synthesis of LC, RC and RL driving point impedance function using Foster and Cauer first and second forms.

Course learning outcome (CLO): The students will be able to

1. understand the basics of different types of circuit components and their analysis procedures.
2. do analysis based on network theorems and to determine the current, voltage and power.
3. analyze two port networks and to analyze time response of the circuit.
4. check stability of a circuit and to design the circuit using foster and cauer forms

Text Books:

1. Vanvalkenberg, M.E., Networks Analysis, Prentice Hall of India (2007) 3rd ed.
2. Arshad, M., Network Analysis and Synthesis, Laxmi Publications (2008) 2nd ed. **Reference Books**

1. Kuo, F., Network Analysis and Synthesis, John Wiley (2003) 2nd ed.
2. Anderson, B.D.O., Vongpanitlerd, S., Network Analysis and Synthesis, Dover Publications (2006) 3rd ed.2.

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UEC401: DIGITAL SIGNAL PROCESSSING

L	T	P	Cr
3	1	2	4.5

Course objective: At the end of the course the student should be able to perform Fourier analysis of continuous and discrete time signals. He should be able to compute Fourier transform in a number of ways e.g. divide and conquer and butterfly method. The student should be able to convert analog filters to digital ones and design IIR and FIR filters using standard techniques. He should be able to design linear predictors for adaptive signal processing and obtain results from multirate signal processing.

Review of Z transforms, Continuous and discrete time Fourier Series and Fourier Transforms, Discrete Fourier Transform, Divide and Conquer Algorithm, Decimation-in-Time and Decimation-in-Frequency FFT Algorithms

Implementation of Discrete-Time Systems: Structures for the Realization of Discrete-Time Systems, Structures for FIR Systems like Direcl-Form Structure, Cascade-Form Structures. Frequency-Sampling Structures1. Lattice Structure. Structures for IIR Systems, Direct-Form Structures.Signal Flow Graphs and Transposed Structures. Cascade-Form Structures, Parallel-Form Structures. Lattice and Lattice-Ladder Structures for IIR Systems Quantization, round-off and over flow errors in Digital Filters.

Design of FIR Filters: Choosing between FIR and IIR Filters, Symmetrical, Asymmetrical FIR Filters, Window Methods- Rectangular, Triangular, Hamming, Hanning, Blackman, Kaiser Window etc, Frequency sampling Method, Optimum equiripple method and their comparison.

Design of IIR Filters: IIR filters using analog approximations by methods like Approximation of Derivatives, Impulse Invariance, Bilinear Transformation, Matched-Z transformation, Use of BZT and classical analog filters to design IIR filters.

Multirate Signal Processing: Concept of multirate signal processing, Decimation and interpolation by integer and non-integer factors, Design of practical sample rate converters and their software implementation, Efficient polyphase structures, Design of phase shifters.

Prediction: Linear prediction and optimum linear filters, Forward & backward linear prediction, Levinson-Durbin Algorithm, Schur algorithm, Properties of linear prediction error filters, Wiener filters for filtering and prediction.

Laboratory Work: Calculation of Z, Fourier transform-DFT, Design of FIR and IIR filters, Multirate signal processing, realization of prediction.

Course learning outcome (CLO): The students will be able to
1. acquired knowledge about communication systems
2. learn AM transmission and reception techniques
3. learn FM and PM transmission and reception techniques
4. acquire knowledge about pulse modulation techniques
5. acquire knowledge about noise

Text Books:
1. *Proakis, J.G., Digital Filters: Analysis, Design and Application, McGraw Hill (1981) 2nd ed.*
2. *Proakis, J.G., and Manolakis, D.G., Digital Signal Processing, PHI (2001) 3rd ed.*

Reference Books
1. *Antonion, Andrea,s "Digital Filters, Analysis, Design and Applications, McGraw Hill (2000) 2nd ed.*
2. *Oppenheim, A.V., and Schafer, R.W., Discrete-Time Signal Processing, Pearson (2002) 2nd ed.*
3. *Rabiner, C.R., and B. Gold, Theory and Applications of signal processing, PHI (1990) 4th ed.*
4. *Mitra , S. K., Digital Signal Processing: A computer based approach, Tata McGraw Hill (1996) 4 ed*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

ENGINEERING DESIGN

((Includes project with 8 self effort hours)

L	T	P	Cr
2	0	4	8

Course Objective: Understanding of Arduino microcontroller architecture and programming, Interfacing of Arduino board with various I/O devices. Serial data transmission using Arduino board.

Arduino Microcontroller:

Features of Ardunio Microcontroller, Architecture of Arduino, Different boards of Arduino, Arduino Interfacing and Applications, Anatomy of an Interactive Device like Sensors and Actuators, A to D converters and their comparison, Blinking an LED, LCD Display, Driving a DC and stepper motor, Temperature sensors, Serial Communications, Sending Debug Information from Arduino to Your Computer, Sending Formatted Text and Numeric Data from Arduino, Receiving Serial Data in Arduino, Sending Multiple Text Fields from Arduino in a Single Message, Receiving Multiple Text Fields in a Single Message in Arduino. Light controlling with PWM.

Introduction to ARM processor: Features of ARM processor, ARM Architecture, Instruction set, ARM Programming

Programming of Arduino: The Code designing step by step. Taking a Variety of Actions Based on a Single Variable, Comparing Character and Numeric Values, Comparing Strings, Performing Logical Comparisons, Performing Bitwise Operations, Combining Operations and Assignment, Using Embedded techniques to program Arduino microcontroller, Understanding the libraries of Arduino programming language and applying for circuit design

Laboratory work: Introduction to Arduino board. Programming examples of Arduino board. Interfacing of LED, seven segment display, ADC and DAC with Arduino board. Introduction to ARM processor kit.

Projects: Arduino based projects to be allocated by concerned faculty.

Text Books:

1. *Michael McRoberts, Beginning Arduino, Technology in action publications, 2nd Edition.*
2. *Alan G. Smith, Introduction to Arduino: A piece of cake, CreateSpace Independent Publishing Platform (2011)*

Reference Book:

1. *John Boxall, Arduino Workshop - A Hands-On Introduction with 65 Projects, No Starch Press; 1 edition (2013).*

Course Outcome: The student should be able to:

1. understand of features of Arduino board.
2. analyze of internal Architecture of Arduino board.

3. apply Arduino board programming concepts.
4. design and implement Buggy project based on different goals and challenges defined.

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1.	Mid Semester evaluation 1	20
2.	Mid Semester evaluation 2	20
3.	Mid Semester evaluation 3	20
4.	End Semester Evaluation	40

UEC404 ANALOG ELECTRONIC CIRCUITS

L	T	P	Cr
3	1	2	4.5

Course objective: Study the operation of Tuned Amplifiers, Power Amplifiers and Feedback Amplifiers. Study the operation of different Oscillator circuits viz. R-C phase shift, Hartley, Colpitts, Crystal and Wien Bridge Oscillators. Study the operation of different Wave shaping circuits viz. Multi-vibratotrs (Astable, Mono-stable, Bi-Stable), High pass and low pass filters using R-C Circuits and R-L, R-L-C Circuits, Clipping and Clamping circuits, Schmitt Trigger and Comparator

Tuned Amplifiers: Single tuned, double tuned and stagger tuned amplifiers and their frequency response characteristics.

Power Amplifiers: Class A, B, AB, Push pull & Class C amplifiers, Comparison of their Efficiencies, Types of distortion.

Feedback Amplifiers: Voltage and current feedback, Series and shunt feedback and their related circuits, Effect of feedback on performance characteristics of an amplifier.

Oscillators: Analysis of R-C phase shift, Hartley, Colpitts, Crystal and Wien Bridge Oscillators, Frequency stability criterion.

Wave shaping circuits: Multi-vibratotrs (Astable, Mono-stable, Bi-Stable), High pass and low pass filters using R-C Circuits and R-L, R-L-C Circuits & their response to step input, Pulse input, Square input and Ramp Input, Attenuators, Clamping Circuit theorem, Clipping and Clamping circuits, Schmitt Trigger, Comparator.

Laboratory Work:

1. Frequency response analysis of RC coupled amplifier.
2. Frequency response analysis of Tuned amplifiers.
3. Push-pull amplifier.
4. Frequency response analysis of Feedback amplifier.
5. Hartley and Colpitts Oscillator.

6. RC Phase shift oscillator.
7. Study of Multi-vibrators (Astable, Mono-stable, Bi-stable Multi-vibrator).
8. Clipper and Clamper circuit.
9. Schmitt Trigger.

Course learning outcome (CLO): The students will be able to

1. understand the concept of multistage amplifiers, analysis of multistage amplifier and its frequency response, Darlington pair and bootstrap circuits.
2. study the basics of tuned amplifiers such as single tuned, double tuned, stagger tuned & power amplifiers.
3. study and analyze the performance of negative as well as positive feedback circuits.
4. study and analyze the wave shaping circuits and operational amplifies

Text Books:

1. *Milliman, J. and Halkias, C.C., Intergrated Electronics, Tata McGraw Hill (2007) 2nd edition.*
2. *Milliman, J. & Taub, H., Pulse, Digital and switching waveforms, Tata McGraw Hill (2007) 3rd ed.*

Reference Books:

1. *Malvino, L., Electronic principles, Tata McGraw Hill (1998) 5th ed.*
2. *Cathey, J. J., 2000 Solved Examples in Electronics, McGraw Hill (1991) 4th ed.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC405 DIGITAL ELECTRONIC CIRCUITS

L	T	P	Cr
3	1	2	4.5

Course objective: Students can understand number systems and codes. They can have an idea of postulates of Boolean algebra and correlation between Boolean expressions. They can understand the formal procedures for the analysis and design of combinational circuits and sequential circuits. An introduction to the concept of programmable logic devices and digital ICs will also be given. The students can design combinational and sequential digital logic circuits on the basis of understanding of the subject.

Number Systems: Binary codes, Error detection and correction codes.

Combinational circuits: Simplification of Boolean functions by Q. M. method, Half adder, Full adder, BCD adder, High speed adder, Subtractor, Code conversion, Magnitude comparators, Encoders, Decoders, Multiplexers, Demultiplexer, Application of Encoders, Decoders, MUX, DEMUX, Implementations using ROM, PLA, PAL.

Sequential circuits: Various types of flip-flops and their conversions, Registers, Counters – Ring, Johnson, Asynchronous & Synchronous, Timing issues, Setup and hold times, Finite State Machines – Moore and Mealy, Design of Synchronous sequential circuits.

Logic Circuits: DTL, TTL, MOS, CMOS logic families their comparison, Detailed study of TTL, CMOS and their characteristics, Fan-in, Fan-out, Unit load, Propagation delay, Power dissipation, Current & voltage parameters, Tristate Logic, Interfacing of TTL & CMOS logic families.

Laboratory Work: To study basic gates and design combinational circuits using them. To study latches and Flip flops, Design of registers and asynchronous/synchronous up/down counters, Variable modulus counters, Usage of IC tester.

Course learning outcome (CLO): The students will be able to

1. acquired knowledge about binary codes, logic minimization
2. design combinational circuits
3. design sequential circuits

4. acquire knowledge about logic families

Text Books:

1. *Mano, M.M., Digital Design, Prentice Hall (2001) 3rd ed.*
2. *Tocci, R.J., Digital Systems: Principles and Applications, Prentice-Hall (2006) 10th ed.*

Reference Books:

1. *Wakerly, J.F., Digital Design Principles and Practices, Prentice Hall of India (2006) 3rd ed.*
2. *Fletcher, W.I., Engineering Approach to Digital Design, Prentice Hall of India (2007) 4th ed.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC501: Digital Communication Systems

L	T	P	Cr
3	1	2	4.5

Course objective:

The aim of this course is to build the foundation for communication systems design focusing on the challenges of digital communications. It will help to discuss the different types of digital pulse and band pass signalling techniques. It will give the idea to understand the statistical analysis from estimation and detection theory. Course will help to analyze error performance of a digital communication system in presence of noise and other interferences and it will help to improve the performance of the system.

Pulse Modulation Systems: Model of digital communication systems, Noisy communications channels, Channel capacity of a discrete memory less channel – Hartley Shanon Law , Bandwidth – S/N tradeoff, Shannon's limit, Sampling theorem for baseband and bandpass signals: natural sampling, Flat top sampling, Signal recovery & holding, Quantization of signal, Quantization error, Source coding & companding, Pulse code modulation (PCM), Noise in PCM systems, Differential pulse code modulation (DPCM), Adaptive pulse code modulation (ADPCM), Delta modulation (DM), Comparison of PCM, DPCM and DM, Adaptive delta modulation, Quantization noise, Time division multiplexed systems (T & E type systems), Calculation of O/P signal power, The effect of thermal noise, O/P signal to noise ratio in PCM, Quantization noise in delta modulation, The O/P signal to quantization noise ratio in delta modulation, O/P signal to noise ratio in delta modulation, Intersymbol Interference, Nyquist criterion for distortionless baseband binary transmission.

Digital Formats and Baseband Modulation: Unipolar and bipolar, Duo binary signaling, Modified duo binary signaling, Correlative coding, NRZ, RZ, Signal design or pulse shaping for band-limited channels for no intersymbol interference and controlled ISI, Sinc function, Reconstruction filter, Raised cosine spectrum, Filter roll off factor, Data detection for controlled ISI, Eye-pattern.

Probabilistic Detection: Gram Schmidt Orthogonalization procedure, Geometric interpolation of signals, Response of bank of correlators to noisy input, Detection of known signals in noise, Probability of error concepts &

criteria of estimation, Maximum likelihood estimation, Union bound on probability of error detection of a single real-valued symbol and detection of a signal vector, A posteriori probability detection, Symbol-error probability for MLSD, Non coherent detection.

Digital Modulation Techniques: Digital modulation formats, Coherent binary modulation techniques, Coherent quadrature-modulation techniques, Comparison of binary and quadratery modulation, Coherent binary ASK, PSK, FSK, QPSK, Non coherent binary modulation techniques, M-ary modulation techniques, Comparison of signal constellations and power spectra analysis, QAM, CPPSK, DPSK, MSK, GMSK, Bandwidth efficiency, Bit error, Bit error vs symbol error probabilities, PLL, DPLL, Direct digital synthesis, ADPLL, Coherent and non-coherent receivers, Correlator, Optimum receiver, Matched filter receiver, Probability of error of the matched filter receiver, Error calculations under AWGN channel for digital modulation techniques.

Digital Transmission: Digital transmission through band limited channels, Digital modulated signals with memory, System design in the presence of channel distortion, Channel equalization: Optimal Zero Forcing and MMSE equalization, Generalized equalization methods, Fractionally spaced equalizer, Transversal filter equalizers, DFE and error propagation. Laboratory Work Practicals based upon hardware using communication kits and simulation with the help of simulation packages.

Laboratory work : Practical’s based upon hardware using communication kits and simulation with the help of simulation packages.

Course learning outcome (CLO): The students will be able to

1. identify, analyze, design (prototype) and simulate the pulse modulation systems working under the various capacity constraints
2. incorporate digital formats and m-ary baseband modulations for interference suppression /excision to enhance the signal to noise ratio
3. perform statistical analysis of transmitted and received modulated waveforms from estimation and detection point of view
4. evaluate different digital modulation techniques under non-zero probability of symbol error floor in the presence of awgn and other channel characteristics

5. minimize the symbol error rate by utilization of channel equalizers and optimum receivers
6. improve the overall performance of digital communication systems by implementing signal to noise ratio enhancement techniques

Text Books:

1. *Proakis John G., Digital Communication System, McGraw, (2000) 4th ed.*
2. *Simon Haylein, Digital Communication Systems, Wiley India edition, (2009) 2nd ed.*

Reference Books :

1. *Taub & Schilling, Principles of Communication Systems, McGraw Hill Publications, (1998) 2nd ed.*
2. *Simon Haykin, Communication Systems, John Wiley Publication, 3rd ed.*
3. *Sklar, Digital Communications, Prentice Hall-PTR, (2001) 2nd ed.*
4. *Lathi B. P., Modern Analog and Digital Communication, , Oxford University Press, (1998) 3rd*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC502: MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	Cr
3	1	2	4.5

Course objective: To Introduce the basics of microprocessors and microcontrollers technology and related applications. Study of the architectural details and programming of 16 bit 8086 microprocessor and its interfacing with various peripheral ICs; Study of architecture and programming of 8051 microcontroller.

Introduction: General definitions of microprocessors and micro controllers, Similarities and Dissimilarities between microprocessors and microcontrollers. Overview of 8086 microprocessor.

INTEL 8086 Microprocessor: Pin Functions, Architecture, Characteristics and Basic Features of Family, Segmented Memory, Interrupt Structures. INTEL 8086 System Configuration: Clock Generator (8284), Bus Controller (8288), MIN/MAX Modes of 8086 and System Configurations.

8086 Programming: Description of Instructions. Addressing Modes, Assembly directives. Assembly software programs with algorithms, Loops, Nested loops, Parameter Passing etc.

Interfacing with 8086: Interfacing with RAMs, ROMs along with the explanation of timing diagrams. Interfacing with peripheral ICs like 8255, 8254, 8279, 8259, 8259 etc. Interfacing with key boards, LEDs, LCDs, ADCs, and DACs etc.

8051Micro controller: Overview of the architecture of 8051 microcontroller. Overview of the architecture of 8096 16 bit microcontroller. Description of Instructions. Assembly directives. Assembly software programs with Algorithms. Interfacing with keyboards, LEDs, 7 segment LEDs, LCDs, Interfacing with ADCs. Interfacing with DACs, etc

Laboratory Work: Introduction to INTEL kit, Programming examples of 8086 and 8051. Interfacing of LED seven segment display, ADC, DAC, stepper motor etc. Microprocessor/Microcontrollers based projects.

Projects: Microcontroller 8051 based projects to be allocated by concerned faculty.

Course learning outcome (CLO): The students will be able to

1. acquired knowledge about microprocessors and its need
2. identify basic architecture of different microprocessors
3. write the programming using 8086 microprocessor
4. understand the internal architecture and interfacing of different peripheral devices with 8086 microprocessor
5. write the programming using 8051 microcontroller
6. understand the internal architecture and interfacing of different peripheral devices with 8086 and 8051

TEXT BOOKS :

1. *Mckenzie, Scott, The 8051 Microcontroller, PHIs, (1995) 5th ed.*
2. *Hall, D.V., Microprocessor and Interfacing, Tata McGraw Hill Publishing Company, (2006) 2nd ed.*

REFERENCE BOOKS:

1. *Rafiquzzaman, M., Microprocessors and. Microcomputer-Based System Design, CRC Press, (1995) 2nd ed.*
2. *Gibson, Glenn A., Liu, Yu-Cheng., Microcomputer Systems: The 8086/8088 Family Architecture Programming And Design, Pearson, (2001) Ist ed.*
3. *Ayala, Kenneth J., The 8051 Microcontroller: Architecture, Programming, and Application, (2008) 2nd ed.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include	40

	Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	

UEC503: VLSI DESIGN

L	T	P	Cr
3	1	2	**4.5**

Course objective: The objective of this course is to get detailed understanding of the MOS transistor with all its relevant aspects like CMOS process, the static and dynamic operation principles and analysis and design of basic inverter circuits etc. To introduce the various VLSI design methodologies and to study the designing of combinational and sequential logic circuits and their characterization.

MOS Transistor Theory: Introduction to MOS Physics, MOSFET Work Function MOS Models, MOSFET Structure and Operation: Accumulation, Depletion and Inversion region; Weak and Strong Inversion, Threshold voltage, Current-Voltage characteristics, Body effect, MOSFET Scaling theory, Limits of miniaturization, Small geometry effects.

NMOS & CMOS Process technology: Evolution of ICs. Masking sequence of NMOS and CMOS Structures. Latch up in CMOS, Electrical Design Rules, Stick Diagram, Layout Design.

VLSI Design Methodologies: Design Strategies, Design flow, Semi-custom and full-custom design methodology, Concept of Cell Library.

Circuit Characterization: Resistive Load & Active Load MOS Inverters, NMOS Inverters, CMOS Inverters : Static Characteristics, Switching Characteristics, Interconnect Parasitics, Propagation Delay, Static and Dynamic Power Dissipation, Noise Margin, Logic Threshold Voltage, Logical effort, Driving large loads.

Combinational and Sequential Circuits: MOS Logic Circuits with Depletion NMOS loads, CMOS Logic Circuits, CMOS logic Styles, Realization of simple gates, Complex logic circuits, Pass Gate, Transmission Gate, Behavior of Bistable elements, SR Latch Circuit, Clocked Latch and Flip-Flop Circuits.

LABORATORY WORK : Familiarization with Circuit design/simulation tools (Cadence/Mentor/Tanner Tools) for schematic and layout entry, Circuit simulation using SPICE. DC transfer Characteristics of Inverters, Transient response, Calculating propagation delays, rise and fall times, Circuit design of inverters, Complex gates with given constraints. Circuit Simulation and Performance Estimation using SPICE. Layouts of Inverters & Complex gates, Layout Optimization, Design Rule Check (DRC), Electrical Rule Check (ERC), Comparison of Layout vs. Schematics, Circuit Extraction. A project based on the above exercises. **(15P)**

Course learning outcome (CLO): The students will be able to

1. understand the physics of MOS device
2. understand the CMOS process technology
3. design layout of CMOS circuits
4. understand the characteristics of CMOS circuits

5. understand the basic difference between static and dynamic CMOS logic circuits.
6. understand CMOS transmission gates, latches and registers

TEXT BOOKS:

1. *Kang ,Sung-Mo (Steve) & Leblebici, Yusuf., CMOS Digital Integrated Circuits Analysis & Design, McGraw Hill, (1999) 2 ed.*
2. *Uyemura, J. P., CMOS Logic Circuit Design, Kluwer Academic Publishers, (2002) 2nd ed.*

REFERENCE BOOKS:

1. *Weste N., & Eshraghian, K., Priciples of CMOS VLSI Design, Addison Wesley, (1998) 2nd ed.*
2. *Jan Rabaey, A. Chandrakasan & Nikolic, B., Digital Integrated Circuits – A Design Perspective, Pearson, (2003) 2nd ed*
3. *Weste ,Neil & Harris, David., CMOS VLSI Design: A Circuits & Systems Perspective, Addison Wesley, (2004) 3rd ed.*
4. *Pucknell D. A., & Eshraghian, K., Basic VLSI Design, Prentice Hall of India, (2007) 3rd ed.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC504 Microwave Engineering

L	T	P	Cr
3	1	2	4.5

Course objective: The main objectives of teaching Microwave Engineering students is to make them understand, the basic principles and underlying fundamentals of propagation of EM signals in the microwave range through waveguides, using Electromagnetic field analysis. To impart the knowledge of theoretical and practical aspects for the analysis of Microwave components in terms of scattering parameters and determination of their electrical characteristics. To allow the students in understanding the Generation and amplification of microwaves using Klystrons, magnetrons and traveling wave tubes. The use Semiconductors in microwaves like PIN diode and GUNN diode is also studied

Electromagnetic Plane Waves: Microwave Frequencies, IEEE microwave frequency bands, Microwave systems and measurements, Electromagnetic plane wave, Electric and magnetic wave equations, Poynting theorem, Uniform plane wave: reflection, Transmission and absorption, Plane wave in a good conductor, Poor conductor and lossy dielectric, Microwave radiation attenuation.

Microwave Components: Waveguide Microwave Junctions, Scattering matrix and their properties,

Microwave T junctions – H Plane Tee, E Plane Tee Rat Race Junction, Directional coupler – Two hole directional coupler, Single hole coupler and scattering matrix of a directional coupler, Waveguide joints, Bends, Corners, Transition & twists, Coupling probes & loops, Waveguide terminations, Reentrant cavities, Ferrite devices – faraday rotation in devices, Circulator & isolator, Microwave filter – YIG filter resonators, Phase shifters and microwave attenuators.

Wave Guides and Resonators: TE, TM Modes in rectangular & Circular wave guides, Wave guide excitation, characteristics impedance of waveguides, Rectangular, Circular and aperture coupling,Excitation of wave guides.

Microwave Tubes and Circuits: High frequency limitations of conventional tubes, Klystrons – two cavity klystron amplifier & oscillator, Multicavity klystron, Reflex klystron, Travelling wave & MW characteristics, Microwave cross-field tube magnetron – operation and MW characteristics, Helix TWT construction, Operation and applications.

Microwave Measurements: General measurement setup, Microwave bench, Power measurement –low, Medium & high, Attenuation measurement, Measurement of VSWR, Measurement of dielectric constant, Measurement of Impedance: using Smith Chart, Measurement with spectrum analyzer, Scalar & vector network analyzer operation, S-parameter and Q measurement.

Microwave Solid State Devices & Their Applications: P-I-N devices, GUNN Diode, IMPATT, SB diodes parametric amplifier.

Laboratory Work : To study the performance of mode characteristics of reflex klystrons circulator, Characteristics of Gunn diode, Directional coupler, Attenuator, Sliding screw tuner, Verify the relation of wavelength, Finding unknown impedance, VSWR measurement, E-plane, H-plane, Magic Tee, Computer based simulation experiments.

Course learning outcome (CLO): The students will be able to

1. study the performance of microwave components.
2. identify and study the performance of wave guides and resonators
3. study the performance of microwave components
4. study the comparative performance analysis of microwave tubes and circuits
5. study the measurement of impedance using smith chart

Text Book:

1. *Liao, S.Y., Microwave Devices & Circuits, Tata McGraw Hill (2006) 2 nd edition.*
2. *Collins, Robert, Foundation of Microwave Engineering, McGraw Hill (2005) 3 rd edition.*

Reference Books:

1. *Wolf E.A., and kaul, R., Microwave Engineering & Systems Applications, Wiley Interscience (2002) 4 th edition.*
2. *Sze, S. M., Physics of Semiconductor Devices, Wiley Eastern (2003) 2 nd edition.*
3. *Sarvate, V.V., Electromagnetic Fields & Waves, John Wiley & Sons (2004) 3 rd edition.*
4. *John G. Proakis, " Digital Communication", Mcgraw Hill, 2008.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC505: COMPUTER ARCHITECURE

L	T	P	Cr
3	1	0	4.0

Course objective: The main goals of teaching EMBEDDED SYTEM ARCHITECTURE to students are to introduce students to the modern embedded systems and to make them understand the working of such systems. To impart the knowledge and understanding of fundamental embedded systems design paradigms, parallel architectures, pipelining, Multiprocessor configurations and challenges related to these.Also to make them aware of the memory hierarchy followed in the modern computers and the main protocols governing their functioning. To make them gain knowledge regarding the interfacing of external serial and parallel communication devices with these systems

Fundamentals of Computer Design: Historical Perspective, Computer Types, Von-Neuman Architecture, Harward Architecture Functional Units, Basic Operational Concepts, Bus Structures, Performance metrics, CISC and RISC architectures, Control Unit.

Instruction Set Principles: Classification of Instruction set architectures, Memory Addressing, Operations in the instruction set, Type and Size of operands, Encoding an Instruction set. The DLX Architecture, Addressing modes of DLX architecture, Instruction format, DLX operations, Effectiveness of DLX.

Pipelining and Parallelism: Idea of pipelining, The basic pipeline for DLX, Pipeline Hazards, Data hazards, Control Hazards, Design issues of Pipeline Implementation, Multi-cycle operations, The MIPS pipeline, Instruction level parallelism, Pipeline Scheduling and Loop Unrolling, Data, Branch Prediction. Overcoming data hazards with dynamic scheduling,

Memory Hierarchy Design: Introduction, Cache memory, Cache Organization, Write Policies, Reducing Cache Misses, Cache Associatively Techniques, Reducing Cache Miss Penalty, Reducing Hit Time, Main Memory Technology, Fast Address Translation, Translation Look aside buffer Virtual memory,

Multiprocessors: Characteristics of Multiprocessor Architectures, Centralized Shared Memory Architectures, Distributed Shared Memory Architectures, Synchronization, and Models of Memory Consistency.

Input/output Organization and Buses: Accessing I/O Devices, Interrupts, Handling Multiple Devices, Controlling device Requests, Exceptions, Direct Memory Access, Bus arbitration policies, Synchronous and Asynchronous buses, Parallel port, Serial port, Standard I/O interfaces, Peripheral Component Interconnect (PCI) bus and its architecture, SCSI Bus, Universal Synchronous Bus (USB) Interface.

Text Books

1. Hennessy, J. L., Patterson, D. A., Computer Architecture: A Quantitative Approach, Elsevier (2009) 4th ed.

2. Hamacher, V., Carl, Vranesic, Z.G. and Zaky, S.G., Computer Organization, McGraw-Hill (2002) 2nd ed.

Reference Books

1. Murdocca, M. J. and Heuring, V.P., Principles of Computer Architecture, Prentice Hall (1999) 3rd ed.

2. Stephen, A.S., Halstead, R. H., Computation Structure, MIT Press (1999) 2nd ed.

Course learning outcome (CLO): The students will be able to

1. acquired knowledge about Fundamentals of Computer Design
2. identify basic Instruction Set Principles
3. understand Pipelining and Parallelism
4. understand the concept of Multiprocessors
5. understand the Memory Hierarchy Design and its interfacing with microprocessors
6. understand the Input/Output Organization and Buses.

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UEC601: ANTENNA AND WAVE PROPAGATION

L	T	P	Cr
3	1	2	4.5

Course objective: Students can understand the Antenna Basics, basic antenna parameters. The subject deals with field equations and power and phase patterns of point sources and array antennas. This course gives concise description of micro strip antennas with the basics of Maxwell equations. The students will be able to analyze practical design considerations of antennas. Also, this course will enable students to identify characteristics of different types of radio wave propagation.

Introduction to Basic Antenna parameters: Antenna as an element of wireless communication system, Antenna radiation mechanism, Types of antennas, Antenna parameters: Radiation pattern (polarization pattern, Field and phase pattern), Radiation intensity, Beam width, Gain, Directivity, Polarization, Bandwidth, Efficiency.

Antenna as a receiver: Effective height, Effective aperture, Power delivered to antenna as a receiver, Input impedance and friss transmission equation, Properties of uniform plane waves, Retarded vector and scalar potential, Radiation from an infinitesimal small current element, Radiation from an elementary dipole (Hertzian dipole), Power density and radiation resistance for small current element and half wave dipole.

Introduction to Antenna Arrays: Effect of ground on antenna performance (ground as a perfect electric conductor and lossy conductor. Linear Uniform Array of Two & Isotropic sources, Principles of pattern multiplication. Broadside arrays, End fire arrays. Array pattern Synthesis, Uniform Array, Binomial Array. Chebyshev Arrays.

Microstrip Antennas: Microstrip Antennas & their advantages, Media: Dielectric effect, Dielectric Loss Tangent- tan δ, Substrates,

Propagation of Radio Waves: Different modes of propagation: Ground waves, Space waves, Space wave propagation over flat and curved earth, Optical and radio horizons, Surface waves and Troposphere waves. Ionosphere, Wave propagation in the Ionosphere. Critical frequency, Maximum usable frequency (MUF), Skip distance. Virtual height. Radio noise of terrestrial and extraterrestrial origin

LABORATORY WORK: Plot of 2D & 3D radiation pattern of short dipole, Halfwave dipole in rectangular as well as polar coordinates. Simulation of beam pattern of broadside, End fire, Binomial, Chebyshev arrays. The simulation can be done using Matlab.

Course learning outcome (CLO): The students will be able to

1. identify basic antenna parameters
2. design and analyze wire and aperture antennas
3. design and analyze antenna arrays
4. perform various antenna measurements
5. identify characteristics of radio wave propagation

Text Books:

1. *Antenna Theory, Ballanis, John Wiley & Sons, 2003.*
2. *Antennas and Radio Propagation, Collins, R. E, McGraw-Hill,1987.*

Reference Books:

1. *Antennas, Kraus and Ronalatory Marhefka, John D., Tata McGraw-Hill, 2002.*
2. *Microwave & RF Design, Michael Steer, Sci.Tech Publishing, 2009.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC505: LINEAR INTEGRATED CIRCUITS ANALYSIS

L	T	P	Cr
3	**1**	**2**	**4.5**

Course Objectives: The main objectives of this course are to introduce the basic building blocks of linear integrated circuit and to teach the linear and non-linear applications of operational amplifiers. To design simple filters and oscillator circuits for particular application and to gain knowledge in designing a stable voltage regulators.

Introduction to Operational Amplifiers: Differential Amplifier, Transfer characteristics, CMRR, PSRR, current mirror, voltage references, Internal structure of Op-amp, ldeal Op-amp. Characteristics, Inverting and Non-Inverting Configuration, Ideal Open-Loop and Closed-Loop Operation of Op-Amp, Feedback Configurations, Differential Amplifiers using Op-Amps. Integrated Circuit: Package Types, Pin Identification and Temperature- Ranges.

Frequency Response of an Op-Amp: Introduction to Frequency Response, Compensating Networks, Frequency Response of Internally Compensated Op-Amp, Frequency response of Non-compensated Op-Amp, Closed-Loop Frequency Response, Circuit Stability, Slew Rate.

General Linear Applications: DC & AC Amplifiers, Summing, Scaling and Averaging amplifier, Instrumentation Amplifier, Voltage-to-Current Converter, Current to-Voltage Converter, Integrator, Differentiator, Log/Antilog Amplifier, Peak Detector, Precision Rectifiers, Comparators, Schmitt Trigger, Sample and Hold Circuit, Clippers and Clampers, Analog-to-Digital and Digital-to-Analog Converters, Their types and comparison.

Active Filters and Oscillators: Active Filters:- Butterworth Filters, Band-Pass Filters, Band Reject Filters, All Pass Filters, Oscillators and Wave Generators.

Specialized IC Applications: Introduction, Universal Active Filter, The 555 Timer, Multivibrators using IC 555, Phase-Locked Loop (PLL), Voltage Regulators.

LABORATORY WORK: Interpretation of Data sheets and Characteristics of an Op-Amp, Measurement of Op-amp parameters, Op-amp as a integrator & differentiator, comparator, Schmitt trigger, Converter (ADC, DAC), square wave generator, Sawtooth waveform generator, precision halfwave, full wave rectifiers, log - antilog amplifier, regulator ICs, 555 as an astable, monostable & bi-stable multivibrator, active filters.

(14P)

Course learning outcome (CLO): The students will be able to

1. understand the terminal characteristics of op-amps and design /analyze fundamental circuits based on op-amps
2. analyze feedback and its effect on the performance of op-amp
3. design and analyze of nonlinear circuits
4. design and analyze of active filters
5. design and analyze of various applications using op-amps and IC 555

Text book:

1. *OP-AMP and Linear IC's, Gayakwad, Ramakant A., 2nd ed, Prentice Hall, 1999.*
2. *Digital Integrated Electronics, Taub and Schilling, 4th ed, Mc Graw Hill, 1994.*

Reference Books:

1. *Linear Integrated Circuits By D Choudhury Roy New Age International, (2003) 2nd ed.*
2. *Handbook of operational amplifier circuit design by David F. Stout, Milton Kaufman McGraw Hill (1976).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UECXXX: EMBEDDED SYSTEMS

L	T	P	Cr
3	**1**	**2**	**4.5**

Course Objective: To understand the basic concepts of embedded system, understanding of different types of programming languages used for embedded system. Study of ARM based processors: architecture, programming and Interfacing of ARM processor with memory & I/O devices. Study of RTOS.

Introduction to embedded systems: Background and History of Embedded Systems, Definition and Classification, Programming languages for embedded systems: desirable characteristics of programming languages for embedded systems, Low-level versus high-level languages, Main language implementation issues: control, typing. Major programming languages for embedded systems. Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.

ARM Processor Fundamentals: ARM core data flow model, Architecture, ARM General purpose Register set and GPIO's, CPSR, Pipeline, Exceptions, Interrupts, Vector Table, ARM processors family, ARM instruction set and Thumb Instruction set. ARM programming in Assembly**,** Instruction Scheduling, Conditional Execution, Looping Constructs, Bit Manipulation, Exception and Interrupt Handling.

System Peripherals: Bus Structure, Memory Map, Register Programming, Memory Accelerator Module, Flash memory Programming, External Bus interface, PLL, Watchdog, UART, ADC and DAC. Experimental embedded platform like Raspberry Pi.

Real Time Operating Systems (RTOS): Architecture of an RTOS, Important features of Linux, Locks and Semaphores, Operating System Timers and Interrupts, Exceptions, Tasks: Introduction, Defining a task, Task states and scheduling, Task structures, Synchronization, Communication and concurrency, Kernel objects: Semaphores, Queues, Pipes, Event registers, Signals, And condition variables. Real-time clock and system clock, Programmable interval timers, Timer ISRs, Timing wheels.

Laboratory work: Introduction to ARM processor kit, Programming examples of ARM processor. Interfacing of LED, seven segment display, ADC and DAC with ARM processor. Raspberry Pi based projects.

TEXT BOOKS

1. *Raj Kamal, Embedded System Architecture, Programming and Design, Tata McGraw Hill, (2004).*
2. *Heath, S., Embedded Systems Design, Elsevier Science (2003).*
3. *Andrew N. Sloss, ARM System Developer's Guide Designing and Optimizing System Software, Morgan Kaufman Publication (2010)*

REFERENCE BOOKS

1. *Simon, D.E., An Embedded Software Primer, Dorling Kindersley (2005).*
2. *Rafiquzzaman, M., Microprocessors and. Microcomputer-Based System Design, CRC Press, (1995) 2^nd^ ed.*
3. *Gibson, Glenn A., Liu, Yu-Cheng., Microcomputer Systems: The 8086/8088 Family Architecture Programming And Design, Pearson, (2001) Ist ed.*

Course Outcome: The students will be able to

1. understand of Embedded system, programming, Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.
2. understand of internal Architecture of ARM processor.
3. programme concepts of ARM processor with various interfaces like memory & I/O devices and Raspberry PI based embedded platform.

4. Study the Real time Operating system with Task scheduling and Kernel Objectives.

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC702 FIBER OPTIC COMMUNICATION

L	T	P	Cr
3	1	2	4.5

Course objective: The main objective of this course is to understand the nature of light and how it propagates through optical fibers and further on, mode theory for circular guides and losses due to different mechanisms are analysed. To learn the basic and structures of LEDs and Lasers and their performance analysis on the basis of light launching and coupling. Moreover, to study and analyze the performance of PIN and Avalanche photodiode on the basis of their responsivity. To study the performance analysis of optical receiver and preamplifier types. At last, to study the design steps of analog and digital optical communication systems.

Optical fiber: Structures, Wave guiding and Fabrication – Nature of light, Basic optical laws and Definition, Optical fiber modes and Configuration, Mode theory for circular waveguides, Single mode fibers, Graded index fiber, Fiber materials, Fabrication and mechanical properties, Fiber optic cables.

Signal degradation in optical fibers: Attenuation, Signal distortion in optical waveguide, Pulse broadening in graded index waveguides, Mode coupling, Design optimization of single mode fibers.

Optical sources: Light emitting diodes, Laser diodes, Light source linearity, Modal partition and reflection noise, Reliability consideration.

Power launching and coupling: Source to fiber Launching, Lensing schemes for coupling improvement, Fiber to fiber joints, LED coupling to single mode fibers, Fiber splicing, Optical fiber connectors.

Photodetectors: Physical properties of photodiodes, Photodetector noise, Response time, Avalanche multiplication noise, Temperature effect on avalanvch gain, Photodiode material.

Optical receiver operation: Fundamental receiver operation, Digital receiver performance calculation, Preamplifier types, Analog receivers.

Digital transmission systems: Point to point links, Line coding, Eye pattern, Noise effects on system performance. Analog system: Overview of analog links, Carrier to noise ratio, Multichannel transmission techniques.

Laboratory Work: Basic optical communication link experiments (analog & digital), measurement of numerical aperture, splicing, multiplexing experiments, bending losses, measurement with OTDR, design and performance analysis using simulation tools.

Course learning outcome (CLO) : The students will be able to

1. study fundamentals, advantages and advances in optical communication system
2. have knowledge about types, basic properties and transmission characteristic of optical fibers.
3. have knowledge of working and analysis of optical amplifiers and important parts at the transmitter (semiconductor lasers/leds, modulators etc) as well as at the receiver sides (optical detector etc.) of the optical communications system.
4. study configuration and architecture of coherent optical communication,
5. study configuration and architecture of advanced system techniques and nonlinear optical effects and their applications.

Text Books:

1. *Keiser, Gred, Optical Fiber Communications, Tata McGraw-Hill, (2008) 2nd ed.*
2. *Bagad, V. S., Optical Fiber Communications, Technical Publications, (2008) 3rd ed.*

Reference Books:

1. *Senior, John M., and Yousif Jamro, M., Optical fiber communications: principles and practice, Prentice Hall, (2009) 2nd ed.*
2. *Bala N. Saraswathi Ravi Kumar, Comprehensive Optical*

Communications, Laxmi Publications (2001) 4th ed.

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC703: Modern Control Systems

L	T	P	Cr
3	1	0	3.5

Course objective: At the end of the course the student should be able to solve closed loop systems using block diagram reduction and signal flow graph approaches. He should be able to analyze in time domain the response of the system and obtain important parameters such as rise time, settling time peak overshoot etc. The student should be able to undertake both absolute and relative stability analysis and locate the roots of a system characteristic equation on the s-plane.

Systems And Their Representation Basic elements in control system – Open and closed loop systems – Electrical analogy of mechanical systems – transfer function – brief concept of block diagrams – signal flow graphs.

Concept of time response – time domain specifications – Types of standard test input signals – first and second order control system response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

Concept of frequency response – Bode plot – Polar plot, Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

Stability Of Control System Characteristic equation – Location of roots in S plane – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

State Space Analysis Of Continuous And Discrete Time Systems State variable representation – Conversion of state variable form to transfer function and vice versa – Eigenvalues and Eigenvectors – Solution of state equation – Controllability and Observability – Canonical forms – Effect of sampling time on controllability – Pole placement design.

Nonlinear Systems Types of nonlinearity – phase plane analysis – Singular points – Limit cycles – Phase trajectories – Describing function method – Dead zone – Saturation – Relay – Backlash – Lyapunov stability analysis

Course learning outcome (CLO): The students will be able to

1. Study the Control system and its various representations in terms of block diagrams, signal flow graphs, transfer function and its analogy with mechanical systems.
2. analyze the time response analysis of the control systems and understand the concept of steady state error and its role in various industrial plants.
3. analyze the frequency domain concept of control systems via, Bode and polar plots and to establish the correlation between time domain and frequency domain.
4. gain knowledge about the stability of the control systems and learn various methods to judge the stability criterion.
5. learn the new emerging concept of the state space variable representation of the control systems and discuss about the concept of controllability and observability.
6. study the new concept of nonlinear control systems and its need to the society. Also discuss the various stability criterion related to the nonlinear systems.

Text Books:

1. I. J. Nagrath and M. Gopal, Control Systems Engineering, New Age International Publishers, 2003.
2. Benjamin C. Kuo, Automatic Control Systems, Pearson education, 2003.

References Books:

1. *Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, Wiley, 2007.*
2. *K. Ogata, Modern Control Engineering, 4th Edition, Prentice Hall of India, 2002.*
3. *N. S. Nise, Control Systems Engineering, 4th Edition, John Wiley, 2007.*
4. *M. Gopal, Control Systems: Principles and Design, Tata McGraw Hill, 2002.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30

2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UEC 704 Wireless and Mobile Communication

L	T	P	Cr
3	**1**	**2**	**4.5**

Course objective: At the end of the course the student should be able to understand various generations of wireless and mobile systems. He should be able to understand the architecture, signaling schemes, handoffs and capacity of GSM and CDMA system. The student should be able to analyze the fading and its associated model for various parameters like path loss, shadowing effect. He will be able to understand various spread spectrum techniques.

Introduction to Wireless Communication Systems: History of wireless communication, And future trends, Wireless Generations and Standards, Cellular and wireless systems, Current Wireless Systems, Cellular Telephone Systems, Examples of Wireless Communication Systems, Trends in Cellular Radio and Personal Communications. Introduction. Frequency Division Multiple Access (FDMA). Time Division Multiple Access (TDMA). Spread Spectrum Multiple Access. Space Division Multiple Access (SDMA). He will be able to understand the concept of spread spectrum techniques, detailed

The Cellular Concept : System Design Fundamentals: Introduction. Cellular Concept and Cellular System Fundamentals, Frequency Reuse. Channel Assignment Strategies. Handoff Strategies. Interference and System Capacity. Trunking and Grade of Service. Improving Coverage & Capacity in Cellular Systems. Cell Splitting and Sectoring. Cellular system design considerations

Mobile Radio Propagation: Large-Scale Path Loss: Introduction to Radio Wave Propagation. Free Space Propagation Model. Relating Power to Electric Field. The Three Basic Propagation Mechanisms. Reflection. Ground Reflection (Two-Ray) Model. Diffraction. Scattering. Practical Link Budget Design Using Path Loss Models. Outdoor Propagation Models. Indoor Propagation Models. Signal Penetration into Buildings. Ray Tracing and Site Specific Modeling, Shadow Fading, Combined Path Loss and Shadowing, Outage Probability under Path Loss and Shadowing.

Mobile Radio Propagation: Small-Scale Fading and Multipath: Small-Scale Multipath Propagation. Impulse Response Model of a Multipath Channel. Small-Scale Multipath Measurements. Parameters of Mobile Multipath Channels. Types of Small-Scale Fading. Rayleigh and Ricean Distributions. Statistical Models for Multipath Fading Channels. Theory of Multipath Shape Factors for Small-Scale Fading Wireless Channels, Error probability and outage probability in fading channels for BPSK Modulation performance in fading and multipath channels.

Spread Spectrum: Spread spectrum modulation techniques, codes: Gold, Walsh, Kasomi short and long codes, Pseudo-noise sequence, Direct sequence spread spectrum (DS-SS), Frequency hopped spread spectrum (FHSS), Performance of DS-SS, Performance of FH-SS, Modulation performance in fading and multipath channels. RAKE Receiver

Laboratory work :

Practical's based upon hardware using GSM and CDMA kits and simulation with the help of simulation packages.

Course learning outcome (CLO): The students will be able to

1. acquire knowledge about of different technologies used in wireless communication systems
2. acquire knowledge about overall GSM cellular concept
3. acquire knowledge about multiple access technologies
4. acquire knowledge about of effect of fading and understand different fading models
5. acquire knowledge different of different spread spectrum technologies
6. study different diversity techniques

TEXT BOOKS:

1. *Rappaport, T.S., Wireless Communication-Principles and practice, Pearson, (2000) 2nd edition*
2. *Haykin S & Moher M., Modern wireless communication, Pearson, (2005) 3rd edition*

REFERENCE BOOKS :

1. *Lee, Willium C. Y., Mobile communication Design and fundamentals, (1999) 4th edition.*
2. *Pandya, R., Mobile and personal communication system, PHI (2002) 5th edition*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC701 ASICs and FPGAs

L	T	P	Cr
3	0	0	3.0

Course objective:

This course covers the different types of programming technologies and logic devices, the design flow of different types of ASIC and the architecture of different types of FPGA. To gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC. To know about different high performance algorithms and its applications in ASICs.

Introduction: Course outline, Logistics introduction to ASICs, FPGAs, Economics.

HDL: Logic design Review, Behavior, Dataflow, Structural modeling, Control statements, FSM modeling.

CMOS Review: Classical, CMOS (Deep Sub-micron), ASIC Methodologies (classical) ASIC Methodologies (aggressive).

Combinational Circuit Design: Components of Combinational Design - Multiplexer and Decoder, Multiplexer Based Design of Combinational Circuits, Implementation of Full Adder using Multiplexer, Decoder Implementation of Full Adder using Decoder.

Programmable Logic Devices: Types of Programmable Logic Devices, Combinational Logic Examples, PROM - Fixed AND Array and Programmable OR Array, Implementation of Functions using PROM, PLA - Programmable Logic Array (PLA) – Implementation Examples.

Programmable Array Logic: PAL - Programmable Array Logic, Comparison of PROM, PLA and PAL, Implementation of a Function using PAL, Types of PAL Outputs, Device Examples.

Introduction to Sequential Circuits: R-S Latch and Clocked R-S Latch, D Flip Flop, J-K Flip Flop, Master Slave Operation, Edge Triggered Operation.

FPGA: Programmable logic FPGA, Configuration logic blocks, Function Generator, ROM implementation, RAM implementation, Time skew buffers, FPGA Design tools, Network-on-chip, Adaptive System-on-chip.

System Design Examples using FPGA Board: Design Applications using FPGA Board - Traffic Light Controller and Real Time Clock, XSV FPGA Board Features, Testing of FPGA Board, Setting the XSV Board Clock Oscillator Frequency, Downloading Configuration Bit Streams.

Logic synthesis: Fundamentals, Logic synthesis with synopsis, Physical design compilation, Simulation, implementation. Floor planning and placement, Commercial EDA tools for synthesis.

Course learning outcome (CLO): The students will be able to

1. utilize the top-down design methodology in the design of complex digital devices such as FPGAs/ ASICs.
2. learn modern hardware/software design tools to develop modern digital Systems
3. design and verification of integrated circuits chips
4. design and implement different Field Programmable Gate Array (FPGA)
5. learn architectures and their applications to real life

Text Book:

1. *Smith, Michael.*, Application-Specific Integrated Circuits, *Addison-Wesley Professional, (2008) Ist ed.*
2. *Wolf, W.,* FPGA-based System Design, *PH/Pearson, (2004) Cheap ed.*

Reference Books:

1. *Steve Kilts, Advanced FPGA Design, Wiley Inter-Science, Jhon weilly & sons, (2007) 4th ed.*

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	50
3.	Sessionals (May include	20

	Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	

UEC611: Digital System Design

L	T	P	Cr
3	1	2	4.5

Course objective: Students must demonstrate the use and application of Boolean algebra in the areas of digital circuit reduction, expansion, and factoring. Students must learn the IEEE Standard 1076 VHDL Hardware Description Language. Students must be able to simulate and debug digital systems described in VHDL. Students must be able to synthesize complex digital circuits at several level of abstractions

Digital Systems: Digital Systems, Using combinational modules to design digital systems, Iterative networks.

Modelling Digital Systems: Domains and levels of modelling, Modeling Languages, VHDL Modelling Concepts, Entity declaration, architecture body, configuration declaration, package declaration, package body, Lexical Elements

Scalar Data Types and Operations: Constant and variables, Scalar Types, Type Classification, subtypes, Type Qualification, Type Conversion, Attributes of Scalar Types, Expressions and Operators, Composite data types-arrays, multidimensional arrays, Array aggregates and array attributes, Unconstrained array types, Strings, Bit Vectors, Standard-logic arrays, Array operations and referencing, Records

Sequential Statements: If statements, Case statements, Null statements, exit statements, next statements, for loops, while loops, loop statements, Assertion and report statements, wait statements, Delta delays, Transport and inertial delay mechanisms, process statements, postponed processes.

Dataflow modelling: Concurrent signal assignment statements, Multiple drivers, Conditional signal assignment statement, selected signal assignment statement, The Unaffected Value, Concurrent assertion statements, entities and passive processes, Block statements

Structural Modelling: Component declaration and component instantiations, Resolving Signal values

Generics and Configurations: Generics, Configuration specification and configuration declaration, default rules, Conversion functions, direct instantiation, Incremental binding, generate statements

Subprograms and overloading: Subprograms, subprogram overloading, operator overloading, signatures, alias

Model Simulation: Writing a test bench, dumping results into a Text file, reading vectors from a Text file.

Finite State Machines: Finite state model, Memory elements and their excitation functions, Synthesis of Synchronous sequential circuits, Capabilities and limitations of FSM, Design, Modeling and Simulation of Moore and Mealy machines.

LABORATORY WORK: Design of flip-flops, Counters, Registers, Multiplexers, Decoders, Demultiplexers, State machines using hardware description language at various abstraction levels, Functional emulation of VHDL designs by applying stringent timing constraints, Creating test benches

Course learning outcome (CLO): The students will be able to

1. acquire knowledge about combinational & sequential circuits
2. identify and code the module using different modeling styles
3. code using subprograms
4. write test benches in VHDL
5. acquire knowledge about FSM and how to code a FSM
6. synthesize the VHDL code

Text Books:

1. *Peter Ashenden, The Designer Guide to VHDL, Morgan Kaufmann Publishers (2008) 3rd ed.*
2. *J. Bhasker, VHDL Primer, Prentice Hall of India (1999) 3rd ed.*

Reference Books:

1. Stephen Brown and Zvonko Vranesic, Fundamental of Digital Logic with VHDL Design, McGraw Hill(2005) 2nd ed.
2. Douglas L. Perry, VHDL Programming by Example, McGraw Hill (2002) 4th ed.

3. David Naylor and Simon Jones, VHDL: A Logic Synthesis Approach, Chapman & Hall (1997) 1st ed.

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC 721ANALOG IC DESIGN

L	T	P	Cr
3	1	2	4.5

Course objective: This course focuses on analog integrated circuit design in the CMOS technology for various applications. Design examples cover various common building blocks such as differential amplifiers, current mirrors, voltage reference and operational amplifiers. Also, it includes stability and noise analysis of analog functional modules.

Basic MOS Device Physics: MOS IV Characteristics, Second order effects, Short-Channel Effects, MOS Device Models, Review of Small Signal MOS Transistor Models, MOSFET Noise.

Single Stage Amplifiers: Common Source Stage, Source Follower, Common Gate Stage, Cascode, Folded Cascode.

Differential Amplifier: Single ended and Differential Operation, Qualitative and Quantitative Analysis of Differential pair, Common Mode response, Gilbert Cell.

Current Sources and Mirrors: Current Sources, Basic Current Mirrors, Cascode Current Mirrors, Wilson Current Mirror, Large Signal and Small-Signal analysis.

Frequency Response of Amplifiers: Miller Effect, Association of Poles with nodes, Frequency Response of all single stage amplifiers.

Voltage References: Different Configurations of Voltage References, Major Issues, Supply Independent Biasing, Temperature-Independent References.

Feedback: General Considerations, Topologies, Effect of Loading.

Operational Amplifier: General Considerations, Theory and Design, Performance Parameters, Single-Stage Op Amps, Two-Stage Op Amps, Design of 2-stage MOS Operational Amplifier, Gain Boosting, Comparison of various topologies, slew rate, Offset effects, PSRR.

Stability and Frequency Compensation: General Considerations, Multi-pole systems, Phase Margin, Frequency Compensation, Compensation Techniques.

Noise: Noise Spectrum, Sources, Types, Thermal and Flicker noise, Representation in circuits, Noise Bandwidth, Noise Figure.

Switched-Capacitor Circuits: Sampling Switches, Speed Considerations, Precision Considerations, Charge Injection Cancellation, Switched-Capacitor Amplifiers, Switched- Capacitor Integrator, Switched-Capacitor Common-Mode Feedback.

Laboratory work :
Review of Mentor Tools; Analysis of Various Analog Building Blocks such as, Current and Voltage References/Sources, Current Mirrors, Differential Amplifier, Design and Analysis of Op-Amp (Closed loop and open loop) and its Characterization, Switched Capacitor Integrator

Course learning outcome (CLO): The students will be able to

1. use MOS structure in basic circuits
2. analyze low-frequency characteristics of single-stage amplifiers and differential amplifiers
3. analyze and design current sources/sinks/mirrors
4. analyze high-frequency response of amplifiers

5. understand stability and frequency compensation for amplifiers

Text Book:

1. *Razavi, B., Design of Analog CMOS Integrated Circuits, Tata McGraw Hill (2008).*
2. *Gregorian, R. and Temes, G.C., Analog MOS Integrated Circuits for Signal Processing, John Wiley (2004).*
3. *Allen, P.E. and Holberg, D.R., CMOS Analog Circuit Design, Oxford University Press (2002) 2nd ed.*

Reference Books:

1. *Johns, D.A. and Martin, K., Analog Integrated Circuit Design, John Wiley, (2008).*
2. *Gray, P.R., Hurst, P.J., Lewis, S.H., and Meyer, R.G., Analysis and Design of Analog Integrated Circuits, John Wiley (2001) 5th ed.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC 722 DIGITAL SIGNAL PROCESSORS

L	T	P	Cr
3	1	2	4.5

Course objective: This course will prepare the students to work professionally in the area of digital signal processing. The students will be able to present a comprehensive introduction to important DSP processors with focus on architectures, addressing modes and instruction set. The focus of course is a series of Lab experiments, which provide practical knowledge in filters and DSP processors.

An Introduction to DSP Processors: Advantages of DSP, characteristics of DSP systems, classes of DSP applications, DSP processor embodiment and alternatives, Fixed and floating point number representation, IEEE 754 format representation Fixed Vs Floating point processors,.

DSP Architecture: An introduction to Harvard Architecture, Differentiation between Von-Neumann and Harvard Architecture, Quantization and finite word length effects, Bus Structure, Central Processing Unit, ALU, Accumulators, Barrel Shifters, MAC unit, compare, select, and store unit (CSSU), data addressing and program memory addressing.

Memory Architecture: Memory structures, features for reducing memory access required, wait states, external memory interfaces, memory mapping, data memory, program memory and I/O memory, memory mapped registers.

Addressing and Instruction Set: Various addressing modes - implied addressing, immediate data addressing, memory direct addressing, register direct and indirect addressing, and short addressing modes, Instruction types, various types registers, orthogonality, assembly language and application development.

Interrupts and Pipelining: Interrupts, pipelining and performance, pipelining depth, interlocking, interrupt effects, instruction pipelining.

Processors: Architecture and instruction set of TMS320C3X, TMS320C5X, TMS320C67XX, some example programs. Development tools for Programmable DSPs, An introduction to Code Composer Studio.

Laboratory Work: Introduction to code composer studio, Using CCS write a program to compute factorial, dot product of two arrays, Generate Sine, Square and Ramp wave of varying frequency and amplitude, Design various FIR and IIR filters, Interfacing of LED, LCD, Audio and Video Devices with the DSP processor.

Course learning outcome (CLO): The students will be able to

1. acquire knowledge about DSP processors
2. understand fundamentals of DSP processor architecture
3. understand fundamentals of memory interface and pipeline structures
4. design programs using Addressing and Instruction Set of DSP processors
5. understand the various industry standards DSP processors

Text books

1. *Lapsley, P., Bier, J., Shoham, A. and Lee, E.A., DSP Processor Fundamentals: Architecture and Features, IEEE Press Series on Signal Processing, IEEE (2000).*
2. *Venkataramani, B. and Bhaskar, M., Digital Signal Processor: Architecture, Programming and Applications, Tata McGraw Hill (2003).*

Reference books

1. *Padmanabhan, K., Ananthi, S. and Vijayarajeswaran, R., A practical Approach to Digital Signal Processing, New Age International Pvt. Ltd (2001).*
2. *Babast, J., Digital Signal Processing Applications using the ADSP-2100 family, PHI (1992).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC 723: SOFT COMPUTING TECHNIQUES

L	T	P	Cr
3	1	2	4.5

Course objective: At the end of the course the student should be able to design neural architectures for solving pattern recognition problems. The student should be able to quantify non exact parameters using theory of fuzzy sets and be able to design systems having hybrid neuro fuzzy modules. He should be able to accomplish optimization tasks using biologically inspired paradigms viz. Genetic algorithm and Particle Swarm Optimization.

Introduction and History: Applications of soft computing techniques, Difference between conventional and soft computing, Historical Development, Overview of contemporary paradigms.

Artificial Neural Networks: Structure of Biological Neurons, Information processing inside the human brain, Models of a Neuron, Artificial counterparts of biological neurons, Hardware implementation of Artificial Neural Networks.

Learning Processes: Pattern space and decision boundaries, McCulloch-Pitts model of a neuron, Learning tasks, Hebbian learning, Supervised and unsupervised learning.

Perceptron Learning Algorithms: Rosenblatt's perceptron, The perceptron and Bayes classifier for a Gaussian environment, The Least Mean Square (LMS) algorithm, The Recursive Least Square (RLS) algorithm.

Multilayer Perceptrons: Batch learning and On-Line learning, The Back-Propagation Algorithm, XOR Problem, K-Fold cross validation.

Kernel Methods: Cover's theorem on separability of patterns, The interpolation problem, Radial Basis Function Networks, Hybrid Learning Procedure for RBF Networks, Support Vector Machines.

Preprocessing and Unsupervised Learning: Self Organizing Maps, K-means clustering algorithm, Principal Component Analysis for dimensionality reduction, Cluster Analysis for compaction.

Fuzzy Logic: Fundamental of fuzzy reasoning, Crisp versus fuzzy sets, Fuzzy sets and membership functions, Fuzzy algebra, Fuzzy Identities and Min Max decomposition, Generation of fuzzy rule base, Fuzzy Entropy, Fuzzy Subsethood and Fuzzy Similarity measures, Fuzzification and defuzzification

Fuzzy Electronics: Design of simple fuzzy controllers, Fuzzy Airconditioning, Fuzzy throttle control and Fuzzy truck upper backer systems, Neuro-fuzzy controller design.

Evolutionary Computing: Introduction to evolutionary algorithms, Multilevel optimization techniques, Genetic algorithm, Selection, Cross-over and Mutation operators, Design of neuro-genetic systems.

LABORATORY WORK: Lab experiments based on MATLAB Neural and Fuzzy Toolboxes**.** Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction

Course learning outcome (CLO): The students will be able to

1. comprehend the nuances of biologically inspired computing , need of soft computing and its relevance to Electronics and communication engineering
2. represent data in pattern space and identify dimensional attributes
3. construct decision boundaries analytically for a given function approximation problem
4. classify patterns using standard feed-forward and recursive neural networks
5. formulate fuzzy rules for electronic system design
6. formulate objective functions and optimize them using evolutionary computing paradigms

Text Books :

1. Jang, J.S.R., Sun, C.T., and Mizutani, E., Neuro-Fuzzy and Soft Computing, Pearson Education (2004) 2nd ed.

2. Eberhart, R., Simpson, P., and Dobbins, R., Computational Intelligence - PC Tools, AP Professional (1996) 3rd ed.

3. Simon Hykin, Neural Networks and Learning Machines, Prentice Hall of India, (2010) 3rd Ed.

Reference Books

1. *Ross, Timothy J., Fuzzy Logic with Engineering Applications, McGraw-Hill (1997) 2nd ed.*
2. *Goldberg, Davis E., Genetic Algorithms: Search, Optimization and Machine Learning, Wesley Addison (1989) 3rd ed.*
3. *Rajasekaran, S., and Pai, G.A.V., Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI (2003) 4th ed.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC812: TELECOMMUNICATION ENGINEERING

L	T	P	Cr
3	**0**	**0**	**3.0**

Class objective: The purpose of this course is to teach and prepare the students to discover the need and role of telecommunication**.** To prepare the student infer the purposes and functions of each exchange with different trading systems. The course will help to render the explanation and view of routing, signing and addressing of protocol used in the telecom. It also furnishes the scholars with the basic understanding telle traffic theory and give the knowledge around the different modelling techniques used in switching.

Evolution of Tele-Communication: Basic Switching System, Simple Tele-phone Communication, Telephone Transmitter, Telephone receiver, Dialing types, Signaling tones, Brief introduction to electromagnetic exchanges, Concept of tone dialing and DTMF.

Digital Exchanges and Control: Introduction to multistage switching technique. Blocking and non-blocking switches. Multicasting and distribution, Blocking probability analysis of multistage switches. Network synchronization, Digital subscriber lines (DSL), GDMT and G.Lit Digital subscriber lines, Video on demand (VoD), ADSL, Traditional Cable Networks, HFC Networks, Sharing, CM & CMTS and DOCSIS. Signaling: customer line signaling – outband signaling – inband signaling – PCM signaling – inter register signaling – common channel signaling principles – CCITT signaling system No:7 – digital customer line signaling, cross-talks and interference in telecomm networks. STS I, Virtual Tributaries and Higher rate of service. Introduction to ATM switching – Strict sense non block switch – self routing switches . ATM routers – Design of typical switches, ATM traffic & congestion control, Signaling, Routing and addressing, ISDN architecture, ISDN interfaces, Functional grouping, Reference points, protocol architecture, Signaling, Numbering, Addressing, BISDN. Data compression-Network security-cryptography.

Traffic Engineering: Grade of Service and Blocking Probability – Telephone Networks, Subscriber Loops, Switching Hierarchy and Routing, Network traffic load and parameters – grade of service and blocking probability – incoming traffic and service time characterization – blocking models and loss estimates – delay systems, Modeling and performance analysis in networks. DTE/DCEs. Characteristics of Queuing Process, Markov chain. Markov Chain Queuing Models. Network of exponential servers, Generating function, Phase-dependent arrival and service, Steady state solution, A/B/C/D/E. Advance Markovian Models: bulk arrivals and services, Erlang arrivals and services, Priority queues. M/G/1 and G/M/1: M/G/1, Occupancy distribution, Renewal theory, Waiting time and busy period, preemptive-resume LCFS, head-of-the-line priority, Embedded Markov chain.

Course learning outcome (CLO): The students will be able to

1. Acquire knowledge about Telecommunication System
2. Acquire knowledge about different Switching and signalling Systems.
3. Acquire knowledge about Traffic Engineering

Text Books:

1. *Viswanathan T., Telecommunication Switching Systems and Networks, Prentice Hall of India (2006) 2nd ed.*
2. *Betsekos D and Gallager R., Data Networks, Prentice Hall (1992) 2nd ed.*

Reference Books:

1. *Tanenbaum A. S., Computer Networks, PHI, (2003) 3rd ed*
2. *Schwartz M., Wesley Addision, Telecommunication Networks - Protocols, Modeling and Analysis, Massacheusetts, (1987) 3rd ed.*
3. *Flood J. E., Telecommunications Switching Traffic and Networks, Pearson, (2002) 2nd ed.*
4. *Freeman R. L., Telecommunication System Engineering, John Wiley New York, 1998 3rd ed.*
5. *Tomasi Wayne, Advanced Electronic Communications Systems, Pearson Ed., (2008) 5th ed.*
6. *Bellamy J., Digital Telephony, John Wiley and Sons New York, (2000) 4th ed*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	50
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	20

UEC813 WIRELESS SENSOR NETWORKS

L	T	P	Cr
3	0	0	3

Course objective: This course is targeted at understanding the concept of Physical and Wireless Mac Layer Alternatives, design of wireless modems and also to study Wireless Network Planning its operations. This course provides a broad coverage of Mechanism to support a mobile environment for IS – 95 CDMA, Wireless home networking, IEEE 802.11 and IEEE 802.15. Covered topics under geo location system includes WPAN Bluetooth, Interface between Bluetooth and 802.11and Geo location standards for E.911 service.

Physical and Wireless Mac Layer Alternatives: Wired transmission techniques: Design of wireless modems, Power efficiency, Out of band radiation, Applied wireless transmission techniques, Short distance base band transmission, UWB pulse transmission, Broad Modems for higher speeds, Diversity and smart receiving techniques, Random access for data oriented networks, Integration of voice and data traffic.

Wireless Network Planning and Operation: Wireless networks topologies, Cellular topology, Cell fundamentals signal to interference ratio calculation, Capacity expansion techniques, Cell splitting, Use of directional antennas for cell sectoring, Channel borrowing techniques, DCA, Mobility management, Radio resources and power management securities in wireless networks.

Wireless WAN: Mechanism to support a mobile environment, Communication in the infrastructure, IS-95 CDMA forward channel, IS – 95 CDMA reverse channel, Pallert and frame formats in IS – 95, IMT – 2000.

Wireless LAN: Historical overviews of the LAN industry, Evolution of the WLAN industry, Wireless home networking, IEEE 802.11. The PHY Layer, MAC Layer.

Wpan and Geolocation Systems: IEEE 802.15 WPAN, Home RF, Bluetooth, Interface between Bluetooth and 802.11, Wireless geo location technologies for wireless geo location, Geo location standards for E.911 service.

Course learning outcome (CLO): The students will be able to

1. understand various physical and wireless MAC layer alternatives.
2. understand the integration of voice and data traffic.

3. understand wireless network planning and operation.
4. design wireless LAN, WAN,
5. design wireless PAN and geolocation systems.

Text Books:

1. Pahlavan, Kaveh., Krishnamoorthy, Prashant., Principles of Wireless Networks, - A united approach - Pearson Education, (2002) 2nd ed.

2. Wang, X., and Poor, H.V., Wireless Communication Systems, Pearson education, (2004) 3rd ed.

Reference Books:

1. Schiller, Jochen., Mobile Communications, Person Education – 2003, 2nd ed.

2. Mallick, M., Mobile and Wireless design essentials, Wiley Publishing Inc. (2003) 4th ed.

3. Nicopolitidis, P., Obaidat, M.S., Papadimitria, G.I., Pomportsis, A. S., Wireless Networks, John Wiley & Sons, (2003) 2nd ed.

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	50
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	20

UEC 814: Power Electronics

L	T	P	Cr
3	0	0	3.0

Course objective: Power electronics deals with the application of solid-state electronics for the control and conversion of electric power. The main objective of this course is to understand and acquire knowledge about various power semiconductor devices and to prepare the students to analyze and design different power converter circuits

Introduction:, Power semiconductor devices, Basic structure of power diodes, Characteristics of power diodes, Power transistors, Power MOSFETS, Insulated gate bipolar transistor, Static induction transistor, MOS controlled thyristor.

Thyristors: Terminal characteristics of thyristors, thyristor turn on methods, Two transistor model of a thyristor, Thyristor protection, Series and parallel operation of thyristors, Gate turn off thyristor, Firing circuits for thyristors.

Phase Controlled Converters: Principle of phase control, Single phase half wave circuit with different types of loads, Single phase and three phase semi converter and full converter bridge circuits with line commutation, effect of source inductance on single phase and three phase full converters,

DC Choppers: Principle of chopper operation and its types, Control strategies, Step up and down choppers.

Inverters: Single phase voltage source inverters: Operating principle, Force commutated thyristor inverters, Current Source inverters, Series Inverters, Parallel Inverters.

AC Voltage Controllers: Types of single-phase voltage controllers, Single-phase voltage controller with R and RL type of loads. Three phase voltage controller configurations R Load.

Cycloconverters: Principles of operation, Single phase to single phase step up and step down cycloconverters. Three phase to single phase and three-phase to three-phase cycloconverters, Output voltage equation for a cycloconverter.

Laboratory Work : V-I characteristics of SCR, DIAC, TRIAC, Methods of turning on of an SCR through gate triggering, DC -DC chopper, Solid state fan regulator, Semi converter and Full converter with R and RL type of loads, DC shunt motor speed control, Single phase AC voltage controller with R load,

Course learning outcome (CLO): The students will be able to

1. have knowledge about fundamental concepts and techniques used in power electronics
2. understand working of power devices like SCR's, Power transistors etc.
3. analyze various single phase and three phase power converter circuits and its applications.
4. have a thorough understanding of D.C choppers and its types.
5. have Knowledge of inverters and analysis of A.C voltage controllers with different loads.
6. acquire understanding of cyclo-converter usages and their conversion from three to single phase.

Text Books:

1. *Dubey, G.K., Doradla, S.R., Joshi, A. and Sinha, R.N.K., Thyristorised Power Controllers, New Age International (P) Limited, Publishers (2004).*
2. *Rashid, M., Power Electronics, Prentice-Hall of India Private Limited (2006).*

Reference Books

1. *Mohan,N., Undel, T.M. and Robbins, W. P., Power Electronics: Converter Applications and Design, John Wiley and Sons (2007).*
2. *Jain,A., Power Electronics and its Applications, Penram International Publishing (India) Pvt. Ltd. (2008).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	50
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	20

UEC 815 Audio and Speech Signal Processing

L	T	P	Cr
3	0	0	3.0

Course objective: The objective of this course is to frame the study to know the key concept of digital signal and processing utilized speech signals. Speech production and perception, basic notions from psycho-acoustics, applications in speech processing. Linear-predictive model, spectrum using LP, applications of LP. Speech recognition dynamic programming DTW, hidden Markov models HMM and speech synthesis. Speaker verification, identification, feature vectors, Pattern matching, Hypothesis testing

Introduction: Review of digital signal and systems, Transform representation of signal and systems, Sampling Theorem, Digital filters and filter banks.

Digital Models for Speech Signals: Speech production and acoustic modeling, Acoustic phonetics, Hearing and perception.

Digital Representation: Linear quantization, Companding, Optimum quantization, Pulse code modulation effects of channel errors, Vector quantization (VQ), Adaptive quantization, Differential PCM, APCM *vs.* ADPCM, Delta modulation, Adaptive delta modulation.

Digital Vocoders: Linear predictive coding (LPC), Hybrid coders: voice excited vocoders, Voice excited linear predictor.

Speech Recognition: Hidden Markov Models, Viterbi algorithm, Discrete and continuous observation density HMMs, Isolated word recognition, Continuous speech recognition, Speaker (in) dependent, Measures and dynamic time warping (DTW).

Speaker recognition: Speaker verification/authentication *vs.* speaker identification, Closed *vs.* open set, Feature vectors, Pattern matching, Hypothesis testing.

Course learning outcome (CLO): The students will be able to

1. realize the properties of acoustic signals and human hearing and perception in the design of audio signal processing systems

2. design and implement algorithms for processing audio and speech signals, Can estimate the effect of the signal representations on sound quality.
3. understand the fundamental intricacies involved in the design of speech and audio systems
4. design new software for the audio and speech processing
5. explain the main principles of common audio signal processing operations and their applications on the devices available in the market

Text Books:

1. *Borden, G., and Harris, K., Speech Science Primer,Williams and Wilkins (2006) 2nd ed.*
2. *Furui, S., Digital Speech Processing, Synthesis and Recognition, CRC (2001) 4th ed.*

Reference Books:

1. *Deller, J., Proakis, J. and Hansen, J., Discrete-Time Processing of Speech Signals, IEEE (1993) 2nd ed.*
2. *Rabiner, L., and Schafer, R., Digital Processing of Speech Signals. Signal Processing, Prentice-Hall (1978) 3rd ed.*
3. *Owens, F. J, Signal Processing of Speech, McGraw-Hill (1993) 4th ed.*
4. *Parsons, T., Voice and Speech Processing: Communications and Signal Processing, McGraw-Hill (1986) 2nd ed.*

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	50
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	20

UEC-791 Project Semester

COURSE OUTCOMES

Students are able to

(1) gain experience in the conduct of an investigation of a particular topic in electronic engineering;

(2) develop and improve their skills in sourcing and synthesis of information, problem solving, design, analysis and communicating results;

(3) increase their level of skill in one or more of the areas of mathematical analysis, computing, computer interfacing, electronics, control, communications and power.

(4) have an understanding of professional and ethical responsibility.

(5) to function effectively as a leader and team member in multidisciplinary groups.

(6) to manage the process of carrying out technical projects