PROPOSED CURRICULA AND SYLLABI
FOR

T.Y. B.Tech.

(Electronics & Telecommunication Engineering)

with effect from

Academic Year 2016-2017

onwards

Department of Electronics and Telecommunication Engineering
Shri Guru Gobind Singhji Institute of Engineering & Technology
Vishnupuri, Nanded (M.S.) PIN 431606 INDIA

SYLLABUS SCHEME for
T. Y. B.Tech. (Electronics and Telecommunication Engineering)
Academic Year2016-17 onwards

Semester I

Course Code	Course Title	Lectures (L)	Tutorials (T)	Practical (P)	Credits
EC351	Signals and Systems	3	0	2	4
EC352	Communication Systems Theory	3	1	2	5
EC353	Control Systems	3	0	2	4
EC354	Electromagnetic Engineering	3	1	0	4
EC355	Elective-I*	3	0	0	3
EC365	Seminar	0	0	2	1
	Total	15	3	8	21

Semester II

Course Code	Course Title	Lectures (L)	Tutorials (T)	Practical (P)	Credits
EC357	Digital Signal Processing	3	0	2	4
EC358	Linear Integrated Circuits	3	0	2	4
EC359	Embedded Systems	3	0	2	4
EC360	Digital Communication	3	0	0	3
EC361	Elective-II*	3	0	2	4
EC362	Mini Project	0	0	6	3
	Total	18	0	12	22

N.B.: Lectures/Tutorials/Practical are mentioned in Hours/Week

Elective-I (Any one from the following)	**Elective-II** (Any one from the following)
Computer vision **EC355A** Probability and Random Variables **EC355B** Advanced Robotics **EC355C** Bio Medical Signal Processing	**Computer vision** **EC361A** Wavelets and Applications **EC361B** Pattern Recognition
VLSI AND EMBEDDED SYSTEMS **EC355D** Microelectronics **EC355E** DSP Processors **EC355F** Computer Organization	**VLSI AND EMBEDDED SYSTEMS** **EC36C** Digital System Design with Verilog **EC361D** Digital VLSI Design **EC361E** EDA tools
COMMUNICATION ENGINEERING **EC355G** Antenna and Wave Propagation **EC355H** Digital Telephony	**COMMUNICATION ENGINEERING** **EC361F** Satellite Communication
GENERAL **EC355I** Physiology for Engineers **EC355J** Computer Security **EC355K** Mechatronics **EC35L** Computer Oriented Numerical Methods	**GENERAL** **EC361G** Power Electronics **EC361H** Consumer Electronics **EC361I** System Software and Operating Systems **EC361K** Linear Algebra

**Practical for Electives can be converted in to either assignments, quizzes, surprise tests, mini projects, seminars, field work, etc., or any combination of the same decided by the course coordinators which should be announced at the commencement of the course. However, the midterm and end-term evaluation based on the performance of the students is compulsory as per the examination scheme of the courses.*

SEMISTER I

EC351: SIGNALS AND SYSTEMS (L-3, T-0, P-2, CR-4)

Teaching Scheme	*Examination Scheme*			
Lecturer: 3 Hrs/week	*Theory*		*Practical*	
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	*Mid Term/Cont. Eval.: 50 Marks*	*End Term: 50 Marks*
Practical: 2 Hrs/week	*Credits: 3*		*Credits: 1*	

Course Objectives:

- Coverage of continuous and discrete-time signals and systems, their properties and representations and methods that are necessary for the analysis of continuous and discrete-time signals and systems.
- Knowledge of time-domain representation and analysis concepts as they relate to difference equations, impulse response and convolution, etc.
- Knowledge of frequency-domain representation and analysis concepts using Fourier analysis tools, Z-transform
- Concepts of the sampling process.
- Build the Mathematical and computational skills and foundations needed in areas like communication, digital signal and image processing, controlsyustems which will be taught in further courses.

Course Syllabus:

Introduction

Signals, transformation of the independent variable, basic continuous-time signals, basic discrete-time signals, systems, properties of systems

Linear Time-Invariant Systems

Introduction, the representation of signals in terms of impulses, discrete-time LTI systems: the convolution sum, continuous-time LTI systems: the convolution integral, properties of linear time-invariant systems, systems described by differential and difference equations, block diagram representations of LTI systems

Fourier Analysis for Continuous-Time Signals and Systems

Introduction, the response of Continuous-time LTI systems to complex exponentials, representation of periodic signals: the continuous-time Fourier series, approximation of periodic signals using Fourier series and the convergence of Fourier series, representation of aperiodic signals: the continuous-time Fourier transform, periodic signals and the continuous-time Fourier transform, properties of continuous-time Fourier transform, the convolution property, the modulation property, the polar representation of continuous-time Fourier transforms, the frequency response of systems characterized by linear constant-coefficient differential equations, first-order and second-order systems.

Reference Books:

1. A. V. Oppenheim, A. S. Willsky, and I.T. Young, Signals and Systems, 3rd Ed. Prentice Hall. 1997.
2. Simon Haykin, B.V. Veen, Signals and Systems, John Wiely and Sons, 1999.

Course Outcomes:

After successfully completing the course students will be able to:

- Characterize and analyze the properties of CT and DT signals and systems
- Analyze CT and DT systems in Time domain using convolution
- Represent CT and DT systems in the Frequency domain using Fourier analysis tools like CTFS, CTFT, DTFS and DTFT.
- Conceptualize the effects of sampling a CT signal
- Analyse CT and DT systems using Laplace transforms and Z Transforms.

EC352: COMMUNICATION SYSTEM THEORY (L-3, T-1, P-2, CR-5)

Teaching Scheme	***Examination Scheme***			
Lecturer: 3 Hrs/week	*Theory*		*Practical*	
Tutorial: 1 Hrs/week	*Mid Term: 30 Marks*	*End Term: 70 Marks*	*Mid Term/Cont. Eval.: 50 Marks*	*End Term: 50 Marks*
Practical: 2 Hrs/week	*Credits: 4*		*Credits: 1*	

Course Objectives:

- Knowledge about principles and techniques of modern communication systems
- Knowledge in various methods of analog and digital communications, including amplitude (AM), frequency modulation (FM), and phase modulation (PM)
- Analyze the analog-to-digital conversion process with emphasis on Nyquist Sampling Criteria.
- Knowledge about the theory of probability, random process, and optimum detection

Course Syllabus:

Introduction: The communication process, Primary Communication resources, Sources of information, Communication networks, communication channels, modulation process, analog and digital types of communications, Shannon's information capacity theorem.

Random Processes: Mathematical definition of a random process, Stationary processes, mean, correlation and covariance functions, Ergodic processes, Transmission of a random process through a linear time invariant filter, power spectral density, Gaussian process, Noise, narrowband noise, representation of narrowband noise in terms of in-phase and quadrature components, representation of narrowband noise in terms of envelope and phase components, sine wave plus narrow band noise.

Continuous-Wave Modulation: AM, linear modulation schemes, frequency translation, FDM, Angle Modulation, frequency modulation, Non-linear effects in FM systems, Super-heterodyne receiver, Noise in CW modulation systems, noise in linear receivers using coherent detection, noise in AM receivers using envelope detection, noise in FM receivers.

Pulse Modulation: Sampling process, PAM, other forms of pulse modulation, bandwidth-noise trade off, quantization process, PCM, Noise considerations in PCM systems, TDM, digital multiplexers, virtues, limitations and modification of PCM, Delta modulation, Linear prediction, differential pulse code modulation, Adaptive DPCM, MPEG audio coding standard.

Baseband Pulse Transmission: Matched filter, error rate due to noise, inter-symbol interference, Nyqiest's criteria for distortionless baseband binary transmission, correlative-level coding, base band M-ary PAM transmission, digital subscriber lines, optimum linear receiver, adaptive equalization.

Signal-Space Analysis: Geometric representation of Signals, conversion of continuous, AWGN channel into a vector channel, likelihood functions, coherent detection of signals in noise: maximum likelihood decoding, correlation receiver, probability of error.

Text/References:

1. Haykin S., "Communications Systems", 4th Ed., John Wiley and Sons, 2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
3. Taub H. and Schilling D.L., "Prnciples of Communication Systems", Tata McGraw Hill, 2001.

Course Outcomes:

After successfully completing the course students will be able to:

- Understand the mathematical modeling of noise.
- Analyse the behaviour of Analog and Digital Modulation Systems In presence of noise;

- Design the Optimum Filter like Matched Filter to optimize the detector performance
- To understand concepts of Information theory and various coding techniques.
- Understand the M-ary communication which is pre-requisites for Digital Communication.

EC353: CONTROL SYSTEMS (L-3, T-0, P-2, CR-4)

Teaching Scheme	*Examination Scheme*			
Lecturer: 3 Hrs/week	*Theory*		*Practical*	
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	*Mid Term/Cont. Eval.: 50 Marks*	*End Term: 50 Marks*
Practical: 2 Hrs/week	*Credits: 3*		*Credits: 1*	

Course Objectives:

- To learn modeling of a physical system and express its internal dynamics and input-output relationships by means of block diagrams, mathematical model and transfer functions.
- To understand the relationships between the parameters of a control system and its stability, accuracy, transient behavior.
- Students should be able identify the parameters that the system is sensitive to. Determine the stability of a system and parameter ranges for a desired degree of stability using algebraic and frequency domain methods.
- Understanding concept of controllers like P, PD, PI, or PID controller based on the transient and steady state response criteria.

Course Syllabus:

Introduction to Control Systems
Definition, history, elements of control systems, examples of control systems, open loop and closed loop control systems, effect of feedback on overall gain, parameter variations, external disturbances or noise and control over system dynamics, regenerative feedback, linear versus nonlinear control systems, time- invariant versus time-varying systems, SISO and MIMO systems.

Laplace Transform
Properties, transfer function, poles and zeros.

Mathematical Modeling of Dynamic Systems
Introduction, canonical form of feedback control systems, transfer function and impulse response, differential equations and transfer functions of physical systems such as mechanical, electrical, electromechanical, thermal, pneumatic and liquid-level systems, analogous systems: force-voltage, force-current and torque-current analogies, linearization of nonlinear mathematical models, block diagram representation of control system, rules and reduction techniques, signal flow graph: elements, definition, properties, Masons gain formula, application of gain formula to block diagrams.

Time-Domain Analysis of Control Systems
Standard test signals, transient response, error and error constants, time response of first and second order systems and transient response specifications, effect of adding poles and zeros to transfer functions, dominant poles of transfer function, basic control actions and response of control systems, effects of integral and derivative control action on system performance. Control system compensators: elements of lead and lag compensation, elements of Proportional-Integral-Derivative (PID) control.

Stability of Linear Control systems
Concept of stability, BIBO stability: condition, zero-input and asymptotic stability, Hurwitz stability criterion, Routh-Hurwitz criterion in detail, relative stability analysis, Root-locus

technique: introduction, basic properties of the root loci, general rules for constructing root loci, root-locus analysis of control systems.

Frequency Domain Analysis
Frequency response of closed loop systems, frequency domain specifications of the prototype second order system, correlation between time and frequency response, polar plots, Bode plots, phase and gain margin, stability analysis with Bode plot, Log magnitude versus Phase plots. Nyquist stability criterion: Mathematical preliminaries, stability and relative stability analysis.

State Variable Analysis and Design
Concept of state, state variable, and state model, state model for linear continuous time system, diagonalisation, solution of state equation, concept of controllability and observability.

<u>Reference Books :</u>

1. K. Ogata, Modern Control Engineering, Fourth edition, Pearson Education India, 2002.
2. B.C. Kuo, Automatic Control Systems, Seventh Edition, Prentice–Hall of India, 2000.
3. Norman S. Nise, Control systems Engineering, Third Edition, John Wiley and Sons Inc., Singapore, 2001.
4. R.C. Dorf and R.H. Bishop, Modern Control Systems, Eighth edition, Addison-Wesley, 1999.
5. I.J. Nagrath and M. Gopal, Control Systems Engineering, Third Edition, New age International Publishers, India, 2001.

Course Outcomes:
After successfully completing the course students will be able to:

- Model a physical system and express its internal dynamics and input-output relationships by means of block diagrams, mathematical model and transfer functions.
- Understand and explain the relationships between the parameters of a control system and its stability, accuracy, transient behavior.
- Identify the parameters that the system is sensitive to. Determine the stability of a system and parameter ranges for a desired degree of stability.
- Plot the Bode, Nyquist, Root Locus diagrams for a given control system and identify the parameters and carry out the stability analysis.
- Determine the frequency response of a control system and use it to evaluate or adjust the relative stability,
- Design a P, PD, PI, or PID controller based on the transient and steady state response criteria.
- Model and analyse the control systems using state space analysis.

EC354: ELECTROMAGNETIC ENGINEERING (L-3, T-1, P-0, CR-4)

Teaching Scheme	***Examination Scheme***		
Lecturer: 3 Hrs/week	*Theory*		*Practical*
Tutorial: 1 Hrs/week	*Mid Term: 30 Marks*	*End Term: 70 Marks*	---
Practical: ---	*Credits: 4*		*Credits: ---*

Course Objectives:

- To understand three dimensional geometry.
- To get the knowledge, communication takes place using electric and magnetic fields through free space.
- To understand the electric field and magnetic field.
- To get the knowledge of electric and magnetic field are propagated in free space and changes with respect to distance.
- To study the different theorems useful for signal propagation, like divergence theorem, Stokes's Theorem.

- To get the knowledge of different laws useful for propagation of signal in free space, like Gauss's law, Faraday's law, Coulomb's law, etc.
- To understand when charge moves there is change in energy and potential.
- To understand field component changes when medium changed.
- To study and understand how Maxwell's equation useful for communication.
- To understand the wave motion in free space and perfect dielectric

Course Syllabus:

Vector Analysis

Dot product, cross product, coordinate systems, and transformations

Coulomb's Law and Electric Field Intensity

The experimental law of Coulomb, electric field intensity of point charge, field due to a continuous volume charge distribution, field of line charge, field of sheet of charge, streamlines and sketches of fields.

Electric Flux Density, Gauss's Law, and Divergence

Electric flux density, Gauss's law, applications of Gauss's law, divergence, Maxwell's first equation, vector operator and divergence theorem.

Energy and Potential

Energy expended in moving a point charge in electric field, line integral, definition of potential difference and potential, potential field of a point charge and system of charges, potential gradient, the dipole, energy density in the electrostatic field.

Conductors, Dielectrics and Capacitance

Current and current density, continuity of current, conductor properties and boundary conditions, boundary conditions for perfect dielectric materials, capacitance .

Poisson's and Laplace Equations

Poisson's and Laplace's equations, example of the solution of Laplace's and Poisson's equation.

Steady Magnetic Field

Biot-Savart law, Ampere's circuital law, Curl, Stoke's theorem, magnetic flux and magnetic flux density, scalar and vector magnetic potentials.

Magnetic Forces, Materials and Inductance

Force on a moving charge, force between differential current elements.

Time Varying Field and Maxwell's Equations

Faraday's law, displacement current, Maxwell's equations in point form and integral form.

Uniform Plane Wave

The wave motion in free space and perfect dielectric.

Text/Reference Books:

1. W.H. Hayt, Engineering Electromagnetics, Tata McGraw Hill.
2. R. K. Shevgaonkar, Electromagnetic Waves, McGraw Hill, 2005
3. M.A. Wazed Miah, Fundamentals of Electromagnetics, Tata McGraw Hill.
4. N. Narayanrao, Basic Electromagnetic with Application, PHI.
5. J.D. Kraus, Electromagnetics, McGraw Hill.

Course Outcomes:

After successfully completing the course students will be able to:

- Understanding the vector fields E, D, H & B.
- Cleared the Concepts Divergence and Stokes theorem
- Get an idea of the concepts: Work done, Potential, Potential gradient and dipole

- Get the idea of the terms Conductors, Dielectrics, boundary conditions and capacitance
- Understanding of Poisson's and Laplace's equations
- Get knowledge about Time Varying Field and Maxwell's Equations
- Get an idea of Uniform Plane Wave used for propagation

ELECTIVE I

EC355C: BIOMEDICAL SIGNAL PROCESSING (L-3,T-0,P-0,C-3)

Teaching Scheme	***Examination Scheme***		
Lecturer: 3 Hrs/week	*Theory*		*Practical*
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	---
Practical: ---	*Credits: 3*		*Credits: ---*

Course Objectives:

- To understand basic of various Biomedical signals.
- To study origin and characteristics of most commonly used biomedical signals, including ECG, EEG, evoked potential, and EMG.
- To understand sources and characteristics of noise and artifacts in bio signals.
- To understand use of bio signal for simple diagnosis, patient monitoring and physiological investigation.
- To explore the research in biomedical signal processing.
- To explore application of established engineering methods to complex biomedical signals problems.

Course Syllabus:

Unit I:

Essentials of continuous time signals and systems: Convolution, Fourier transform, system transfer functions; Discrete time signals and systems: sampling and quantization, the sampling theorem and signal reconstruction; Frequency analysis of discrete signals and systems: the discrete Fourier transform, power spectrum estimation and system identification

Unit II:

Discrete and continuous Random variables, Probability distribution and density functions. Gaussian and Rayleigh density functions, Correlation between random variables.

Unit III:

Stationary random process, Ergodicity, Power spectral density and autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth, noise figure of systems.

Unit IV:

Data Compression Techniques: Lossy and Lossless data reduction Algorithms. ECG data compression using Turning point, AZTEC, CORTES, Hoffman coding, vector quantisation, DCT and the K L transform.

Unit V:

Cardiological Signal Processing: Pre-processing. QRS Detection Methods. Rhythm analysis. Arrhythmia detection Algorithms. Automated ECG Analysis. ECG Pattern Recognition. Heart rate variability analysis.

Unit VI:

Adaptive Noise Canceling: Principles of Adaptive Noise Canceling. Adaptive Noise Canceling with the LMS adaptation Algorithm. Noise Canceling Method to Enhance ECG Monitoring. Fetal ECG Monitoring.

Unit VII:

Signal Averaging, polishing–mean and trend removal, Prony's method. Linear prediction. Yule–walker(Y–W) equations.

Unit VIII:
Neurological Signal Processing: Modeling of EEG Signals. Detection of spikes and spindles Detection of Alpha, Beta and Gamma Waves. Auto Regressive(A.R.) modeling of seizure EEG. Sleep Stage analysis. Inverse Filtering. Least squares and polynomial modeling.

Unit IX:
Original Prony's Method. Prony's Method based on the Least Squares Estimate. Analysis of Evoked Potentials and PCG.

Unit X:
Analysis of non-stationary processes: examples using Wavelet analysis and Time-series models; Examples of physiological signals and systems including feedback systems.

Text Books

1. Rangaraj M. Rangayyan – Biomedical Signal Analysis. IEEE Press, 2001.
2. D.C.Reddy, Biomedical Signal Processing- principles and techniques, Tata McGraw-Hill, 2005.
3. Biomedical Digital Signal Processing, Willis J.Tompkins, PHI,

Reference Books:

1. Weitkunat R, Digital Bio signal Processing, Elsevier, 1991.
2. Akay M , Biomedical Signal Processing, Academic: Press 1994
3. Cohen.A, Biomedical Signal Processing -Vol. I Time and Frequency Analysis, CRC Press, 1986.

Course Outcomes:
After successfully completing the course students will be able to:

- Model a biomedical system.
- Understand various methods of acquiring bio signals.
- Understand various sources of bio signal distortions and its remedial techniques.
- Analyze ECG, EEG and PCG signal.
- Have basic understanding of diagnosing bio-signals and classifying them by detecting various parameters.

EC355D: MICROELECTRONICS (L-3,T-0,P-0,C-3)

Teaching Scheme	***Examination Scheme***		
Lecturer: 3 Hrs/week	*Theory*		*Practical*
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	---
Practical: ---	*Credits: 3*		*Credits: ---*

Course Educational Objectives (CEO):
The course aims to:

- Describe crystal structure of solid and Clarify basics of semiconductor.
- Analyzing carrier concentration and energy band diagrams of extrinsic, P type, N type semiconductor material under equilibrium condition.
- Explain different phenomenon like Charge neutrality principle, Hall effect, Mass action law, drift, diffusion, carrier generation and recombination.
- Explain terminal voltage and current characteristics of PN junction and MOSFET with the help of energy band diagrams
- A comprehensive understanding of manufacturing processes of PN junction and MOSFET.

Course Syllabus:

The crystal structure of solids, theory of solids, the semiconductor in equilibrium, carrier distribution in extrinsic semiconductors, carrier transport and excess carrier phenomena, carrier drift, carrier diffusion, carrier generation and recombination, Hall effect.

The pn junction and metal semiconductor contact, basic structure of pn junction, metal semiconductor contact, doped pn junction, device fabrication techniques.

Fundamentals of MOSFET, MOSFET action, MOS capacitor, MOSFET operations, small signal equivalent circuit, MOSFET scaling, non-ideal effects, threshold voltage modifications, additional electrical characteristics,

Reference Books:

1. Donald Neamen, An introduction to semiconductor devices, McGraw Hill International Edition, 2006
2. Ben G. Streetman, S. Banerjee, Solid state electronic devices, Prentice Hall, 2000
3. R. F. Pierret, Semiconductor Device Fundamentals, Pearson Education, 2011

Course Outcomes (COs):

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

- Understand the physics of semiconductor material and use the concept in designing of integrated circuit.
- Compute carrier concentration of semiconductor under various conditions.
- Compare conductivity and resistivity of semiconductor material under various conditions.
- Inspect terminal voltage and current characteristics of PN junction, MOSFET.
- Design integrated circuits with consideration of capabilities and limitations of fabrication technology.

EC355E: DSP PROCESSORS (L-3,T-0,P-0,C-3)

Teaching Scheme	*Examination Scheme*		
Lecturer: 3 Hrs/week	*Theory*		*Practical*
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	---
Practical: ---	*Credits: 3*		*Credits: ---*

Course Syllabus:

Unit I:

Introduction to Programmable DSPs: Comparison of GP Processors and DSP processor Architecture, Multiplier and MAC, Modified Bus structures and Memory Access schemes, Multiple Access Memory, Dual port memory, VLIW Architecture, Pipelining, Special Addressing Modes, On-Chip Peripherals, RISC Vs CISC design

Unit II:

Architecture of TMS32054X: Introduction, Architecture, buses, Memory organization, CPU, ALU, Barrel Shifter, On-chip Peripherals, Address Generation Logic

Unit III:

TMS32054X Assembly Language Instructions, Programmimg in Assembly language
Application Programmes in C54X: Code Composer Studio, Application Programmes in C54X

Unit IV:

TMS320C6xx DSPs: Features, Architecture, Memory Interfacing, Addressing Modes, Pipeline operation, Peripheral, C-Programming and DSP Application development like Speech coding Image processing and coding applications

Unit V:
Recent trends in DSP System design, Media processor, FPGA Based DSP System Design

Reference Books:
1. B. Venkatramani, M. Basker: Digital Signal Processors: Architecture, Programming and Applicaions, TMS, 2004
2. Shehrzad Qureshi, EMBEDDED IMAGE PROCESSING ON THE TMS320C6000™ DSP (Examples in Code Composer Studio™ and MATLAB), Springer Science 2005.

EC355F: COMPUTER ORGANIZATION (L-3,T-0,P-0,C-3)

Teaching Scheme	*Examination Scheme*		
Lecturer: 3 Hrs/week	*Theory*		*Practical*
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	---
Practical: ---	*Credits: 3*		*Credits: ---*

Course Syllabus:

Introduction
Computer Types, Function and structure of a computer, Functional components of a computer, Interconnection of components, Performance of a computer.

Representation of Instruction
Machine instructions, Operands, Addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.

Processing Unit
Organization of a processor - Registers, ALU and Control Unit, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardware control unit, Microprogrammed control unit.

Memory Subsystem
Semiconductor memories, Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms, Memory management unit - Concept of virtual memory, Address translation, Hardware support for memory management

Input/output Subsystem
Access of I/O devices, I/O ports, I/O control mechanisms - Program controlled I/O, Interrupt controlled I/O, and DMA controlled I/O, I/O interfaces – Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infiniband, I/O peripherals - Input devices, Output devices, Secondary storage devices.

References
1. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization", McGraw-Hill, 2002.
2. W. Stallings, "Computer Organization and Architecture - Designing for Performance", Prentice Hall of India, 2002.
3. D. A. Patterson and J. L. Hennessy, "Computer Organization and Design - The Hardware/Software Interface", Morgan Kaufmann, 1998.
4. J .P. Hayes, "Computer Architecture and Organization", McGraw-Hill, 1998

EC355G: DIGITAL TELEPHONY (L-3,T-0,P-0,C-3)

Teaching Scheme	*Examination Scheme*		
Lecturer: 3 Hrs/week	*Theory*		*Practical*
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	---

Practical: ---	*Credits: 3*	*Credits: ---*

Course Objectives:

- To get knowledge of fundamental structure of telephone switching system.
- To understand the working principle of telephone switching system.
- To understand traffic and losses in network.
- To Know the ISDN Technology.
- To understand the principle of digital Internet Protocol based telephony.
- To grasp the knowledge of new technology of transmitting voice over packet network.

Course Syllabus:

Telephony Background

An overview of telephone networks, transmission system, switching system, signaling, echo cancellation, working principles of telephone, DC (pulse) and DTMF (tone) signaling.

Traffic Analysis

Traffic characterization, loss systems, network blocking probabilities, delay systems.

Digital Switching and Networks

Space division switching, time division switching, time space time (TST) switch, space time space (STS) switch, comparison of TST and STS switches, network synchronization, control and management timing, timing inaccuracies, network synchronization, network control, Network management.

Digital Subscriber Access

Integrated service digital network (ISDN): ISDN overview, ISDN interfaces and functions, user network interface, ISDN protocol architecture, ISDN physical layer: basic user– network interface, primary rate user- network interface, ISDN data link layer: LPAD protocol, terminal adaptation, bearer channel data link control, ISDN network layer: basic call control, control of supplementary services.Broadband ISDN (B - ISDN) Architecture, Protocols. Digital subscriber loop (DSL): ADSL, HDSL, VDSL, Fiber in loop, wireless local loop (WLL) Signaling System Number 7 (SS7): SS7, architecture signaling date link level, signaling link level, network level, signaling connection control part.

Introduction to IP Telephony and Related Protocols

Overview of TCP/IP protocol, Resource reservation protocol (RSVP), multiprotocol label switching, real time protocol (RTP), session initiation protocol (SIP), H.323 standard, media gateway control protocol.

Voice Over Packet Networks

Voice over ATM, ATM cell format, ATM protocol stack, ATM adaptation layer, IP over ATM, frame relay over ATM.

Course Outcomes:

After successfully completing the course students will be able to:

- Understand telephone network.
- Analyze traffic in telephone network.
- Interpret working of different switching networks.
- Understand various techniques of transmitting digital data over telephone line.
- Understand terminology of exchange of voice, video, fax and other form of information using internet protocol over telephone network.

EC355H: PHYSIOLOGY FOR ENGINEERS (L-3,T-0,P-0,C-3)

Teaching Scheme	*Examination Scheme*		
Lecturer: 3 Hrs/week	*Theory*		*Practical*
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	---

Practical: ---	*Credits: 3*	*Credits: ---*

Course Objectives:

- To learn basic aspects of human physiology.
- To develop an engineering approach towards understanding of biological function.
- Understand the integration and control of the different physiological systems and their roles in maintaining homeostasis.
- Apply engineering principles to physiological problems in biochemistry, smooth, cardiac, and skeletal muscle mechanics, as well as the cardiovascular, respiratory, neural, auditory, visual, endocrine and renal systems.

Course Syllabus:

Basic cell physiology; Biochemical cycles.

Systemic physiology: Neuromuscular system; Blood and lymph; Circulatory system; Gastro-intestinal system; Kidney and excretory system; Sensory systems- visual, auditory, vestibular; Endocrine- pituitary, adrenal, pancreatic, etc.

Reference books:

1. Arthur C. Guyton : Textbook of Medical Physiology, 8th ed, Prism Books (Pvt) Ltd & W.B. Saunders Company, 1991.
2. J.B.West. ed.: Best and Taylor's Physiological Basis of Medical Practice, 11th ed., Williams and Wilkins, Baltimore, 1985.
3. W.F.Ganong:Title: Review of Medical Physiology, 13th ed., Prentice-Hall, Connecticut, 1987.
4. D.S. Luciano, A.J. Vander & J.H Sherman : Human Anatomy And Physiology, 2nd ed., McGraw Hill, New York, 1983.

Course Outcomes:

After successfully completing the course students will be able to:

- Describe organization of cell and tissues.
- Understand fundamental cell physiology for living organisms.
- Analyze structure of connective tissues, skeletal muscle, bones and joints.
- Recognize and describe the microscopic structure of various body system viz. Neuro-muscular system, Circulatory system, Gastrointestinal system, Kidney system etc.
- Understand function and interaction of above systems with each other

355I: COMPUTER SECURITY (L-3,T-0,P-0,C-3)

Teaching Scheme	***Examination Scheme***		
Lecturer: 3 Hrs/week	*Theory*		*Practical*
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	---
Practical: ---	*Credits: 3*		*Credits: ---*

Course Objectives:

- To understand Network Device Functions and configuration of Hubs, Switch and Routers.
- To develop a basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
- To gain the knowledge about Network Security Devices (Firewall, IDS, etc).
- To understand and analyze network traffic and protocols.
- To understand network security concept.
- To develop understanding of security policies and protocols for implementation of these policies.

Course Syllabus:

Elementary Cryptography

Terminology and Background, Substitution Ciphers, Transpositions, Making Good Encryption Algorithms, Data Encryption Standard, AES Encryption Algorithm, Public Key Encryption, Cryptographic Hash Functions, Key Exchange, Digital Signatures, Certificates.

Program Security
Secure programs, Non-malicious Program Errors, Viruses, Targeted Malicious code, Controls against Program Threat, Control of Access to General Objects, User Authentication, Good Coding Practices, and Open Web Application Security Project Top 10 Flaws, Common Weakness Enumeration Top 25 Most Dangerous Software Errors.

Security In Networks
Threats in networks, Encryption, Virtual Private Networks, PKI, SSH, SSL, IPSec, Content Integrity, Access Controls, Wireless Security, Honeypots, Traffic Flow Security, Firewalls, Intrusion Detection Systems, Secure e-mail.

Security In Databases
Security requirements of database systems, Reliability and Integrity in databases, Two Phase Update, Redundancy/Internal Consistency, Recovery, Concurrency/Consistency, Monitors, Sensitive Data, Types of disclosures, Inference.

Security Models And Standards
Secure SDLC, Secure Application Testing, Security architecture models, Trusted Computing Base, Bell-LaPadula Confidentiality Model, Biba Integrity Model, Graham-Denning Access Control Model, Harrison-Ruzzo-Ulman Model, Secure Frameworks, COSO, CobiT, Compliances, PCI DSS, Security Standards - ISO 27000 family of standards, NIST.

Text Books:

1. Charles P. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, Fourth Edition, Pearson Education, 2007.
2. Matt Bishop, “Introduction to Computer Security”, Addison-Wesley, 2004.
3. Michael Whitman, Herbert J. Mattord, “Management of Information Security”, Third Edition, Course Technology, 2010.

References:

1. William Stallings, “Cryptography and Network Security: Principles and Practices”, Fifth Edition, Prentice Hall, 2010.
2. Michael Howard, David LeBlanc, John Viega, “24 Deadly Sins of Software Security: Programming Flaws and How to Fix Them”, First Edition, Mc Graw Hill Osborne Media, 2009.
3. Matt Bishop, “Computer Security: Art and Science”, First Edition, Addison-Wesley, 2002.
5. https://www.pcisecuritystandards.org/security_standards/pci_dss.shtml
6. http://cwe.mitre.org/top25/index.html

Course Outcomes:
After successfully completing the course students will be able to:

- Understand necessity of computing security.
- Describe the various encryption and description terminology.
- Identify major types of threats and attack to computer security and develop the strategy to protect computer organization from treats and attacks.
- Understand how security policies, standards and practices are developed.
- Understand security model in program, network and data base.

EC355J: MECHATRONICS (L-3,T-0,P-0,C-3)

Teaching Scheme	*Examination Scheme*		
Lecturer: 3 Hrs/week	*Theory*		*Practical*
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	---
Practical: ---	*Credits: 3*		*Credits: ---*

Course Objectives:

- To develop an ability to model and analyze electrical and mechanical systems and their interconnection.
- To develop an ability to integrate mechanical, electrical, electronics, Instrumentation and control, and computer engineering in the design of mechatronics systems.
- To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- To develop ability to do the complete design, building, interfacing and actuation of a mechatronic system for a set of specifications.

Course Syllabus:

Unit I:
Introduction: Mechatronics Systems, Measurement systems, Control systems, Microprocessor-based controllers, Mechatronics approach

Unit II:
Sensors, Transducers, and Signal Conditioning: Sensors and Transducers, Performance terminology, Displacement, position and proximity, Velocity and motion, Force, Fluid pressure, Liquid level, Temperature, Light sensors, Selection of sensors, signal conditioning circuits

Unit III:
Pneumatic, Hydraulic, and Mechanical Actuation Systems: Acquisition systems, Pneumatic and hydraulic systems, Pressure control valves, Cylinders, Process controlled valves, Rotary actuators, Mechanical systems, Types of motion, Kinematic chains, Cams, Gear trains, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection

Unit IV:
Representation and Electrical Actuation Systems: Data Displays, Data presentation elements, Data acquisition systems, Testing and calibration, Electrical systems, Solid state switches, solenoids, D. C. Motors, A. C. Motors, stepper motors.

Unit V:
Systems Models Review: Mathematical models, Mechanical system building blocks, electrical system building blocks, fluid system building blocks, thermal system building blocks, Rotational-translational systems, Electromechanical systems, hydraulic mechanical systems, System transfer function, dynamic response of systems, frequency response.

Unit VI:
Programmable logic controllers: closed loop controllers, PLCs, Basic structure, input output processing, programming, mnemonics, timers, interval relays and counters, shift registers, master and jump controls, data handling, analogue input/output, selection of a PLC

Unit VII:
Fault finding: Fault detection techniques, watchdog timer, parity and error coding checks, common hardware faults, microprocessor systems, emulation and simulation, PLC systems

Unit VIII:
Design and mechatronics: Possible design solutions, case studies of mechatronic systems, A robotic arm

Unit IX:
Robotics: Types of robots, types of robot contol, robot drive system, selection parameter of a robot, application of robot

Reference Books:

1 W. Bolton, Mechatronics – Electronic control systems in mechanical and electrical Engineering, 2nd Edition, Pearson Education Asia.
2 Dan Necsulescu, Mechatronics, Pearson Education, Asia
3 David Alciatore and Histand, Introduction to Mechatronics and measurment system, TMH
4 M D Singh, J G Joshi, Mechatronics, PHI

Course Outcomes:

After successfully completing the course students will be able to:

- Model and analyse electrical and mechanical systems and their interconnection.
- Develop an ability to integrate mechanical, electrical ,electronics, Instrumentation and control, and computer engineering in the design of mechatronics systems.
- Develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- Efficiently use software for data acquisition and the programming of micro controllers.
- Develop an ability to do the complete design, building, interfacing and actuation of a mechatronic system for a set of specifications.
- Gain information about the function of various measuring instruments and using them and recognize upcoming challenges in Sensor.

EC355K: NUMERICAL METHODS (L-3, T-0, P-0, CR-3)

Teaching Scheme	*Examination Scheme*		
Lecturer: 3 Hrs/week	*Theory*		*Practical*
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	---
Practical: ---	*Credits: 3*		*Credits: ---*

Course Objects:

- To derive numerical methods to approximate a function.
- To prove the results for various root finding methods.
- To derive appropriate numerical methods to solve linear algebraic equations.
- To derive appropriate numerical methods for various curve fitting and interpolation problems.
- To derive appropriate numerical methods to calculate definite integral.
- To derive appropriate numerical methods to solve differential equation.

Course Syllabus:

Unit I:

Approximations & Errors: Significant figures, accuracy & precision, Error definitions, round off errors, Truncation errors, Error Approximations, Total numerical errors, Blunders formulation errors and Data uncertainty.

Unit II:

Roots of Equation: Bracketing Methods: Graphical methods, Bisections method, false position method Open Methods: Simple one point iteration method, Newton Raphson method, secants method, multiple Roots, System of nonlinear equations, Case Study: Design of Electric circuit and General Engineering problems.

Unit III:

System of Linear algebraic equations: Gauss eliminations method, pitfalls of elimination, techniques for improving solutions. Gauss Jordan & Guass seidal methods. Matrix inverse, error analysis and system condition and Guass Seidal method.

Unit IV:

Curve fitting: Least Squares regression: Linear regression, Polynomial regression, multiple linear regression, nonlinear regression. Interpolation: Newtons divided difference-interpolating polynomials, Lagrange interpolation polynomials and Spline Interpolation.

Unit V:
Numerical Differentiation & Integration: Newton cotes integration formula: trapezoidal rule, Simpson's rule, and integration with unequal segments. Integrations of equations: Romberg integration, gauss quadralure integration improper integration. Numerical Differentiation, High accuracy differentiation formula, Richardson extrapolation, Derivative of unequally spaced data, derivative and integral estimates for data with errors. Case studies: Cash flow analysis determination of root mean square current by numerical Integration.

Unit VI:
Ordinary differential equations: One step method: Euler's method, modification & improvement of Euler's method, Runga-Kutta methods, system of equation Case Study: Mathematical model for computer sales Projection, Simulating transient current for Electrical circuit.

Reference Books:
1. Steven C Chapra, Numerical Methods For Engineers, McGraw-Hill.
2. S. S. Satry, Introductory Methods of Numerical Analysis, Prentice-Hall India.3. V. Rajaraman, Computer Oriented Numerical Methods, Prentice-Hall India.

Course Outcomes:
After successfully completing the course students will be able to:

- Demonstrate common error minimization methods to obtain approximate solutions for mathematical problems.
- Describe the numerical methods for solving ordinary differential equation.
- Understand and solve various linear algebraic equation by numerical methods.
- Familiar with numerical interpolation and approximation of functions.
- Compute numerical differentiation and Integration.

EC356: SEMINAR (L-0, T-0, P-2, CR-1)
It should be based on latest topics in Electronics Engineering and related fields.

Course Outcomes:
After successfully completing the course students will be able to:

- Develop knowledge in the Electronics and telecommunication field through independent learning and collaborative study.
- Identify, understand and discuss current, real-world issues in the field of social and electronics and telecommunications.
- Improve oral communication, written communication and presentation skills.
- Explore creative avenues of expression, solve problems, and make consequential decisions with principles of ethics and respect in interaction with others.

SEMESTER II

EC357: DIGITAL SIGNALS PROCESSING (L-3, T-0, P-2, CR-4)

Teaching Scheme	*Examination Scheme*			
Lecturer: 3 Hrs/week	*Theory*		*Practical*	
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	*Mid Term/Cont. Eval.: 50 Marks*	*End Term: 50 Marks*
Practical: 2 Hrs/week	*Credits: 3*		*Credits: 1*	

Course Educational Objectives (CEO):
The course aims to:

- Coverage of Characterization and classification of signals, signal processing operations.
- Knowledge of Discrete time Fourier transform, Discrete Fourier Transform,Discrete Fourier Transform properties, Computation of the DFT of real sequences
- Knowledge of Z-transform, ROC ofthe rational Z-transform, Inverse Z-transform, Z-transform properties.
- Concepts of digital filters, All pass Transfer function, Minimum phase and maximum phase transfer functions, Complementary transfer functions.
- Study of Block diagram representation, equivalent structures, Basic FIR structures, Basic IIR structures, FIR and IIR filter design

Course Syllabus:

Signals and Signal Processing
Motivation, Characterization and classification of signals, signal processing operations, examples of signals, signal processing applications.

Discrete Time signals in Transform domain
Discrete time Fourier transform, Discrete Fourier Transform, Relationship between the DTFT and the DFT and their inverses, Discrete Fourier Transform properties, Computation of the DFT of real sequences, Linear convolution using the DFT, The Z-transform, ROC of the rational Z-transform, Inverse Z-transform, Z-transform properties, Transform domain representation of random signals.

LTI Discrete time systems in Transform Domain
Finite dimensional Discrete time systems, the frequency response, the transfer function, types of transfer functions, Simple digital filters, All pass Transfer function, Minimum phase and maximum phase transfer functions, Complementary transfer functions, Inverse systems, Systems identification, Digital two pairs.

Digital filter structures
Block diagram representation, equivalent structures, Basic FIR structures, Basic IIR structures, all pass filters, IIR tapped cascaded lattice structures, FIR cascaded lattice structures.

Digital Filter design
IIR filter design – Bilinear transformation, Impulse invariant transformation, Low pass IIR digital filters, Spectral transformations, FIR filter design using windowing techniques, Frequency sampling technique, Computer aided design.

DSP algorithm implementation
Computation of DFT, FFT algorithms, Decimation in time, Decimation in Frequency, Different algorithms of FFT such as DIT and DIF where input and output is in order, radix-n algorithms.

Applications of DSP

<u>Reference Books:</u>

1. S. K. Mitra, Digital signal processing- A computer based approach, Tata McGraw Hill, 2002
2. A. V. Oppenheim, R, W, Schafer, Discrete time signal processing, PHI
3. J. G. Proakis, D. G. Manolakis, Digital signal processing –Principles, algorithms and applications, PHI
4. A. V. Oppenheim, R. W. Schafer, Digital signal processing, PHI

5. E. C. Ifeachor, B. W. Jarvis, Digital signal processing- A practical approach, Pearson Education.

Course Outcomes (COs):

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

- Represent discrete-time signals analytically and visualize them in the time domain
- Understand the meaning and implications of the properties of systems and signals
- Understand the Transform domain and its significance and problems related to Computational complexity
- Specify and design digital filters using MATLAB

EC358: LINEAR INTEGRATED CIRCUITS (L-3, T-0, P-2, CR-4)

Teaching Scheme	***Examination Scheme***			
Lecturer: 3 Hrs/week	*Theory*		*Practical*	
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	*Mid Term/Cont. Eval.: 50 Marks*	*End Term: 50 Marks*
Practical: 2 Hrs/week	*Credits: 3*		*Credits: 1*	

Course Objectives:

- To study fundamentals of OPAMP.
- Study linear integrated circuits and their use in design of different circuits for various applications.
- To study and design different voltage regulator circuits.
- To study and design different audio power amplifiers.

Course Syllabus:

Operational Amplifier

OpAmp (741), specifications, packaging, characteristics, ac and dc parameters and their measurements, noise and frequency compensation.

Linear OpAmp Circuits

Inverting and non-inverting amplifiers, summing amplifier, differential amplifier, instrumentation amplifier and its applications, voltage to current converters and current to voltage converters, low voltage ac and dc voltmeter

Nonlinear OpAmp Circuits

Differentiator, integrator, comparator and its characteristics, Schmitt trigger, window detector, peak detector, precision rectifier, log and antilog amplifier

Voltage Regulators

Design of series voltage regulator using discrete components, protection circuits and pre-regulator, design of fixed voltage regulators (IC 78xx and 79xx), adjustable regulators (LM 317, 337), precision voltage regulators (IC 723), design of switching regulators (IC 78s40)

Amplifier Design

Design of class A, class AB, and class C amplifiers, performance parameters, monolithic power amplifiers LM 380 and TBA 810.

Waveform Generators

Square wave, triangular wave and sawtooth wave generator, phase shift and Wein bridge oscillators and its design, function Generator using ICL 8038.

Specialized ICs and Their Applications

Design of IC 555 and its applications, PLL IC 565 and its applications, design of voltmeter using 7106/07.

Reference Books :

1. Ramakant Gaikwad, OPAMPS and Linear Integrated Circuits, PHI/Pearson Education.
2. S.N. Talbar and T.R. Sontakke, Electronic Circuit Design, SadhuSudha Prakashan, Nanded
3. K.R. Botkar, Integrated Circuits, Khanna Publishers, Delhi.
4. B.S. Sonde, Design using Integrated Circuits, Wiley Eastern.
5. Sedra and Smith, Microelectronic Circuits, Sixth Edition.

Course Outcomes:

After successfully completing the course students will be able to:

- Learn the basic principle of op-amp, construction, characteristics, parameter, limitations, various configurations.
- Understand the need and use of linear and non linear op-amp circuits and their applications.
- Work out the practical and design implementation of different voltage regulators.\
- Design different audio power amplifiers.
- Work out on design implementation of different waveform circuits and specialized ICs.

EC359: EMBEDDED SYSTEM (L-3,T-0 P-2, CR-4)

Teaching Scheme	***Examination Scheme***			
Lecturer: 3 Hrs/week	*Theory*		*Practical*	
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	*Mid Term/Cont. Eval.: 50 Marks*	*End Term: 50 Marks*
Practical: 2 Hrs/week	*Credits: 3*		*Credits: 1*	

Course Educational Objectives (CEO):

The course aims to:

- Introduce the basic concepts of embedded system design.
- Teach aspects of the design and development of an embedded system.
- Development of targeted hardware using embedded software programming.
- Design applications using ARM7.
- Introduce basic concepts of RTOS.

Course Syllabus:

Embedded System Introduction

Introduction to Embedded System, History, Design challenges, optimizing design metrics, time to market, applications of embedded systems and recent trends in embedded systems, embedded design concepts and definitions.

Custom Single-Purpose Design

Design of General purpose processor: Controller and data path design, Concept of FSM, RT level processor design using FSM, Optimization, concept of pipelining, superscalar and VLIW architectures, etc. Design of Custom Single purpose processors like: Soda vending machine design, UART design, GCD design, Elevator controller design, etc.

System Architecture

Introduction to ARM core architecture, LPC 2148, ARM extension family, operating modes, overview of instruction set, Pipeline, memory management, Bus architecture, Exception Handling and interrupt structure, etc.

Interfacing and Programming

Need of interfacing, interfacing techniques, Basic embedded C programs for GPIO and interfacing of different devices like switches, keypad, LED, LCD, Graphic LCD, Relay, Stepper Motor, Study and programming of on-chip peripherals like timers, counters, on-chip ADC, DAC, RTC modules, WDT, PLL, PWM, Can etc.

Real Time Operating System Concept
Need of RTOS in Embedded system software, Foreground/Background systems, multitasking, context switching, IPC, Scheduler policies, Architecture of kernel, task scheduler, ISR, Semaphores, mailbox, message queues, pipes, events, timers, memory management, RTOS services in contrast with traditional OS. Introduction to MUCOS-II RTOS, study of kernel structure of MUCOS-II, Synchronization in MUCOS-II, Inter-task communication in MUCOS-II, Memory management in MUSOS-II, porting of RTOS on ARM 2148, Application developments using MUCOS-II.

Memory
Common Memory types, Advanced RAMs, Memory hierarchy and Cache Memory management, hardware and software design

Communication protocol
Basic protocol concept, study of protocols like SPI, SCI, I2C, CAN, Ethernet, Wireless Protocols: IrDA, Bluetooth, IEEE802.11, Zigbee, RF modules, GSM modem for AT command study etc.

Digital Camera Design
Introduction to simple digital camera, requirement specification, different ways to design of camera.

Reference Books:

1. Embedded Systems, Rajkamal , TMH, 2008.
2. Frank Vahid - Embedded Systems , Wiley India, 2002
3. ARM System-on-Chip Architecture, Steve Furber - Pearson 2005
4. Jean J Labrose - MicroC / OS-II, Indian Low Price Edition 2002
5. DR.K.V.K.K. Prasad - Embedded / real time system, Dreamtech
6. Iyer, Gupta - Embedded real systems Programming , TMH
7. Embedded systems software primer, David Simon - Pearson
8. ARM System Developers Guide- Sloss, Symes, Wright, ElsevierMorgan Kaufman, 2005
9. LPC2148 Data Sheets www.arm.com

Course Outcomes (COs):

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

- Understand and explain architecture of ARM 7.
- Write embedded C program for ARM 7.
- Identify built-in peripherals and write program in embedded C for interfacing of I/O devices.
- Design application using ARM 7.
- Understand to basic concepts of RTOS.

EC360: DIGITAL COMMUNICATION (L-3, T-0, P-0, CR-3)

Teaching Scheme	***Examination Scheme***		
Lecturer: 3 Hrs/week	*Theory*		*Practical*
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	----
Practical: -- Hrs/week	*Credits: 3*		*Credits:*

Course Educational Objectives (CEO):

- To understand the building blocks of digital communication system.
- To prepare mathematical background for communication signal analysis.
- To understand and analyze the signal flow in a digital communication system.
- To analyze error performance of a digital communication system in presence of noise and other interferences.
- To understand concept of spread spectrum communication system.

Course Syllabus:

Introduction

Elements of digital communication system, communication channels and their characteristics, mathematical models for communication channels, historical perspective in the development of digital communications, review of probability, random variables and stochastic processes, response of a linear time invariant system to a random input signal.

Source Coding

Mathematical models for information sources, a logarithmic measure of information, average mutual information and entropy, information measures for continuous random variables. Coding for discrete sources, Coding for discrete memoryless sources, discrete stationary sources, The Lempel-Ziv algorithm, coding for analog sources-optimum quantization, rate distortion function, scalar quantization, vector quantization, Coding techniques for analog sources. Temporal waveform coding, spectral waveform coding, model based source coding.

Characterization of Communication Signals and Systems

Representation of bandpass signals and systems, representation of band-pass systems, response of a band pass system to a band pass signal, representation of a band-pass stationary stochastic processes, orthogonal expansion of signals, representation of digitally modulated signals, memoryless modulation methods.

Digital Modulation Techniques

Digital modulation formats, Amplitude shift keying, frequency shift keying, phase shift keying, DPSK, QPSK, Minimum shift keying.

Channel Capacity and Coding

Channel models and channel capacity, random selection of codes.

Block and Convolutional Channel Codes

Linear block codes, generator matrix and parity check matrix, some specific linear block codes, cyclic codes, convolutional codes , transfer function , optimum decoding of convolutional codes-Viterbi algorithm distance properties of binary convolutional codes.

Spread Spectrum Techniques

Introduction, PN sequences, direct sequence spread spectrum signals, processing gain, probability of error. Frequency hop spread spectrum signals, applications.

Multiuser Communication

Introduction to multiple access techniques, capacity of multiple access methods, Random access methods.

Text books:

1. J. G. Proakis, Digital Communication, Fourth Edition, McGraw Hill

Reference books:

1. Simon Haykin, Digital Communication, John Wiley & Sons Pvt. Ltd.
2. B. P. Lathi, Modern Analog and Digital Communication Systems, Prism Sounders.
3. K.S. Shanmugam, Digital and Analog Communication Systems, Wiley Int. Pub.

Course Outcomes:

After successfully completing the course students will be able to:

- Understand the principles of digital communications system.
- Explain importance and use of probability and random variables in digital communication.
- Characterize communication signal and system.
- Work out the practical and design implementation of different type of encoding and decoding techniques.
- Classify different multi-user systems.

ELECTIVE II:

EC361B PATTERN RECOGNITION (L-3,T-0,P-2,C-4)

Teaching Scheme	*Examination Scheme*			
Lecturer: 3 Hrs/week	*Theory*		*Practical*	
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	*Mid Term/Cont. Eval.: 50 Marks*	*End Term: 50 Marks*
Practical: 2 Hrs/week	*Credits: 3*		*Credits: 1*	

Course Educational Objectives(CEO):

- To study basic concepts in pattern recognition.
- To provide knowledge of models, methods and tools used to solve regression, classification, feature selection and density estimation problems.
- To understand pattern recognition theories, such as Bayes classifier, linear discriminant analysis.
- To explore knowledge of recognition, decision making and statistical learning problems.
- To provide hands-on experience in analyzing and applying pattern recognition techniques in practical problems.

Course Syllabus:

Introduction
Machine perception, pattern recognition example, pattern recognition systems, the design cycle, learning and adaptation.

Bayesian Decision Theory
Introduction, continuous features – two categories classifications, minimum error-rate classification- zero–one loss function, classifiers, discriminant functions, and decision surfaces

Normal Density
Univariate and multivariate density, discriminant functions for the normal densitydifferent cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context

Maximum Likelihood and Bayesian Parameter Estimation
Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case

Un-supervised Learning and Clustering
Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Date description and clustering – similarity measures, criteria function for clustering.

Component Analyses
Principal component analysis, non-linear component analysis; Low dimensional representations and multi dimensional scaling

Discrete Hidden Morkov Models
Introduction, Discrete–time markov process, extensions to hidden Markov models, three basic problems for HMMs

Introduction to Soft Computing Approaches in Pattern Recognition.

Reference Books :

1. Pattern classifications, Richard O. Duda, Peter E. Hart, David G. Stroke. Wiley Pub, Second Edition.
2. Fundamentals of speech Recognition, Lawerence Rabiner, Biing, Hwang Juang Pearson education.
3. Pattern Recognition and Image Analysis – Earl Gose, Richard John baugh, Steve Jost PHI 2004
4. T. M. Ross, Fuzzy logic, Mc-Graw Hill Inc.

Course Outcomes:

After studying this course the students would be able to:

- Describe concepts of Pattern Recognition and its system, learning and adaptation for the classification.
- Understand the principles of Bayesian and Maximum-likelihood parameter estimation and apply them in relatively simple probabilistic models such as Gaussian Model.
- Perform data clustering in an unsupervised manner by means of various algorithms, such as parzen window density estimate
- Understand the concept of classification using K-means and K-nearest neighbour and its applications

EC361C: DIGITAL SYSTEM DESIGN WITH VERILOG (L-3,T-0,P-2,C-4)

Teaching Scheme	***Examination Scheme***			
Lecturer: 3 Hrs/week	*Theory*		*Practical*	
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	*Mid Term/Cont. Eval.: 50 Marks*	*End Term: 50 Marks*
Practical: 2 Hrs/week	*Credits: 3*		*Credits: 1*	

Course Objectives:

- Introduction to combinational logic design.
- Introduction tosequential logic design.
- Introduction to Verilog HDL, Features, Syntax and Modelling styles.
- Design of combinational logicmodules using Verilog HDL and Synthesis.
- Design of Sequential logicmodules, FSMs using Verilog HDL and verification.

Course Syllabus:

Introduction

Introduction to digital design, analog Vs. digital, digital devices, electronic aspects of digital design, software aspects of digital design, programmable logic devices, ASICs, PCBs, digital design levels, PLDs, PLAs, Basic components and architecture of FPGA.

Combinational Component Design

Adders: Full adders, Ripple carry adders, carry look ahead adders, pipelined adders, Two’s complement binary numbers, Subtractor, ALU, decoder, Encoder, multiplier, comparator, Barrel shifters, multiplier design and its Verilog implementation

Multi-operand addition, sequential multiplication with sign and magnitude, two’s complement, partially combinational implementation, MAC, saturating multiplier, truncating multiplier, rectangular multiplier.

Sequential Circuit Design Finite state machine (FSM) models, state diagram, analysis and synthesis of sequential circuits, Verilog implantation of sequential circuits. Registers, shift registers, counters: up/down, register files, SRAM, memory components: FIFO’s, RTL design.

Data Path Design

Designing dedicated data path, general datapath design, timing issue, Verilog implementation of datapath.

Control Unit design
Constructing the control unit, stand alone controllers, ASM charts and state action tables, Verilog implementation of control unit. Examples of manual design of dedicated microprocessors.

Text books:
1. J. F. Wakerly, Digital design- Principles and Practices, Pearson India, Third edition.
2. J. Bhasker, VHDL Primer, Pearson Education Asia, Third edition.

Reference books:
1. W. I. Fletcher, An Engineering Approach to Digital Design, PHI.
2. Samual C. Lee, Digital Circuits and Logic Design, PHI.
3. C. H. Roth Jr., Digital System Design using VHDL, PWS Publishing Company.
4. Kevin Skahil, VHDL for Programmable Logic, Addison Wesley.
5. M.D. Ercegovac, Digital Arithmetic, Elsevier.
6. E.O. Hwang, Digital Logic and Microprocessor design with VHDL, Cengage Learning.

Course Outcomes:
After studying this course the students would be able to

- Use of VLSI design methodologies and apply fordesign of complex digital systems.
- To develop ability to solve a problem with given description and to design combinational logic function.
- To design, simulate and synthesize the digital circuits with Verilog HDL.
- To create circuits for given system specifications.
- Students may gain practical experience by designing, modeling, implementing and verifying several digital circuits.

EC361D: DIGITAL VLSI DESIGN (L-3,T-0,P-2,C-4)

Teaching Scheme	***Examination Scheme***			
Lecturer: 3 Hrs/week	*Theory*		*Practical*	
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	*Mid Term/Cont. Eval.: 50 Marks*	*End Term: 50 Marks*
Practical: 2 Hrs/week	*Credits: 3*		*Credits: 1*	

Course Objectives:

- Introduction to digital integrated circuits, CMOS devices and their manufacturing technology.
- To find propagation delay, noise margins, and power dissipation in the digital VLSI circuits.
- Design of combinational and sequential circuits using various logic styles.
- Designing SRAM and DRAM in VLSI circuits.
- To introduce architecture and design concepts underlying modern complex VLSIs and system-on-chips.

Course Syllabus:

Introduction
Issues in digital IC design; Quality metrics of a digital design.

The manufacturing process:
CMOS IC manufacturing processes; Design rules; Packaging ICs.

The devices:
The diode; The MOS(FET) transistor; Process variations.

The wire:

Interconnect parameters; Electrical wire models; SPICE wire models.

The CMOS inverter:

The static CMOS inverter; Evaluating robustness of CMOS inverter; Dynamic performance of CMOS inverter; Power, energy and energy delay; Technology scaling and its impact on the inverter metrics.

Designing Combinational logic gates in CMOS:

Static CMOS design; Dynamic CMOS design; Perspectives.

Designing sequential logic circuits:

Static latches and registers; Dynamic latches and registers; Alternative register styles; Pipelining - an approach to optimize sequential circuits; Non-bistable sequential circuits; Perspectives-choosing a clocking strategy.

Implementation strategies for digital ICs: From custom to semicustom and structured array design approaches; Custom circuit design; Cell-based design methodology; Array-based implementation approaches.

Designing Arithmetic Building Blocks:

Datapath in digital processor architectures; The adder; The multiplier; The shifter; Other arithmetic operators; Power and speed trade-off in data path structures; Perspectives-design as trade-off.

Designing memory:

SRAM; DRAM; Associated circuits.

Reference Books:

1. Digital integrated circuits: a design perspective, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, PHI
2. Inroduction to VLSI circuits and systems, John P. Uyemura, Wliey
3. CMOS VLSI Design, Weste and Harris, Addison Wesley.
4. Modern VLSI Design - System-on-chip Design, Wayne Wolf, Prentice Hall India/Pearson Education
5. CMOS Digital Integrated Circuits, Analysis andDesign, Sung-Mo Kang andYusuf Lablebici, Tata McGraw-Hill Edition

Course Outcomes:

After studying this course the students would be able to:

- Understanding trends in semiconductor technology, and how it impacts scaling and performance.
- To analyse the performance and characteristics of CMOS inverter.
- Analyse different performance issues and the inherent trade-offs involved in system design (viz. power vs. speed etc).
- Implement digital logic designs of various types using VLSI circuits.
- Study of moderately complex VLSI design project having a set of objective criteria and design constraints

EC361F: ELECTRONIC DESIGN AUTOMATION TOOLS (L-3,T-0,P-2,C-4)

Teaching Scheme	***Examination Scheme***			
Lecturer: 3 Hrs/week	*Theory*		*Practical*	
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	*Mid Term/Cont. Eval.: 50 Marks*	*End Term: 50 Marks*
Practical: 2 Hrs/week	*Credits: 3*		*Credits: 1*	

Course Objectives:

- To enable student to design and verify HDL modules for combinational and sequential logic circuits.

- To make student learn EDA Tools for HDL programming.
- Introduction to Advanced Verilog HDL and Verilog Test Benches.
- Introduction to SPICE and layout design.
- An overview of the features of practical CAD tools for simulation, synthesis and verification.

Course Syllabus:

Basics of EDA Tools
VLSI Design Automation tools-An overview of the features of practical CAD tools – FPGA Technology & Tools - Modelsim - Leonardo spectrum -Xilinx ISE - Quartus II – ASIC Technology & Tools – Pyxis, Cadence, Synopsys and Microwind.

Basics of Verilog HDL and Modeling
Importance of HDL, Design Methodologies, Basic Concepts- Lexical Conventions- Data Types-Verilog Operators- Modules and Ports - Types of Modeling- Gate-Level Modeling, DataflowModeling, Behavioral Modeling, Switch Level Modeling- Design Examples using Combinational & Sequential Logic.

Advanced Verilog HDL and Verilog Test Benches
Finite State Machines (FSM) Synthesis in Verilog, Memory Design – Single Port and Dual Port SRAM, Tasks, Functions, User Defined Primitives (UDP)- Timing and Delays, Compiler Directives- Verilog Test Benches for Combinational Logic Modules and Sequential Digital Circuits, Applications oriented system design.

VHDL
Data Types, Operators, Classes of Objects, entities and architectures, Attributes – concurrent statements – sequential statements – signals and variables – Behavior, dataflow and structural modeling – Configurations, functions – procedures – packages – test benches – Design examples

Analysis of SPICE& Layout Design
Introduction - Types of SPICE – Types of Analysis - Circuit description - DC circuit analysis- Transient analysis - AC circuit analysis - Advanced spice commands and analysis – VLSI Layout – Design Rules – Stick Diagram – Example Layout of digital logic circuits using EDA Tools.

Unit VI
Design flow in EDA tools for FPGA based design and ASIC based Design. Comparisons between PLDs CPLD and FPGAs - Interfacing Matlab Simulink with Xilinx ISE - DSP Application using Xilinx System Generator

<u>Reference(s)</u>

1. Ming-Bo Lin, Digital System Designs and Practices using Verilog HDL and FPGAs, Wiley,2012.
2. Samir Palnitkar, Verilog HDL, Pearson Education, 2nd Edition, 2004.
3. M.H.Rashid, Spice for Circuits and Electronics using Pspice, PHI 1995.
4. M.J.S.Smith, Application Specific Integrated Circuits, Pearson Education, 2008.
5. J.Bhaskar, A VHDL Primer, Prentice Hall, 1998.
6. J.Bhaskar, A Verilog Primer, Prentice Hall, 2005.

Course Outcomes:
After studying this course the students would be able to

- Design, implement and analyze combinational and sequential logic circuits.
- Formulate and solve design problem.
- Implement problems in of EDA tool environment.

- DevelopesEDA tools usage skills in designing linear and digital VLSI circuits.
- Students may implementfunctional design and verify using an industry standard EDA tool.
- Enable students to implementsmall VLSI design project using EDA tools on commercially available devices.

EC361F: SATELLITE COMMUNICATION (L-3,T-0,P-2,C-4)

Teaching Scheme	*Examination Scheme*			
Lecturer: 3 Hrs/week	*Theory*		*Practical*	
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	*Mid Term/Cont. Eval.: 50 Marks*	*End Term: 50 Marks*
Practical: 2 Hrs/week	*Credits: 3*		*Credits: 1*	

Course Syllabus:

Basic Principles

General features, frequency allocation for satellite services, properties of satellite communication systems.

Satellite Orbits

Introduction, Kepler's laws, orbital dynamics, orbital characteristics, satellite spacing and orbital capacity, angle of elevation, eclipses, launching and positioning, satellite drift and station keeping.

Satellite Construction (Space Segment)

Introduction; altitude and orbit control system; telemetry, tracking and command; power systems, communication subsystems, antenna subsystem, equipment reliability and space qualification.

Satellite Links

Introduction, general link design equation, system noise temperature, uplink design, downlink design, complete link design, effects of rain.

Earth Station

Introduction, earth station subsystem, different types of earth stations.

The Space Segment Access and Utilization

Introduction, space segment access methods, TDMA, FDMA, CDMA, SDMA, assignment methods.

Satellite Navigation

Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Messages, GPS Signal Levels, Timing Accuracy, GPS Receiver Operation, Differential GPS, Introduction to Indian Regional Navigation Satellite System (IRNSS)-NAVIC.

Reference Books:

1. Timothy Pratt, Charles W. Bostian, Satellite Communications, John Wiley & Sons.
2. Dennis Roddy, Satellite Communications, 3rd Ed., Mc. Graw-Hill International Ed. 2001.

EC361G: ANTENNA AND WAVE PROPAGATION (L-3,T-0,P-2,C-4)

Teaching Scheme	*Examination Scheme*

Lecturer: 3 Hrs/week	Theory		Practical	
Tutorial: ---	Mid Term: 30 Marks	End Term: 70 Marks	Mid Term/Cont. Eval.: 50 Marks	End Term: 50 Marks
Practical: 2 Hrs/week	Credits: 3		Credits: 1	

Course Syllabus:

Introduction to Antenna
Resonance of antenna, Types of antenna, radiation mechanism of antenna in single wire, two wire and dipole.

Fundamental Parameters of Antenna
Power density, radiation intensity, radiated power, radiation intensity, gain directivity, efficiency, effective aperture, effective length, band width, polarization, antenna temperature.

Linear Wire and Loop Antennas
Infinitesimal dipole, small dipole, finite length dipole, half length dipole, small circular loop, polygonal loop, ferrite loop.

Antenna Arrays
Types of arrays, two element linear arrays, n-element linear arrays, continuous array, planar arrays.

Different Antennas
Folded dipole, Yagi-Uda antenna, long wire antenna, V antenna, inverted antenna, log periodic antenna, Helical antenna, Horn antenna, lens antenna.

Antenna Measurements
Measurement of impedance, gain, radiation pattern, phase, polarization, directivity, beam width, radiation resistance.

Wave Propagation
Modes of propagation, structure of atmosphere, ground wave propagation, sky wave propagation, duct propagation.

Reference Books:
1. C. A. Balanis, Antenna theory: Analysis and design, Harper and Row Pow.(N.Y.)
2. J.D. Kraus and R. J. Marahefka, Antennas for applications, Tata Mc-Graw Hill Pub.
3. K. D. Prasad., Antenna and wave propagation, Satya Prakashan, New Delhi.

Course Outcomes:

After studying this course the students would be able to:

- Understand the concept of radiation through mathematical formulation
- Plot the characteristics of wire and aperture antennas.
- Develop the performance characteristics of array antenna.
- Measure the antenna parameters and understand its fundamentals.
- Understand the behavior of nature on em wave propagation
- Apply boundary conditions to different media, and formulate uniform plane wave equation, which is the basic of Antenna and wave propagation.

EC361H: POWER ELECTRONICS (L-3,T-0,P-2,C-4)

Teaching Scheme	***Examination Scheme***

Lecturer: 3 Hrs/week	Theory		Practical	
Tutorial: ---	Mid Term: 30 Marks	End Term: 70 Marks	Mid Term/Cont. Eval.: 50 Marks	End Term: 50 Marks
Practical: 2 Hrs/week	Credits: 3		Credits: 1	

Course Syllabus:

Power Semiconductor Devices
Power diodes, power transistor, power MOSFET and IGBT-construction, operation, steady state and switching characteristics.

Thyristor Families and Triggering Devices
SCR, TRIAC, GTO, LASCR, UJT, PUT and DIAC – construction, steady state and switching characteristics, performance parameters, SCR protection circuits.

Triggering and Commutation of SCR
R and RC triggering, UJT triggering circuits, different commutation techniques – circuits and principles of operation.

Controlled Converters
1phase and 3phase fully and half controlled converters, their harmonic and power factor analysis, dual converters, effect of load and source inductance, power factor improvement techniques.

AC Voltage Controllers
Principles of on/off control and phase control, 1phase ac voltage controllers with R and RL loads, cyclo-converters, reduction of output harmonics in cyclo-converters.

DC Choppers
Principles of operation of step-down and step-up choppers, 2–Quadrant and 4–Quadrant choppers, voltage and current commutated choppers, use of source filter.

Inverters
Parallel inverters, series inverters, 3phase inverters.

Induction Motors and Control
General principle, construction, performance characteristics, starting torque, torque variation with different factors, speed control: stator voltage and V/f control.

Text/Reference Books:

1. M.H. Rashid, Power Electronics, PHI.
2. P.S. Bimbra, Power Electronics, Khanna Publishers.
3. M. Ramamoorthy, An Introduction to Thyristor and Their Applications, Affiliated East West Press.
4. P.C. Sen, Power Electronics, Tata McGraw Hill.
5. General Electric, SCR Manual, Prentice Hall.
6. Edward Hughes, Electrical Technology, ELBS/Longman.

Course Outcomes:
After studying this course the students would be able to:
- .Design & implement a triggering / gate drive circuit for a power converters
- Design and analyse different line commutated converter,inverters circuits.
- Understand the fundamental principles and applications of power electronics circuits.
- Solve problems and design switching regulators according to specifications.
- Design a single phase AC voltage controller i.e. light dimmer / fan regulator
- To understand the operation of Dual converters, Cyclo converters and Multilevel inverters.
- Understand the operation of Dual converters, Cyclo converters and Multilevel inverters.

- Design a step down chopper

EC361J: SYSTEM SOFTWARE AND OPERATING SYSTEMS(L-3,T-0,P-2,C-4)

Teaching Scheme	***Examination Scheme***			
Lecturer: 3 Hrs/week	*Theory*		*Practical*	
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	*Mid Term/Cont. Eval.: 50 Marks*	*End Term: 50 Marks*
Practical: 2 Hrs/week	*Credits: 3*		*Credits: 1*	

Course Objectives:

- Learn tools for software development and software programming.
- Study of fundamentals of operating systems and function.
- Learn memory management and IO organization.
- Learn basics of file systems, protection and distributed operating systems.

Course Syllabus:

Language Processors and Data Structures
Introduction, Language processing activities, Fundamentals of language processing and specifications, Language processor development tools, Search data structures, Allocation data structures, Scanning and Parsing

Assemblers and Macroprocessors
Assemblers: Elements of assembly language programming, Simple assembly scheme, Pass structure of assemblers, Design of two pass assembler, Single pass assembler for PC
Macroprocessor: Macro definition and call, Macro expansion, Nested macro calls, Advanced macro facilities, Design of macroprocessor

Compilers, Interpreters and Linkers
Compilers and Interpreters: Aspects of compilation, Memory allocation, Compilation of expressions and control structures, Code optimization, Interpreters

Linkers: Relocation and linking concept Design of a linker, Self-relocating programs, Linker for MS DOS, Linking for overlays. Loaders

Software Tools
Software tools for program development, Editors, Debug monitors, Programming environments, User interfaces

Evolution of OS Functions
OS functions and their evolution, Batch processing systems, Multiprogramming systems, time sharing systems, real time operating systems, OS structure

Processes, Scheduling, and Deadlocks
Processes: Process definition, Process control, Interacting processes, Implementation of interacting processes, Threads

Scheduling: Scheduling policies, Job scheduling, Process scheduling, Process management in UNIX, Scheduling in multiprocessor OS

Deadlock: Definitions, Resource status modeling, Handling deadlocks, Deadlock detection and resolution, Deadlock avoidance, Mixed approach to deadlock handling

Process Synchronization and Interprocess Communication
Process Synchronization: Implementing control synchronization, Critical sections, Classical process synchronization problems, Evolution of language features for process

synchronization, Semaphores, Critical reasons, Conditional critical reasons, Monitors Interprocess Communication: Interprocess messages, Implementation issues, Mail boxes, Interprocess messages in Unix.

Memory Management
Memory allocation preliminaries, Contiguous and Noncontiguous memory allocations, Virtual memory using paging and segmentation.

I/O Organization and I/O Programming

I/O organization, I/O devices, Physical IOCS (PIOCS), Fundamental file organization, Advanced I/O programming, Logical IOCS, File processing in Unix

File Systems, Protection and Security
File Systems: Directory structures, File protection, Allocation of disk space, Implementing file access, File sharing, file system reliability, The Unix file system

Protection and Security: Encryption of data, Protection and security mechanisms, Protection of user files, Capabilities

Distributed Operating Systems
Definition and examples, Design issues in distributed operating systems, Networking issues, Communication protocols, System state and event precedence, Resource allocation, Algorithm for distributed control, File systems, Reliability, Security

Text Book:
1. Dhamdhere D. M., System Programming and Operating Systems, TMH Pub.

Reference Books:
1. William Stallings, Operating system: Internals and design principles, Pearson education.
2. Silberschatz and Galvin, Operating system concepts, Addison Wesley.

Course Outcomes:
- Understanding of the basic concepts for system software development and programming tools.
- Comprehends the fundamentals of operating systems, real time operating systems.
- Interpretation of various functions of operating systems such as process, scheduling, deadlocks and interprocess communication.
- Distinguish between memory management techniques, I/O organization and programming.
- Description of file systems, file protection and security and basics of distributed operating systems.

EC361K: LINEAR ALGEBRA (L-3,T-0,P-2,C-4)

Teaching Scheme	***Examination Scheme***			
Lecturer: 3 Hrs/week	*Theory*		*Practical*	
Tutorial: ---	*Mid Term: 30 Marks*	*End Term: 70 Marks*	*Mid Term/Cont. Eval.: 50 Marks*	*End Term: 50 Marks*
Practical: 2 Hrs/week	*Credits: 3*		*Credits: 1*	

Course Objectives:
- Work with matrices by performing operations with matrices, learn to solve systems of linear equations.
- Learn about and work with vector spaces and subspaces.
- Learn the concepts of norm and orthogonality.
- Learn to find use of eigen values and eigen vectors of matrix.

Course Syllabus:

Matrices and Linear Systems
Introduction, The Geometry of Linear Equations, Gaussian Elimination and Gauss-Jordan Methods, Row Echelon Form and Rank of Matrix, Consistency of Linear Systems, Homogeneous Systems, Non-homogeneous Systems, Matrix Multiplication and Its

Properties, Elementary matrices and Equivalence, LU factorization, Inverses and Transposes, Special Matrices and Applications

Vector Spaces

Vector Spaces and Subspaces, Four Fundamental Subspaces: Column Space, Row Space, Null Space and left Hand Null Space, Linear independence, Basis and Dimensions, Rank and Dimension, Linear Transformation, Change of Basis and Similarity, Invariant Subspaces(Optional)

Norms ,Inner Products and Orthogonality

Vector Norm, Matrix Norm, Inner Product Space, Orthogonal Vectors, Gram-Schmidt Orthogonalization Procedure, Unitary and Orthogonal Matrices, Orthogonal reduction, Complementary Subspaces, Range-Nullspace Decomposition, Orthogonal Decomposition, Singular Value Decomposition, Orthogonal Projection, Least Squares, Angles between Subspaces.

Eigenvalues and Eigenvectors

Determinants and Their Properties, Elementary Properties of Eigensystems, Diagonalization by Similarity Transformation, Systems of Differential Equations, Normal Matrices, Positive Definite Matrices, Jordan Form, Optional: Stochastic Matrices and Markov Chains

Reference Books:

1. Carl D. Meyer, Matrix and Applied linear Algebra, SIAM.
2. Gilbert Strang, Linear Algebra and Its Applications, Cengage Learning

Course Outcomes:

- Carry out matrix operations such as inverse and determinants and solve systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion.
- Demonstration and understanding of the concepts of vector space and subspace.
- Understanding and application of the concepts of vector and matrix norm, inner product and orthogonality by various techniques such as orthogonal decomposition, least squares.
- Determine eigenvalues and eigenvectors and solve eigenvalue problems by similarity transformations and Jordon form and others.

EC362 Mini-Project (L0,T-0,P-6,C-3)

A student or a group of students should carry out a mini-project related to the field of electronics. It may be hardware or a software project.

Course Outcomes:

After studying this course the students would be able to:

- Demonstrate the ability to locate and apply technical information from multiple sources.
- Acquire practical knowledge within the chosen area of technology for project development.
- Acquire practical knowledge within the chosen area of technology for project development.
- Identify, analyze, formulate and handle hardware and software projects with a comprehensive and systematic approach in the field of electronics and telecommunication.
- Contribute as an individual or in a team in development of technical projects within time bounds.
- Develop effective communication skills for presentation of project related activities.