ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code	**15EC32 - ANALOG ELECTRONICS**
CO1	Working principles, characteristics and basic applications of BJT and FET.
CO2	Single stage, cascaded and feedback amplifier configurations.
CO3	Frequency response characteristics of BJT and FET
CO4	Power amplifier classifications such as Class A, Class B, etc.
Course Code	**15EC33 - DIGITAL ELECTRONICS**
CO1	Combinational Logic circuits
CO2	Simplification Techniques using Karnaugh Maps, Quine-McClusky Technique
CO3	Operation of Decoders, Encoders, Multiplexers, Adders and Subtractors.
CO4	Working of Latches, Flip-Flops, Designing Registers, Counters
CO5	Mealy and Moore Models, State Diagrams
CO6	Synchronous Sequential Circuits, Design and Develop Mealy and Moore Models for digital circuits, Apply the knowledge gained in the design of Counters and Registers
Course Code	**15EC34 - NETWORK ANALYSIS**
CO1	Series and Parallel combination of Passive Components, Source Transformation and Source Shifting.
CO2	Network Theorems and Electrical laws to reduce circuit complexities and to arrive at feasible solutions
CO3	Various Two port Parameters and their Relationship for finding Network Solutions.
CO4	Analyze the Performance of various Types of Networks Using different concepts and principles
Course Code	**15EC35 - ELECTRONIC INSTRUMENTATION**
CO1	Acquire knowledge and solve problems related to o Accuracy and precision
CO2	Functioning of various types of analog and digital measuring instruments.
CO3	Different types of quantization, resolution and sensitivity in digital instruments such as frequency meters, tachometers, pH meters etc.
CO4	Microprocessor based instrumentation
CO5	Functioning of various types of Oscilloscopes and signal generators
CO6	Different types of transducers in various applications.
CO7	Apply the knowledge of passive component measurement
Course Code	**15EC36 - ENGINEERING ELECTROMAGNETICS**
CO1	Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law.
CO2	Determine potential and energy with respect to point charge and capacitance using Laplace equation.
CO3	Calculate magnetic field, force, and potential energy with respect to magnetic materials.
CO4	Apply Maxwell's equation for time varying fields, EM waves in free space and conductors.
CO5	Evaluate power associated with EM waves using Poynting theorem.

Course Code	15ECL37 - ANALOG ELECTRONICS LABORATORY
CO1	Able to know the operation of all electronic devices like cathode ray oscilloscope (CRO), Regulated power supply (RPS), Signal generator (SG).
CO2	Students able to Design and test rectifiers, clipping circuits, voltage regulators
CO3	Compute the parameters from the characteristics of JFET and MOSFET devices.
CO4	Students able to Design test and evaluate BJT amplifier in CE configuration.
CO5	Students able to Design and test JFET/MOSFET amplifier
CO6	Students able to Design and test a power amplifier
Course Code	**15ECL38 - DIGITAL ELECTRONICS LABORATORY**
CO1	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
CO2	To prepare students to perform the analysis and design of various digital circuits
CO3	Have a thorough understanding of the fundamental concepts and techniques used in digital circuits.
CO4	To understand and examine the structure of various number systems and its application in digital design.
CO5	The ability to understand analyze and design various combinational and sequential circuits.
CO6	Ability to identify basic requirements for a design application and propose a cost effective solution.
CO7	The ability to identify and prevent various hazards and timing problems in a digital design.
CO8	To develop skill to build and troubleshoot digital circuits.
Course Code	**15EC42- MICROPROCESSORS**
CO1	The History of evaluation of Microprocessors, Architecture of 8086, 8088, 8087, CISC & RISC, Von-Neumann & Harvard CPU architecture
CO2	8086 Assembly level programs using the 8086 instruction set
CO3	Modular programs using procedures and macros
CO4	8086 Stack and Interrupts programming
CO5	Interface 8086 to Static memory chips and 8255, 8254, 0808 ADC, 0800 DAC, Keyboard, Display and Stepper motors.
CO6	Use INT 21 DOS interrupt function calls to handle Keyboard and Display
Course Code	**15EC43- CONTROL SYSTEMS**
CO1	Develop the mathematical model of mechanical and electrical systems
CO2	Obtain the transfer function of electrical and mechanical systems by block diagram reduction rule and mason gain formula
CO3	Understand time domain specifications for first and second order systems
CO4	Determine the stability of a system in the time domain using Route Harvitz criteria and root locus technique
CO5	Determine the stability of a system in the frequency domain using Nyquist and bode plots
CO6	Model a control system in continuous and discrete time using state variable techniques
Course Code	**15EC44 - SIGNALS AND SYSTEMS**
CO1	Classify the signals as continuous/discrete, periodic/aperiodic, even/odd, energy/power and

	deterministic/random signals.
CO2	Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems.
CO3	Compute the response of a Continuous and Discrete LTI system using convolution integral and convolution sum.signal, odd vs. even, conjugate symmetric vs anti- symmetric
CO4	Determine the spectral characteristics of continuous and discrete time signal using Fourier analysis.
CO5	Compute Z-transforms, inverse Z- transforms and transfer functions of complex LTI systems
Course Code	**15EC45 - PRINCIPLES OF COMMUNICATION SYSTEMS**
CO1	Analyse communication systems in both the time and frequency domains
CO2	Have familiarity with amplitude modulated and angle modulated communication systems and be able to analyse their performance in the presence of noise.
CO3	Understand source coding, information theory and Shannon's theorem.
CO4	Have familiarity with various digital modulation systems and their properties, including bandwidth, channel capacity, transmission over bandlimited channels, inter-symbol interference (ISI), demodulation methods, and error performance in the presence of noise.
CO5	Have knowledge of error correcting codes, including block codes
Course Code	**15EC46 - LINEAR INTEGRATED CIRCUITS**
CO1	Operational amplifiers and characteristics as well as various types of op-amps.
CO2	Functioning of PLL, VCO, V-I, I-V converters.
CO3	Active Filters, ADC, DAC
CO4	555 Timer
CO5	Op-amps and Various applications
CO6	Instrumentation Amplifiers, Isolation Amplifiers, Wave Generators and Oscillators.
CO7	Interpretation of Performance Characteristics of Practical Op-amps.
CO8	Apply the knowledge gained in the design of practical circuits for amplifiers, filters oscillators, multi vibrators, voltage regulators and electronic systems
Course Code	**15ECL47 - MICROPROCESSOR LABORATORY**
CO1	Proficiently use DOS assemblers like MASM
CO2	Use the knowledge of the 8086 instruction set and utilizes it in programming.
CO3	Perform Logical, Arithmatic and Rotate/shift operations on data
CO4	Understand and implement delay generation using 8086 instructions
CO5	Understand different interfacing concepts and use of PPI
CO6	Implement programming module of keyboard, stepper motor, waveform generator (DAC), Seven segment display to work with 8086.
Course Code	**15ECL48 - LINEAR ICS AND COMMUNICATION LAB**
CO1	To discuss the op-amp's basic construction, characteristics, parameter limitations, various configurations and countless applications of op-amp
CO2	Analyze and deign basic op-amp circuits, particularly various linear and non-linear circuits, active filters, signal generators, and data converters
Course Code	**15ES51 - MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT**

CO1	Explain the meaning of Management, its characteristics and clarify management as science or art or profession. Identify the role of managers and their functions
CO2	Describe the nature and importance of planning process, types of plans and steps in planning. State the importance of decision making and planning.
CO3	Describe the nature and purpose of organization. Differentiate centralization and decentralization, authority and responsibility and finally MBO and MBE.
CO4	Explain the meaning and nature of Directing, various types of leadership styles and various motivational theories and at the end the need and importance of control.
CO5	Describe the meaning and role of an entrepreneur and the functions. Classify the Types of entrepreneurs Define SSIs and their need and characteristics. Explain the steps to start SSIs, to tell the impact of LPG, effect of WTO/GATT on SSIs.
CO6	Explain the important schemes of government through various agencies such as TECKSOK, KIADB, KSSIDC, DIC, SIDBI and KSFC for technical and financial assistance.
CO7	Identify and select a project and finally prepare a project report. Adopt the guidelines of planning commission for developing a project.
Course Code	**15EC52 - DIGITAL SIGNAL PROCESSING**
CO1	Identify time domain and frequency domain sequences
CO2	Calculate the DFT of the time domain sequence
CO3	Apply the FFT algorithm to optimize the calculation process for DFT
CO4	Determine the type of Filter to be used
CO5	Apply the proper filter characteristics.
Course Code	**15EC53 - VERILOG HDL**
CO1	Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction.
CO2	Write simple programs in VHDL in different styles.
CO3	Design and verify the functionality of digital circuit/system using test benches.
CO4	Identify the suitable Abstraction level for a particular digital design.
CO5	Write the programs more effectively using Verilog tasks and directives.
CO6	Perform timing and delay Simulation.
Course Code	**15EC54 - INFORMATION THEORY AND CODING**
CO1	Determine the amount of information per symbol and information rate of a discrete memory less source
CO2	Design lossless source codes for discrete memoryless source to improve the efficiency of information transmission
CO3	Evaluate the information capacity of discrete memoryless channels and determine possible code rate to achievable on such channels
CO4	Apply Shannon theorem for information transmission on Gaussian channels to determine the capacity.
Course Code	**15EC553 - OPERATING SYSTEM**
CO1	What is an operating system
CO2	Types of operating systems and differences among them
CO3	Processes, threads, and the differences between the two
CO4	Interrupts, synchronization, waiting, and atomic behavior.

CO5	Virtual memory, paging, and memory allocation.
Course Code	**15EC562- Object Oriented Programming Using C++**
CO1	List object oriented programming features in C++. Apply these features to program design and implementation
CO2	Define object oriented concepts and how they are supported by C++.Gain some practical experience of C++. Demonstrate implementation issues related to object- oriented techniques.
CO3	Demonstrate the basic components of an object oriented program including methods and attributes, Differentiate between classes and instances
CO4	Define and use friend functions and friend classes. Explain the need for Data Encapsulation
CO5	Create Class and Function Templates. Use Standard Template Library functions and classes.
CO6	Define and Use of constructors and destructors in object oriented programming approach and different types of constructors
CO7	Explaining the concepts of polymorphism and inheritance in object oriented programming.
CO8	Define and use of iosteam files and algorithms in c++ approach
Course Code	**15ECL57 - DSP Lab**
CO1	The students will be able to carry out simulation of DSP system.
CO2	Effectively utilize the MATLAB tool.
CO3	Determine the performance of sampling theorem
CO4	Understand the concepts of correlation properties.
CO5	Understand the characteristic of DFT and IDFT
CO6	Design and implementation FIR and IIR filters.
CO7	Solving a difference equation using MATLAB
CO8	Develop and implement DSP algorithms in software using a computer language such as C with CCS studio.
CO9	Utilize the procedures for simulating and hardware built of Code compressor Studio programming.
Course Code	**15ECL58 - HDL Lab**
CO1	Write the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
CO2	Describe sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
CO3	Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware.
CO4	Interface the hardware to the programmable chips and obtain the required output.
Course Code	**15EC61 - DIGITAL COMMUNICATION**
CO1	Analyze the perfomance of a baseband and passband in a didital communication system.
CO2	Perform the time and frquency domine anlysis of the signal in a digital communication system.
CO3	Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels.
CO4	Describe the different didgital modulation schemes and concepts.
C05	Identify the presense of error bit signal and calculate unknown phase of noise in the received signal.

C06	Analyze the performance of spread spectrum communication system.
Course Code	**15EC62 - ARM MICROCONTROLLER & EMBEDDED SYSTEMS**
CO1	Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3
CO2	Apply the knowledge gained for Programming ARM Cortex M3 for different applications
CO3	Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system
CO4	Develop the hardware /software co-design and firmware design approaches
CO5	Explain the need of real time operating system for embedded system applications
Course Code	**15EC63 - VLSI Design**
CO1	Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
CO2	Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.
CO3	Interpret Memory elements along with timing considerations
CO4	Demonstrate knowledge of FPGA based system design
CO5	Interpret testing and testability issues in VLSI Design
CO6	Analyze CMOS subsystems and architectural issues with the design constraints.
Course Code	**15EC64 - COMPUTER COMMUNICATION NETWORKS**
CO1	Identify the protocols and services of Data link layer
CO2	Identify the protocols and functions associated with the transport layer services
CO3	Describe the layering architecture of computer networks and distinguish between the OSI reference model and TCP/IP protocol suite
CO4	Distinguish the basic network configurations and standards associated with each network
CO5	Construct a network model and determine the routing of packets using different routing algorithms
Course Code	**15EC654 - DIGITAL SWITCHING SYSTEMS**
CO1	Describe the electromechanical switching systems and its comparison with the digital switching
CO2	Determine the telecommunication traffic and its measurements
CO3	Define the technologies associated with the data switching operations
CO4	Describe the software aspects of switching systems and its maintenance
Course Code	**15EC663 - DIGITAL SYSTEM DESIGN USING VERILOG**
CO1	Construct the combinational circuits, using discrete gates and programmable logic devices.
CO2	Describe Verilog model for sequential circuits and test pattern generation.
CO3	Design a semiconductor memory for specific chip design
CO4	Design embedded systems using small microcontrollers, larger CPUs/DSPs, or hard or soft processor cores
CO5	Synthesize different types of processor and I/O controllers that are used in embedded system.
Course Code	**15ECL67 - EMBEDDED CONTROLLER LAB**
CO1	Understand the instruction set of 32 bit microcontroller ARM Cortex M3, and the software tool

	required for programming in Assembly and C language
CO2	Develop assembly language programs using ARM Cortex M3 for different applications
CO3	Interface external devices and I/O with ARM Cortex M3
CO4	Develop C language programs and library functions for embedded system applications
Course Code	**15ECL68 - COMPUTER NETWORKS LABORATORY**
CO1	Use the network simulator for learning and practice of networking algorithms
CO2	Illustrate the operations of network protocols and algorithms using C programming
CO3	Simulate the network with different configurations to measure the performance parameters.
CO4	Implement the data link and routing protocols using C programming
Course Code	**15EC72 - DIGITAL IMAGE PROCESSING**
CO1	Understand image formation and the role human visual system plays in perception of gray and color image data.
CO2	Apply image processing techniques in both the spatial and frequency (Fourier) domains.
CO3	Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.
CO4	Conduct independent study and analysis of Image Enhancement techniques.
Course Code	**15EC73 - POWER ELECTRONICS**
CO1	Describe the characteristics of different power devices and identify the various applications associated with it.
CO2	Illustrate the working of power circuit as DC-DC converter.
CO3	Illustrate the operation of inverter circuit and static switches.
CO4	Determine the output response of a thyristor circuit with various triggering options.
CO5	Determine the response of controlled rectifier with resistive and inductive loads.
Course Code	**15EC743 - REAL TIME SYSTEMS**
CO1	Understand the fundamentals of Real time systems and its classifications.
CO2	Understand the concepts of computer control, operating system and the suitable computer hardware requirements for real-time applications.
CO3	Develop the software languages to meet Real time applications.
CO4	Apply suitable methodologies to design and develop Real-Time Systems.
Course Code	**15EC755 - SATELLITE COMMUNICATION**
CO1	Describe the satellite orbits and its trajectories with the definitions of parameters associated with it.
CO2	Describe the electronic hardware systems associated with the satellite subsystem and earth station.
CO3	Describe the various applications of satellite with the focus on national satellite system.
Course Code	**15ECL767 - ADVANCED COMMUNICATION LABORATORY**
CO1	Determine the characteristics and response of microwave devices and optical waveguide.

CO2	Determine the characteristics of microstrip antennas and devices and compute the parameters associated with it.
CO3	Simulate the digital modulation schemes with the display of waveforms and computation of performance parameters.
CO4	Design and test the digital modulation circuits/systems and display the waveforms.
Course Code	**15ECL77 - VLSI LABORATORY**
CO1	Write test bench to simulate various digital circuits.
CO2	Interpret concepts of DC Analysis, AC Analysis and Transient Analysis in analog circuits.
CO3	Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.
CO4	Use basic amplifiers and further design higher level circuits like operational amplifier and analog/digital converters to meet desired parameters.
CO5	Use transistors to design gates and further using gates realize shift registers and adders to meet desired parameters.

Course Code	**15EC81 - Wireless Cellular and LTE 4G Broadband**
CO1	Understand the basics of LTE standarization phases and specifications.
CO2	Explain the system architecture of LTE and E-UTRAN, the layer of LTE, based on the use of OFDMA and SC-FDMA principles
CO3	Analyze the role of LTE radio interface protocols to set up, reconfigure and release the Radio Bearer, for transferring the EPS bearer.
CO4	Analyze the main factors affecting LTE performance including mobile speed and transmission bandwidth
Course Code	**15EC82 - FIBER OPTICS and NETWORKS**
CO1	Explain the working of fiber optics communication system, graded index fibers in single mutli code propagation connectors and couplers
CO2	Compute angle of accpetancy, mode volume cutoff wavelength observation scattering, bundling, alignment and joint losses
CO3	Describe optical signal emission using LED, laser, optical signal using photo detector, opitcal reception using receivers
CO4	Explain WDM concepts, active and passive optical components and optical amplifiers used in fiber optic networks
CO5	Explain optical networks, concepts, terminology, standards used in fiber optic networks
CO6	Analyse impact of high speed optical communication links on human health and society
Course Code	**15EC835 - NETWORK AND CYBER SECURITY**
CO1	Network layer protpcal and security
CO2	E-Mail security concepts
CO3	IP-security to secure IP
CO4	Cyber security and antipatterns
CO5	Enterprise wide network security algorithms