



HKBK College of Engineering
Department of Electronics & Communication Engineering

YEAR: 2 SEM: 3

Course Name: Transform Calculus, Fourier Series and Numerical Techniques **Sub code:**18MAT31

CO	Course Outcomes
1.	Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.
2.	Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
3.	Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in wave and heat propagation, signals and systems.
4.	Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods
5.	Determine the externals of functional using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

Course Name:NETWORK THEORY

Sub code:18EC32

CO	Course Outcomes
1.	Determine currents and voltages using source transformation/ source shifting/ mesh/ nodal analysis and reduce given network using star-delta transformation/source transformation/ source shifting.
2.	Solve network problems by applying Superposition/ Reciprocity/ Thevenin's/ Norton's/ Maximum Power Transfer/ Millman's Network Theorems and electrical laws to reduce circuit complexities and to arrive at feasible solutions.
3.	Calculate current and voltages for the given circuit under transient conditions.
4.	Apply Laplace transform to solve the given network.
5.	Solve the given network using specified two port network parameter like Z or Y or T or h.
6.	Understand the concept of resonance

Course Name:ELECTRONIC DEVICES

Sub code:18EC33

CO	Course Outcomes
1.	Understand the principles of semiconductor Physics
2.	Understand the principles and characteristics of different types of semiconductor devices
3.	Understand the fabrication process of semiconductor devices
4.	Utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.

Course Name: DIGITALSYSTEMDESIGN

Sub code:18EC34

CO	Course Outcomes
1.	Explain the concept of combinational and sequential logic circuits.
2.	Design the combinational logic circuits.
3.	Design the sequential circuits using SR, JK, D, T flip-flops and Mealy & Moore machines
4.	Design applications of Combinational & Sequential Circuits.

Course Name: COMPUTER ORGANIZATIONANDARCHITECTURE

Sub code:18EC35

CO	Course Outcomes
1.	Explain the basic organization of a computer system.
2.	Explain different ways of accessing an input / output device including interrupts.
3.	Illustrate the organization of different types of semiconductor and other secondary storage memories.
4.	Illustrate simple processor organization based on hardwired control and micro programmed control.

Course Name: POWER ELECTRONICSANDINSTRUMENTATION

Sub code:18EC36

CO	Course Outcomes
1.	Build and test circuits using power electronic devices.
2.	Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters and SMPS.
3.	Define instrument errors.
4.	Develop circuits for multirange Ammeters, Voltmeters and Bridges to measure passive component values and frequency.
5.	Describe the principle of operation of Digital instruments and PLCs.
6.	Use Instrumentation amplifier for measuring physical parameters.

Course Name: ELECTRONIC DEVICES AND INSTRUMENTATION LABORATORY

Sub code: 18ECL37

CO	Course Outcomes
1.	Understand the characteristics of various electronic devices and measurement of parameters.
2.	Design and test simple electronic circuits.
3.	Use of circuit simulation software for the implementation and characterization of electronic circuits and devices.

Course Name: DIGITAL SYSTEMDESIGNLABORATORY

Sub code:18ECL38

CO	Course Outcomes
1.	Demonstrate the truth table of various expressions and combinational circuits using logic gates
2.	Design various combinational circuits such as adders, Subtractors, comparators, multiplexers and demultiplexers
3.	Construct flips-flops, counters and shift registers.
4.	Simulate Serial adder and Binary Multiplier.

Course Name: CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW

Sub code: 18CPC39/49

CO	Course Outcomes
1.	Have constitutional knowledge and legal literacy.
2.	Understand Engineering and Professional ethics and responsibilities of Engineers.
3.	Understand the the cybercrimes and cyber laws for cyber safety measures.

Course Name: ADDITIONAL MATHEMATICS–I

Sub code:18MATDIP31

CO	Course Outcomes
1.	Apply concepts of complex numbers and vector algebra to analyze the problems arising in related area.
2.	Use derivatives and partial derivatives to calculate rate of change of multivariate functions.
3.	Analyze position, velocity and acceleration in two and three dimensions of vector valued functions.
4.	Learn techniques of integration including the evaluation of double and triple integrals.
5.	Identify and solve first order ordinary differential equations.

YEAR: 2 SEM: 4

Course Name: COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS

Sub code: 18MAT41

CO	Course Outcomes
1.	Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
2.	Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
3.	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
4.	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
5.	Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

Course Name: ANALOG CIRCUITS

Sub code: 18EC42

CO	Course Outcomes
1.	Understand the characteristics of BJTs and FETs.
2.	Design and analyze BJT and FET amplifier circuits.
3.	Design sinusoidal and non-sinusoidal oscillators.
4.	Understand the functioning of linear ICs.
5.	Design of Linear IC based circuits.

Course Name: CONTROL SYSTEMS

Sub code: 18EC43

CO	Course Outcomes
1.	Develop the mathematical model of mechanical and electrical systems.
2.	Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method.
3.	Determine the time domain specifications for first and second order systems.
4.	Determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique.
5.	Determine the stability of a system in the frequency domain using Nyquist and bode plots.

CO	Course Outcomes
1.	Identify and associate Random Variables and Random Processes in Communication events.
2.	Analyze and model the Random events in typical communication events to extract quantitative statistical parameters.
3.	Analyze and model typical signal sets in terms of a basis function set of Amplitude, phase and frequency.
4.	Demonstrate by way of simulation or emulation the ease of analysis employing basis functions, statistical representation and Eigen values.

CO	Course Outcomes
1.	Analyze the different types of signals and systems.
2.	Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems.
3.	Represent continuous and discrete systems in time and frequency domain using different transforms Test whether the system is stable.

CO	Course Outcomes
1.	Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and Instruction set of 8051.
2.	Write 8051 Assembly level programs using 8051 instruction set.
3.	Explain the Interrupt system, operation of Timers/Counters and Serial port of 8051.
4.	Write 8051 Assembly language program to generate timings and waveforms using 8051 timers, to send & receive serial data using 8051 serial port and to generate an external interrupt using a switch.
5.	Write 8051 Assembly language programs to generate square wave on 8051 I/O port pin using interrupt and C Programme to send & receive serial data using 8051 serial port
6.	Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O ports.

CO	Course Outcomes
1.	Write Assembly language programs in 8051 for solving simple problems that manipulate input data using different instructions of 8051.
2.	Interface different input and output devices to 8051 and control them using Assembly language programs.
3.	Interface the serial devices to 8051 and do the serial transfer using C programming.

Course Name: ANALOGCIRCUITS LABORATORY

Sub code:18ECL48

CO	Course Outcomes
1.	Design analog circuits using BJT/FETs and evaluate their performance characteristics.
2.	Design analog circuits using OPAMPs for different applications
3.	Simulate and analyze analog circuits that use ICs for different electronic applications.

Course Name: ADDITIONAL MATHEMATICS–II

Sub code:18MATDIP41

CO	Course Outcomes
1.	Solve systems of linear equations using matrix algebra.
2.	Apply the knowledge of numerical methods in modelling and solving engineering problems.
3.	Make use of analytical methods to solve higher order differential equations.
4.	Classify partial differential equations and solve them by exact methods.
5.	Apply elementary probability theory and solve related problems.

YEAR: 3 SEM: 5

Course Name: TECHNOLOGICAL INNOVATION MANAGEMENT AND ENTREPRENEURSHIP

Sub code: 18ES51

CO	Course Outcomes
1.	Understand the fundamental concepts of Management and Entrepreneurship and opportunities in order to setup a business
2.	Describe the functions of Managers, Entrepreneurs and their social responsibilities
3.	Understand the components in developing a business plan
4.	Awareness about various sources of funding and institutions supporting entrepreneurs

Course Name: DIGITAL SIGNAL PROCESSING

Sub code: 18EC53

CO	Course Outcomes
1.	Analyze and compute performance of AM and FM modulation in the presence of noise at the receiver.
2.	Analyze and compute performance of digital formatting processes with quantization noise.
3.	Multiplex digitally formatted signals at Transmitter and demultiplex the signals and reconstruct digitally formatted signals at the receiver.
4.	Design/Demonstrate the use of digital formatting in Multiplexers, Vocoders and Video transmission.
5.	Analyze and compute performance of AM and FM modulation in the presence of noise at the receiver.

Course Name: INFORMATION THEORY and CODING

Sub code: 18EC54

CO	Course Outcomes
1.	Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source
2.	Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms
3.	Model the continuous and discrete communication channels using input, output and joint probabilities
4.	Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes
5.	Design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes, BCH and Golay codes.

Course Name: ELECTROMAGNETIC WAVES

Subject code: 18EC55

CO	Course Outcomes
1.	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.

2.	Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.
3.	Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations
4.	Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
	Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

Course Name:Verilog HDL **Subjectcode:**18EC56

CO	Course Outcomes
1.	Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction.
2.	Design and verify the functionality of digital circuit/system using testbenches.
3.	Identify the suitable Abstraction level for a particular digital design.
4.	Write the programs more effectively using Verilog tasks, functions and directives.
5.	Perform timing and delay Simulation
6.	Interpret the various constructs in logic synthesis.

Course Name: DIGITAL SIGNALPROCESSING LABORATORY **Subject code:** 18ECL57

CO	Course Outcomes
1.	Understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals.
2.	Modeling of discrete time signals and systems and verification of its properties and results.
3.	Implementation of discrete computations using DSP processor and verify the results.
4.	Realize the digital filters using a simulation tool and analyze the response of the filter for an audio signal.

Course Name:HDLLABORATORY **Subject code:**18ECL58

CO	Course Outcomes
1.	Write the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
2.	Describe sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
3.	Synthesize Combinational and Sequential circuits on programmable ICs and test the hardware.
4.	Interface the hardware to the programmable chips and obtain the required output.

Course Name:ENVIRONMENTALSTUDIES **Subject code:** 18CIV59

CO	Course Outcomes
1.	Understand the principles of ecology and environmental issues that apply to air, land, and

	water issues on a global scale.
2.	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
3.	Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components
4.	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

YEAR: 3 SEM: 5

Course Name:DIGITALCOMMUNICATION

Subject code:18EC61

CO	Course Outcomes
1.	Associate and apply the concepts of Band pass sampling to well specified signals and channels.
2.	Analyze and compute performance parameters and transfer rates for low pass and band pass symbol under ideal and corrupted non band limited channels.
3.	Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted band limited channels.
4.	Demonstrate that band pass signals subjected to corruption and distortion in a band limited channel can be processed at the receiver to meet specified performance criteria.

Course Name:EMBEDDED SYSTEMS

Subject code:18EC62

CO	Course Outcomes
1.	Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.
2.	Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
3.	Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
4.	Develop the hardware software co-design and firmware design approaches.
5.	Explain the need of real time operating system for embedded system applications.

Course Name: MICROWAVE and ANTENNAS

Subject code:18EC63

CO	Course Outcomes
1.	Describe the use and advantages of microwave transmission
2.	Analyze various parameters related to microwave transmission lines and waveguides
3.	Identify microwave devices for several applications
4.	Analyze various antenna parameters necessary for building a RF system
5.	Recommend various antenna configurations according to the applications.

Course Name: OPERATING SYSTEM

Subject code:18EC641

CO	Course Outcomes
1.	Explain the goals, structure, operation and types of operating systems.
2.	Apply scheduling techniques to find performance factors.
3.	Explain organization of file systems and IOCS.
4.	Apply suitable techniques for contiguous and non-contiguous memory allocation.
5.	Describe message passing, deadlock detection and prevention methods.

Course Name: ARITIFICALNEURALNETWORKS

Subject code:18EC642

CO	Course Outcomes
1.	Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling.
2.	Understand the concepts and techniques of neural networks through the study of the most important neural network models.
3.	Evaluate whether neural networks are appropriate to a particular application.
4.	Apply neural networks to particular application, and to know what steps to take to improve performance.

Course Name: OBJECT ORIENTED PROGRAMMINGUSINGC++

Subject code:18EC643

CO	Course Outcomes
1.	Explain the basics of Object Oriented Programming concepts.
2.	Apply the object initialization and destroy concept using constructors and destructors.
3.	Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators.
4.	Use the concept of inheritance to reduce the length of code and evaluate the usefulness.
5.	Apply the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs.
6.	Use I/O operations and file streams in programs.

Course Name: DIGITAL SYSTEM DESIGNUSING VERILOG

Subject code:18EC644

CO	Course Outcomes
1.	Construct the combinational circuits, using discrete gates and programmable logic devices.
2.	Describe how arithmetic operations can be performed for each kind of code, and also combinational circuits that implement arithmetic operations.
3.	Design a semiconductor memory for specific chip design.
4.	Design embedded systems using small microcontrollers, larger CPUs/DSPs, or hard or soft processor cores.
5.	Synthesize different types of I/O controllers that are used in embedded system.

Course Name: EMBEDDEDSYSTEMSLAB

Subject code:18ECL66

CO	Course Outcomes
1.	Understand the instruction set of 32 bit microcontroller ARM Cortex M3, and the software tool required for programming in Assembly and C language.
2.	Develop assembly language programs using ARM Cortex M3 for different applications.
3.	Interface external devices and I/O with ARM Cortex M3.
4.	Develop C language programs and library functions for embedded system applications.

Course Name:COMMUNICATIONLAB

Subject code:18ECL67

CO	Course Outcomes
1.	Determine the characteristics and response of microwave waveguide.
2.	Determine the characteristics of microstrip antennas and devices and compute the parameters associated with it.
3.	Design and test the digital and analog modulation circuits and display the waveforms.
4.	Simulate the digital modulation systems and compare the error performance of basic digital modulation schemes.

Course Name:SIGNALPROCESSING

Subject code:18EC651

CO	Course Outcomes
1.	Understand and explain continuous time and discrete time signals and systems, in time and frequency domain
2.	Apply the concepts of signals and systems to obtain the desired parameter/ representation
3.	Analyse the given system and classify the system/arrive at a suitable conclusion
4.	Design analog/digital filters to meet given specifications
5.	Design and implement the analog filter using components/ suitable simulation tools (<i>assignment component</i>)
6.	Design and implement the digital filter (FIR/IIR) using suitable simulation tools, and record the input and output of the filter for the given audio signal (<i>assignment component</i>)

Course Name: SENSORS andSIGNALCONDITIONING

Subject code:18EC652

CO	Course Outcomes
1.	Appreciate various types of sensors and their construction
2.	Use sensors specific to the end use application
3.	Design systems integrated with sensors

YEAR: 4 SEM: VII

Course Name:ComputerNetworks

Sub code: 18EC71

CO	Course Outcomes
1.	Understand the concepts of networking thoroughly
2.	Identify the protocols and services of different layers.
3.	Distinguish the basic network configurations and standards associated with each network.
4.	Analyze a simple network and measurement of its parameters.

Course Name:VLSIDESIGN

Sub code:18EC72

CO	Course Outcomes
1.	Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
2.	Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.
3.	Demonstrate ability to design Combinational, sequential and dynamic logic circuits as per the requirements
4.	Interpret Memory elements along with timing considerations
5.	Interpret testing and testability issues in VLSI Design

Course Name: REALTIMESYSTEM

Sub code: 18EC731

CO	Course Outcomes
1.	Explain the fundamentals of Real time systems and its classifications.
2.	Understand the concepts of computer control and the suitable computer hardware requirements for realtime applications.
3.	Describe the operating system concepts and techniques required for real time systems.
4.	Develop the software algorithms using suitable languages to meet Real time applications.
5.	Apply suitable methodologies to design and develop Real-Time Systems

Course Name: SATELLITE COMMUNICATION**Sub code: 18EC732**

CO	Course Outcomes
1.	Describe the satellite orbits and its trajectories with the definitions of parameters associated with it.
2.	Describe the electronic hardware systems associated with the satellite subsystem and earth station.
3.	Describe the various applications of satellite with the focus on national satellite system.
4.	Compute the satellite link parameters under various propagation conditions with the illustration of multiple access techniques.

Course Name: DIGITAL IMAGE PROCESSING**Sub code: 18EC733**

CO	Course Outcomes
1.	Understand image formation and the role human visual system plays in perception of gray and color image data.
2.	Apply image processing techniques in both the spatial and frequency (Fourier) domains.
3.	Design and evaluate image analysis techniques
4.	Conduct independent study and analysis of Image Enhancement and restoration techniques.

Course Name: DSP ALGORITHMS and ARCHITECTURE**Sub Code: 18EC734**

CO	Course Outcomes
1.	Comprehend the knowledge and concepts of digital signal processing techniques.
2.	Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture or processor.
3.	Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor.
4.	Develop basic DSP algorithms using DSP processors.
5.	Discuss about synchronous serial interface and multichannel buffered serial port (McBSP) of DSP device.
6.	Demonstrate the programming of CODEC interfacing.

Course Name: IoT& WIRELESSSENSORNETWORKS**Sub Code: 18EC741**

CO	Course Outcomes
1.	Understand choice and application of IoT& M2M communication protocols.
2.	Describe Cloud computing and design principles of IoT.
3.	Awareness of MQTT clients, MQTT server and its programming.
4.	Develop an architecture and its communication protocols of of WSNs.

Course Name:AUTOMOTIVEELECTRONICS**Sub Code: 18EC742**

CO	Course Outcomes
1.	Acquire an overview of automotive components, subsystems, and basics of Electronic Engine Control in today's automotive industry.
2.	Use available automotive sensors and actuators while interfacing with microcontrollers / microprocessors during automotive system design.
3.	Understand the networking of various modules in automotive systems, communication protocols and diagnostics of the sub systems.
4.	Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts and get fair idea on future Automotive Electronic Systems.

Course Name:MULTIMEDIACOMMUNICATION**Sub Code: 18EC743**

CO	Course Outcomes
1.	Understand basics of different multimedia networks and applications.
2.	Understand different compression techniques to compress audio and video.
3.	Describe multimedia Communication across Networks.
4.	Analyse different media types to represent them in digital form.
5.	Compress different types of text and images using different compression techniques.

CourseName:CRYPTOGRAPHY**Sub Code: 18EC744**

CO	Course Outcomes
1.	Explain basic cryptographic algorithms to encrypt and decrypt the data.
2.	Use symmetric and asymmetric cryptography algorithms to encrypt and decrypt the information.
3.	Apply concepts of modern algebra in cryptography algorithms.
4.	Apply pseudo random sequence in stream cipher algorithms.

Course Name: MACHINE LEARNINGWITHPYTHON**Sub Code: 18EC745**

CO	Course Outcomes
1.	Identify the problems in machine learning.
2.	Select supervised, unsupervised or reinforcement learning for problem solving.
3.	Apply theory of probability and statistics in machine learning
4.	Apply concept learning, ANN, Bayes classifier, k nearest neighbor
5.	Perform statistical analysis of machine learning techniques.

Course Name: COMPUTERNETWORKS LAB**Sub Code:18ECL76**

CO	Course Outcomes
1.	Use the network simulator for learning and practice of networking algorithms.
2.	Illustrate the operations of network protocols and algorithms using C programming.
3.	Simulate the network with different configurations to measure the performance parameters.
4.	Implement the data link and routing protocols using C programming.

Course Name:VLSILAB**Sub Code:18ECL77**

CO	Course Outcomes
1.	Design and simulate combinational and sequential digital circuits using Verilog HDL
2.	Understand the Synthesis process of digital circuits using EDA tool.
3.	Perform ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level net list
4.	Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.
5.	Perform RTL-GDSII flow and understand the stages in ASIC design.

Course Name:COMMUNICATIONTHEORY**Sub Code: 18EC751**

CO	Course Outcomes
1.	Describe operation of communication systems.
2.	Understand the techniques of Amplitude and Angle modulation
3.	Understand the concept of sampling and quantization.
4.	Understand the concepts of different digital modulation techniques.
5.	Describe the principles of wireless communications system.

Course Name:NEURALNETWORKS**Sub Code:18EC752**

CO	Course Outcomes
1.	Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling.
2.	Understand the concepts and techniques of neural networks through the study of the most important neural network models.
3.	Evaluate whether neural networks are appropriate to a particular application.
4.	Apply neural networks to particular application, and to know what steps to take to improve performance.

YEAR: 4 SEM: VIII

Course Name: WIRELESS AND CELLULAR COMMUNICATION

Sub Code: 18EC81

CO	Course Outcomes
1.	Explain concepts of propagation mechanisms like Reflection, Diffraction, Scattering in wireless channels.
2.	Develop a scheme for idle mode, call set up, call progress handling and call tear down in a GSM cellular network.
3.	Develop a scheme for idle mode, call set up, call progress handling and call tear down in a CDMA cellular network.
4.	Understand the Basic operations of Air interface in a LTE 4G system.

Course Name: NETWORK SECURITY

Sub Code: 18EC821

CO	Course Outcomes
1.	Explain network security services and mechanisms and explain security concepts
2.	Understand the concept of Transport Level Security and Secure Socket Layer.
3.	Explain Security concerns in Internet Protocol security
4.	Explain Intruders, Intrusion detection and Malicious Software
5.	Describe Firewalls, Firewall Characteristics, Biasing and Configuration

Course Name: MICROELECTROMECHANICAL SYSTEMS

Sub Code: 18EC822

CO	Course Outcomes
1.	Appreciate the technologies related to Micro Electro Mechanical Systems.
2.	Understand design and fabrication processes involved with MEMS Devices.
3.	Analyze the MEMS devices and develop suitable mathematical models. Know various application areas for MEMS device.

Course Name: RADAR ENGINEERING

Sub Code: 18EC823

CO	Course Outcomes
1.	Understand the radar fundamentals and radar signals.
2.	Explain the working principle of pulse Doppler radars, their applications and limitations.
3.	Describe the working of various radar transmitters and receivers.
4.	Analyze the range parameters of pulse radar system which affect the system performance.

Course Name: OPTICALCOMMUNICATION NETWORKS

Sub Code:18EC824

CO	Course Outcomes
1.	Classification and working of optical fiber with different modes of signal propagation.
2.	Describe the transmission characteristics and losses in optical fiber communication.
3.	Describe the construction and working principle of optical connectors, multiplexers and amplifiers.
4.	Describe the constructional features and the characteristics of optical Sources and detectors
5.	Illustrate the networking aspects of optical fiber and describe various standards associated with it.

Course Name: BIOMEDICALSIGNALPROCESSING

Sub Code: 18EC825

CO	Course Outcomes
1.	Possess the basic mathematical, scientific and computational skills necessary to analyse ECG and EEG Signals.
2.	Apply classical and modern filtering and compression techniques for ECG and EEG signals
3.	Develop a thorough understanding on basics of ECG and EEG feature extraction.

YEAR 3: V SEM 2017 Scheme

Course Name: MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT**Sub Code:** 17ES51

CO	Course Outcomes
1.	Understand the fundamental concepts of Management and Entrepreneurship
2.	Select a best Entrepreneurship model for the required domain of establishment
3.	Describe the functions of Managers, Entrepreneurs and their social responsibilities
4	Compare various types of Entrepreneurs
5	Analyze the Institutional support by various state and central government agencies

Course Name: DIGITAL SIGNAL PROCESSING

Sub Code: 17EC52

CO	Course Outcomes
1.	Determine response of LTI systems using time domain and DFT techniques.
2.	Compute DFT of real and complex discrete time signals.
3.	Computation of DFT using FFT algorithms and linear filtering approach.
4	Solve problems on digital filter design and realize using digital computations.

Course Name: VERILOG HDL**Sub Code: 17EC53**

CO	Course Outcomes
1.	Write Verilog programs in gate, dataflow (RTL), behavioral and switch modeling levels of Abstraction.
2.	Write simple programs in VHDL in different styles
3.	Design and verify the functionality of digital circuit/system using test benches.
4.	Identify the suitable Abstraction level for a particular digital design.
5.	Write the programs more effectively using Verilog tasks and directives.
6.	Perform timing and delay Simulation.

Course Name: INFORMATION THEORY AND CODING**Sub Code: 17EC54**

CO	Course Outcomes
1.	Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source
2.	Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms
3.	Model the continuous and discrete communication channels using input, output and joint probabilities
4.	Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes
5.	Design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes, BCH and Golay codes.

Course Name: NANO ELECTRONICS**Sub Code: 17EC551**

CO	Course Outcomes
1.	Know the principles behind Nanoscience engineering and Nanoelectronics
2.	Know the effect of particles size on mechanical, thermal, optical and electrical properties of nanomaterials
3.	Know the properties of carbon and carbon nanotubes and its applications
4.	Apply the knowledge to prepare and characterize nanomaterials
5.	Analyse the process flow required to fabricate state-of-the-art transistor technology.

Course Name: SWITCHING & FINITE AUTOMATA THEORY**Sub Code: 17EC552**

CO	Course Outcomes
1.	Explain the concept of threshold logic
2.	Understand the effect of hazards on digital circuits and fault detection and analysis
3.	Define the concepts of finite state model
4.	Analyze the structure of sequential machine
5.	Explain methods of state identification and fault detection experiments

Course Name: OPERATING SYSTEM**Sub Code: 17EC553**

CO	Course Outcomes
1.	Explain the goals, structure, operation and types of operating systems.
2.	Apply scheduling techniques to find performance factors.
3.	Explain organization of file systems and IOCS.
4.	Describe message passing, deadlock detection and prevention methods.

Course Name:ELECTRICAL ENGINEERING MATERIALS**Sub Code:** 17EC554

CO	Course Outcomes
1.	Understand the various kinds of materials and their applications in ac and dc fields.
2.	Understand the conductivity of superconductivity of materials.
3.	Explain the electrical properties of different materials and metallic behavior of materials on the basis of band theory.
4	Explain the properties and applications of all kind of magnetic materials.
5	Explain the properties of electrical conducting and insulating materials.
6	Assess a variety of approaches in developing new materials with enhanced performance to replace existing materials.

Course Name:MSP430 MICROCONTROLLER**Sub Code:** 17EC555

CO	Course Outcomes
1.	Understand the architectural features and instruction set of 16 bit microcontroller MSP430.
2.	Develop programs using the various instructions of MSP430 for different applications.
3.	Understand the functions of the various peripherals which are interfaced with MSP430 microcontroller.
4	Describe the power saving modes in MSP430
5	Explain the low power applications using MSP430 microcontroller.

Course Name:AUTOMOTIVE ELECTRONICS**Sub Code:** 17EC561

CO	Course Outcomes
1.	Acquire an overview of automotive components, subsystems, and basics of Electronic Engine Control in today's automotive industry.
2.	Use available automotive sensors and actuators while interfacing with microcontrollers / microprocessors during automotive system design.
3.	Understand the networking of various modules in automotive systems, communication protocols and diagnostics of the sub systems
4	Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts and get fair idea on future Automotive Electronic Systems.

Course Name:OBJECT ORIENTED PROGRAMMING USING C++**Sub Code:** 17EC562

CO	Course Outcomes
1.	Explain the basics of Object Oriented Programming concepts.
2.	Apply the object initialization and destroy concept using constructors and destructors
3.	Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators.
4	Use the concept of inheritance to reduce the length of code and evaluate the usefulness.
5	Apply the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs.
6	Use I/O operations and file streams in programs.

Course Name:8051 MICROCONTROLLER**Sub Code:** 17EC563

CO	Course Outcomes
1.	Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and Instruction set of 8051.

2.	Write 8051 Assembly level programs using 8051 instruction set.
3.	Explain the Interrupt system, operation of Timers/Counters and Serial port of 8051.
4	Write 8051 Assembly language program to generate timings and waveforms using 8051 timers, to send & receive serial data using 8051 serial port and to generate an external interrupt using a switch.
5	Write 8051 C programs to generate square wave on 8051 I/O port pin using interrupt and to send & receive serial data using 8051 serial port.
6	Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O ports.

YEAR 4: VII SEM 2017 Scheme

Course Name: MICROWAVES AND ANTENNAS

Sub Code:17EC71

CO	Course Outcomes
1.	Describe the use and advantages of microwave transmission
2.	Analyze various parameters related to microwave transmission lines and waveguides
3.	Identify microwave devices for several applications
4.	Analyze various antenna parameters necessary for building an RF system
5.	Recommend various antenna configurations according to the applications

Course Name: DIGITAL IMAGE PROCESSING

Sub Code:17EC72

CO	Course Outcomes
1.	Understand image formation and the role human visual system plays in perception of gray and color image data.
2.	Apply image processing techniques in both the spatial and frequency (Fourier) domains.
3.	Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.
4.	Conduct independent study and analysis of Image Enhancement techniques.

Course Name: POWER ELECTRONICS

Sub Code:17EC73

CO	Course Outcomes
1.	Describe the characteristics of different power devices and identify the various applications associated with it.
2.	Illustrate the working of power circuit as DC-DC converter.
3.	Illustrate the operation of inverter circuit and static switches.
4.	Determine the output response of a thyristor circuit with various triggering options.
5	Determine the response of controlled rectifier with resistive and inductive loads.

Course Name: MULTIMEDIA COMMUNICATION**Sub Code:17EC741**

CO	Course Outcomes
1.	Understand basics of different multimedia networks and applications.
2.	Understand different compression techniques to compress audio and video
3.	Describe multimedia Communication across Networks
4.	Analyse different media types to represent them in digital form.
5	Compress different types of text and images using different compression techniques and analyse DMS.

Course Name: BIOMEDICAL SIGNAL PROCESSING**Sub Code:17EC742**

CO	Course Outcomes
1.	Possess the basic mathematical, scientific and computational skills necessary to analyse ECG and EEG signals.
2.	Apply classical and modern filtering and compression techniques for ECG and EEG signals
3.	Develop a thorough understanding on basics of ECG and EEG feature extraction.

Course Name: REAL TIME SYSTEMS**Sub Code:17EC743**

CO	Course Outcomes
1.	Understand the fundamentals of Real time systems and its classifications.
2.	Understand the concepts of computer control, operating system and the suitable computer hardware requirements for real-time applications
3.	Develop the software languages to meet Real time applications.
4.	Apply suitable methodologies to design and develop Real-Time Systems.

Course Name: CRYPTOGRAPHY**Sub Code:17EC744**

CO	Course Outcomes
1.	Use basic cryptographic algorithms to encrypt the data
2.	Generate some pseudorandom numbers required for cryptographic applications.
3.	Provide authentication and protection for encrypted data

Course Name: CAD for VLSI**Sub Code:17EC745**

CO	Course Outcomes
1.	Appreciate the problems related to physical design of VLSI
2.	Use generalized graph theoretic approach to VLSI problems
3.	Design Simulated Annealing and Evolutionary algorithms

4	Know various approaches to write generalized algorithms
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Course Name: DSP ALGORITHMS and ARCHITECTURES **Sub Code:**17EC751

CO	Course Outcomes
1.	Comprehend the knowledge and concepts of digital signal processing techniques
2.	Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture or processor
3.	Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor
4	Develop basic DSP algorithms using DSP processors.
5	Discuss about synchronous serial interface and multichannel buffered serial port (McBSP) of DSP device.
6	Demonstrate the programming of CODEC interfacing

Course Name: IoT& WIRELESS SENSOR NETWORKS **Sub Code:**17EC752

CO	Course Outcomes
1.	Describe the OSI Model for the IoT/M2M Systems.
2.	Understand the architecture and design principles for IoT
3.	Learn the programming for IoT Applications
4	Identify the communication protocols which best suits the WSNs.

Course Name: PATTERN RECOGNITION **Sub Code:**17EC753

CO	Course Outcomes
1.	Identify areas where Pattern Recognition and Machine Learning can offer a solution.
2.	Describe the strength and limitations of some techniques used in computational Machine Learning for classification, regression and density estimation problems
3.	Describe genetic algorithms, validation methods and sampling techniques
4	Describe and model data to solve problems in regression and classification
5	Implement learning algorithms for supervised tasks

Course Name: ADVANCED COMPUTER ARCHITECTURE **Sub Code:**17EC754

CO	Course Outcomes
1.	Explain parallel computer models and conditions of parallelism
2.	Differentiate control flow, dataflow, demand driven mechanisms
3.	Explain the principle of scalable performance

4	Discuss advanced processors architectures like CISC, RISC, superscalar and VLIW
5	Understand the basics of instruction pipelining and memory technologies
6	Explain the issues in multiprocessor architectures

Course Name: SATELLITE COMMUNICATION

Sub Code:17EC755

CO	Course Outcomes
1.	Describe the satellite orbits and its trajectories with the definitions of parameters associated with it.
2.	Describe the electronic hardware systems associated with the satellite subsystem and earth station.
3.	Describe the various applications of satellite with the focus on national satellite system.
4	Compute the satellite link parameters under various propagation conditions with the illustration of multiple access techniques.

YEAR 4:VIII SEM

Course Name: WIRELESS CELLULAR and LTE 4G BROADBAND

Sub Code:17EC81

CO	Course Outcomes
1.	Understand the system architecture and the functional standard specified in LTE 4G.
2.	Analyze the role of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users.
3.	Demonstrate the UTRAN and EPS handling processes from set up to release including mobility management for a variety of data call scenarios.
4	Test and Evaluate the Performance of resource management and packet data processing and transport algorithms.

Course Name: FIBER OPTICS and NETWORKS

Sub Code:17EC82

CO	Course Outcomes
1.	Classification and working of optical fiber with different modes of signal propagation.
2.	Describe the transmission characteristics and losses in optical fiber communication.
3.	Describe the construction and working principle of optical connectors, multiplexers and amplifiers.
4	Describe the constructional features and the characteristics of optical sources and detectors.
5	Illustrate the networking aspects of optical fiber and describe various standards associated with it.

Course Name: MICRO ELECTRO MECHANICAL SYSTEMS

Sub Code:17EC831

CO	Course Outcomes
1.	Appreciate the technologies related to Micro Electro Mechanical Systems.

2.	Understand design and fabrication processes involved with MEMS devices
3.	Analyse the MEMS devices and develop suitable mathematical models
4	Know various application areas for MEMS device

Course Name: SPEECH PROCESSING

Sub Code:17EC832

CO	Course Outcomes
1.	Model speech production system and describe the fundamentals of speech.
2.	Extract and compare different speech parameters.
3.	Choose an appropriate speech model for a given application.
4	Analyse speech recognition, synthesis and speaker identification systems

Course Name: RADAR ENGINEERING

Sub Code:17EC833

CO	Course Outcomes
1.	Understand the radar fundamentals and radar signals.
2.	Explain the working principle of pulse Doppler radars, their applications and limitations
3.	Describe the working of various radar transmitters and receivers.
4	Analyze the range parameters of pulse radar system which affect the system performance

Course Name: MACHINE LEARNING

Sub Code:17EC834

CO	Course Outcomes
1.	Understand the core concepts of Machine learning.
2.	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms.
3.	Explain paradigms of supervised and un-supervised learning.
4	Recognize a real world problem and apply the learned techniques of Machine Learning to solve the problem.

Course Name: NETWORK AND CYBER SECURITY

Sub Code:17EC835

CO	Course Outcomes
1.	Explain network security protocols
2.	Understand the basic concepts of cyber security

3.	Discuss the cyber security problems
4	Explain Enterprise Security Framework
5	Apply concept of cyber security framework in computer system administration

YEAR 4: VII SEM 2015 Scheme

Course Name: MICROWAVES AND ANTENNAS

Sub Code:15EC71

CO	Course Outcomes
1.	Describe the use and advantages of microwave transmission
2.	Analyze various parameters related to microwave transmission lines and waveguides
3.	Identify microwave devices for several applications
4.	Analyze various antenna parameters necessary for building an RF system
5.	Recommend various antenna configurations according to the applications

Course Name: DIGITAL IMAGE PROCESSING

Sub Code:15EC72

CO	Course Outcomes
1.	Understand image formation and the role human visual system plays in perception of gray and color image data.
2.	Apply image processing techniques in both the spatial and frequency (Fourier) domains.
3.	Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.
4.	Conduct independent study and analysis of Image Enhancement techniques.

Course Name: POWER ELECTRONICS

Sub Code:15EC73

CO	Course Outcomes
1.	Describe the characteristics of different power devices and identify the various applications associated with it.
2.	Illustrate the working of power circuit as DC-DC converter.
3.	Illustrate the operation of inverter circuit and static switches.
4.	Determine the output response of a thyristor circuit with various triggering options.
5	Determine the response of controlled rectifier with resistive and inductive loads.

Course Name: MULTIMEDIA COMMUNICATION

Sub Code:15EC741

CO	Course Outcomes
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1.	Understand basics of different multimedia networks and applications.
2.	Understand different compression techniques to compress audio and video
3.	Describe multimedia Communication across Networks
4.	Analyse different media types to represent them in digital form.
5	Compress different types of text and images using different compression techniques and analyse DMS.

Course Name: BIOMEDICAL SIGNAL PROCESSING

Sub Code:15EC742

CO	Course Outcomes
1.	Possess the basic mathematical, scientific and computational skills necessary to analyse ECG and EEG signals.
2.	Apply classical and modern filtering and compression techniques for ECG and EEG signals
3.	Develop a thorough understanding on basics of ECG and EEG feature extraction.

Course Name: REAL TIME SYSTEMS

Sub Code:15EC743

CO	Course Outcomes
1.	Understand the fundamentals of Real time systems and its classifications.
2.	Understand the concepts of computer control, operating system and the suitable computer hardware requirements for real-time applications
3.	Develop the software languages to meet Real time applications.
4.	Apply suitable methodologies to design and develop Real-Time Systems.

Course Name: CRYPTOGRAPHY

Sub Code:15EC744

CO	Course Outcomes
1.	Use basic cryptographic algorithms to encrypt the data
2.	Generate some pseudorandom numbers required for cryptographic applications.
3.	Provide authentication and protection for encrypted data

Course Name: CAD for VLSI

Sub Code:15EC745

CO	Course Outcomes
1.	Appreciate the problems related to physical design of VLSI
2.	Use generalized graph theoretic approach to VLSI problems
3.	Design Simulated Annealing and Evolutionary algorithms
4	Know various approaches to write generalized algorithms

Course Name: DSP ALGORITHMS and ARCHITECTURE **Sub Code:15EC751**

CO	Course Outcomes
1.	Comprehend the knowledge and concepts of digital signal processing techniques
2.	Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture or processor
3.	Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor
4	Develop basic DSP algorithms using DSP processors.
5	Discuss about synchronous serial interface and multichannel buffered serial port (McBSP) of DSP device.
6	Demonstrate the programming of CODEC interfacing

Course Name: IoT& WIRELESS SENSOR NETWORKS**Sub Code:15EC752**

CO	Course Outcomes
1.	Describe the OSI Model for the IoT/M2M Systems.
2.	Understand the architecture and design principles for IoT
3.	Learn the programming for IoT Applications
4	Identify the communication protocols which best suits the WSNs.

Course Name: PATTERN RECOGNITION**Sub Code:15EC753**

CO	Course Outcomes
1.	Identify areas where Pattern Recognition and Machine Learning can offer a solution.
2.	Describe the strength and limitations of some techniques used in computational Machine Learning for classification, regression and density estimation problems
3.	Describe genetic algorithms, validation methods and sampling techniques
4	Describe and model data to solve problems in regression and classification
5	Implement learning algorithms for supervised tasks

Course Name: ADVANCED COMPUTER ARCHITECTURE**Sub Code:15EC754**

CO	Course Outcomes
1.	Explain parallel computer models and conditions of parallelism
2.	Differentiate control flow, dataflow, demand driven mechanisms
3.	Explain the principle of scalable performance
4	Discuss advanced processors architectures like CISC, RISC, superscalar and VLIW

5	Understand the basics of instruction pipelining and memory technologies
6	Explain the issues in multiprocessor architectures

Course Name: SATELLITE COMMUNICATION

Sub Code:15EC755

CO	Course Outcomes
1.	Describe the satellite orbits and its trajectories with the definitions of parameters associated with it.
2.	Describe the electronic hardware systems associated with the satellite subsystem and earth station.
3.	Describe the various applications of satellite with the focus on national satellite system.
4	Compute the satellite link parameters under various propagation conditions with the illustration of multiple access techniques.

YEAR 4:VIII SEM

Course Name: WIRELESS CELLULAR and LTE 4G BROADBAND

Sub Code:15EC81

CO	Course Outcomes
1.	Understand the system architecture and the functional standard specified in LTE 4G.
2.	Analyze the role of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users.
3.	Demonstrate the UTRAN and EPS handling processes from set up to release including mobility management for a variety of data call scenarios.
4	Test and Evaluate the Performance of resource management and packet data processing and transport algorithms.

Course Name: FIBER OPTICS and NETWORKS

Sub Code:15EC82

CO	Course Outcomes
1.	Classification and working of optical fiber with different modes of signal propagation.
2.	Describe the transmission characteristics and losses in optical fiber communication.
3.	Describe the construction and working principle of optical connectors, multiplexers and amplifiers.
4	Describe the constructional features and the characteristics of optical sources and detectors.
5	Illustrate the networking aspects of optical fiber and describe various standards associated with it.

Course Name: MICRO ELECTRO MECHANICAL SYSTEMS

Sub Code:15EC831

CO	Course Outcomes
1.	Appreciate the technologies related to Micro Electro Mechanical Systems.
2.	Understand design and fabrication processes involved with MEMS devices

3.	Analyse the MEMS devices and develop suitable mathematical models
4	Know various application areas for MEMS device

Course Name: SPEECH PROCESSING

Sub Code:15EC832

CO	Course Outcomes
1.	Model speech production system and describe the fundamentals of speech.
2.	Extract and compare different speech parameters.
3.	Choose an appropriate speech model for a given application.
4	Analyse speech recognition, synthesis and speaker identification systems

Course Name: RADAR ENGINEERING

Sub Code:15EC833

CO	Course Outcomes
1.	Understand the radar fundamentals and radar signals.
2.	Explain the working principle of pulse Doppler radars, their applications and limitations
3.	Describe the working of various radar transmitters and receivers.
4	Analyze the range parameters of pulse radar system which affect the system performance

Course Name: MACHINE LEARNING

Sub Code:15EC834

CO	Course Outcomes
1.	Understand the core concepts of Machine learning.
2.	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms.
3.	Explain paradigms of supervised and un-supervised learning.
4	Recognize a real world problem and apply the learned techniques of Machine Learning to solve the problem.

Course Name: NETWORK AND CYBER SECURITY

Sub Code:15EC835

CO	Course Outcomes
1.	Explain network security protocols
2.	Understand the basic concepts of cyber security
3.	Discuss the cyber security problems

4	Explain Enterprise Security Framework
5	Apply concept of cyber security framework in computer system administration