PEOs(Program Educational Objectives)

After three to four years of graduation our engineers will

PEO1: Able to apply knowledge gained in emerging technologies of Electronics engineering and allied areas

PEO2: Exhibits high professional ethical attitude and social responsibility.

PEO3: Become successful entrepreneur/ Professionals to serve the society.

PEO4: Excel in industry by implementing engineering solution for real life problems

SAPTHAGIRI COLLEGE OF ENGINEERING-560057
(Recognized by All India Council for Technical Education,New Delhi)
(Affiliated to Visvesvaraya Technological University, Belagavi)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAMME OUTCOMES

Graduation students of Bachelor of Electronics and Communication Engineering program at Sapthagiri College of Engineering will attain the following program outcomes in the field of Electronics and communication Engineering

PO-1	Ability to apply the knowledge of mathematics, science, electronics and communication to conceptualize solutions to complex engineering problems.
PO-2	Ability to Identify, formulate and analyse in Engineering domains using first principles of basic sciences and engineering sciences.
PO-3	Ability to design and realize solutions for complex engineering problems with applicable considerations.
PO-4	Ability to support investigations of Research based knowledge including literature survey, design of experiments, data analysis and data interpretation leading to valid conclusions.
PO-5	Ability to choose modern Engineering tools and resources for Electronics & communication engineering problems and their applications
PO-6	Ability to identify and assess societal, safety and legal issues using contextual knowledge and develop potential to assume consequent responsibilities during engineering practice.
PO-7	Ability to recognize the impact of electronics and communication engineering domain in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
PO-8	Ability to apply ethical principles and practice professional ethics.

PO-9	Ability to function effectively either as an individual or as a member/leader within diversified and multidisciplinary teams.
PO-10	Ability to communicate on engineering activities understandably, among stake holders and society at large through effective reports, design documentation and effective presentations.
PO-11	Ability to identify and engage in self-learning in the context of technological changes
PO-12	Ability to demonstrate the knowledge of and apply project management principles to manage projects in multidisciplinary environments in team or as an individual.

PROGRAMME SPECIFIC OUTCOMES

At the end of the B.E Electronics & Communication Engineering program, students of sapthagiri college of Engineering are expected to have developed the following program specific outcomes.

	PROGRAM SPECIFIC OUTCOMES
PSO1	Specify, design, build and test analog, digital and embedded systems for signal processing
PSO2	Understand and architect wired and wireless analog and digital communication systems as per specifications, and determine their performance.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Outcome (Cos)

ECE 2015 scheme

II Year Electronics & Communication Engineering

ECE 2015 scheme

Course Code	Course Name	Course Outcomes-On completion of this course the students will be
15MAT31	**Engineering Mathematics –III**	CO1: Able to find the Fourier series, half range Fourier series and Fourier coefficients of periodic functions. CO2: Able to find the Fourier and inverse Fourier transforms of aperiodic functions. CO3: Able to find Z-transforms and inverse Z-transform, and to solve the finite difference equations using Z-transforms. CO4: Able to apply the concept of statics for curve fitting, correlation and regression. CO5: Able to solve the algebraic/transcendental equation, interpolating polynomials, intermediate values and evaluation of integrals using appropriate numerical techniques. CO6: Able to evaluate the integrals using Green's, Stokes and Gauss divergence theorem and Able to apply Euler's equation to find the maxima or minima of the functional.
15EC32	**Analog Electronics**	CO1: Able to explain the working principles and performance of BJT in different modes with different types of biasing structures. CO2: Able to explain the working principles and performance of FET and MOSFET in different modes with different types of biasing structures. CO3: Able to explain the performance of BJT and FET amplifiers with respect to different frequencies. CO4: Able to classify different feedback systems and explain operation

		of different oscillators. CO5: Able to explain the performance and efficiency of different Power Amplifier
15EC33	**Digital Electronics**	CO1: Able to acquire knowledge of Combinational Logic, Simplification Techniques using Karnaugh Maps, Quine- McClusky Technique. CO2: Able to analyze and Design various combinational circuits. Define, Analyze and Design various combinational circuits. CO3: Able to define, analyze and design various sequential circuits, counters ,Registers, mealy and moore model.
15EC34	**Network Analysis**	CO1: Able to solve problelms related to series and Parallel combination of Passive Components, Source Transformation and Source Shifting. CO2: Able to solve problelms related to Network Theorems and Electrical laws to reduce circuit complexities and to arrive at feasible solutions. CO3: Able to solve problelms related to various Two port Parameters and their Relationship for finding Network Solutions. CO4: Able to solve problelms related to analyze the Performance of various Types of Networks Using different concepts and principles.
15EC35	**Electronic Instrumentation**	CO1: Able to explain Accuracy, precision, types of errors and calculate them , and describe ammeters, voltmeters and multi meters and develop circuits for multi range Ammeters and Voltmeters CO2: Able to describe functional concepts and operation of Digital voltmeters and instruments to measure frequency, time period, phase difference of signals, rotation speed, capacitance and pH of solutions and microprocessor based instrumentation CO3: Able to describe the operation of analog oscilloscope, digital storage oscilloscope and different types of signal generators CO4: Able to describe functional concepts of various Analog measuring instruments to measure field Strength, impedance, stroboscopic speed, Q of coils, insulation resistance and analyze AC and DC bridges for passive component and frequency measurements. CO5: Able to explain working of different types of transducers, their applications, comparison between different transducers , select the transducers for different applications

15EC36	**Engineering Electromagnetics**	CO1: Able to acquire knowledge and solve problems related to Electric Fields and analyze it to derive Electromagnetic Field Equations. CO2: Able to solve problems related to Gauss Law, Maxwell's first equation and divergence theorem. CO3: Able to acquire knowledge , analyse and solve problems related to Poisson's and Laplace's Equations, Uniqueness theorem, and solution of Laplace's equation and steady magnetic field. CO4: Able to acquire knowledge, analyse and solve problems related to Magnetic Forces and Magnetic materials, Electromagnetic Waves, Time-varying fields and Maxwell's equations and wave propagation in free space and dielectrics.
15ECL37	**Analog Electronics Lab**	CO1: Able to design and Test rectifiers, clipping circuits, clamping circuits and voltage regulators. CO2: Able to the parameters from the characteristics of JFET and MOSFET devices CO3: Able to test and evaluate BJT amplifiers in CE configuration as well as JFET/MOSFET amplifiers CO4: Able to test a power amplifier and compute its conversion efficiency. CO5: Able to design and Test various types of oscillators
15ECL38	**Digital Electronics Lab**	CO1: Able to demonstrate the truth table of various expressions and combinational circuits using logic gates. CO2: Able to design and test various combinational circuits such as adders, subtractors, comparators, multiplexers, demultiplexers and decoders. CO3: Able to construct and test flips-flops, counters and shift registers. CO4: Able to simulate full adder and up/down counters.
15MAT 41	**Engineering Mathematics –IV**	CO1: Able to apply the numerical methods to solve the linear ordinary differential equations of first and second order. CO2: Able to derive Bessel's function, Legendre's polynomials and its properties. Also able to apply Rodrigue's formula to find the polynomials. CO3: Able to solve problems on analytic functions using Cauchy –

		Riemann equations and to solve the complex line integrals, conformal and bilinear transformations. CO4: Able to analyze and solve the probability distribution problems. CO5: Able to define hypothesis, analyze and interpret the hypothesis for the given sampling distribution and to solve stochastic process problems.
15EC 42	**Microprocessor**	CO1: Able to explain basic architecture of 8086 microprocessor and its addressing modes. CO2: Able to program 8086 microprocessor using Assembly level language. CO3:Able to perform operations of stack and usage of interrupts, macros and procedures in 8086 programs. CO4: Able to explain physical memory organization, minimum mode and maximum mode operations of 8086. CO5: Able to explain interfacing of stepper motor, static RAM,ADC and DAC using 8255 and 8087/8088 architecture.
15EC 43	**Control Systems**	CO1 - Able to develop the mathematical model of mechanical and electrical systems · CO2 - Able to develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method · CO3 - Able to determine the time domain specifications for first and second order systems · CO4 - Able to determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique. · CO5 - Able to determine the stability of a system in the frequency domain using Nyquist and bode plots · Develop a control system model in continuous and discrete time using state variable techniques
15EC 44	**Signals and Systems**	CO1: Able to classify the different types of signals and systems. CO2: Able to determine performance of the system in time domain for the given impulse response. CO3: Able to determine the spectral characteristics of given arbitrary

		time domain periodic signal CO4: Able to determine the spectral characteristics of given arbitrary time domain non periodic signal. CO5: Able to compute Z-transforms, Inverse Z - transforms and transfer function of LTI systems using Z- transforms
15EC 45	**Principles of Communication Systems**	CO1: Able to analyze and compare the performance of different AM techniques involved in any type of communication system. CO2: Able to find the performance of systems for generation and detection of angle modulated signals and different parameters effecting FM systems. CO3: Able to distinguish analog signals in time domain as random process and in frequency domain using Fourier transforms and to find the existence of type of noise with respect to a particular system. CO4: Able to distinguish the performance of different analog communication systems and analyze the influence of channel noise on analog modulated signals. CO5: Able to understand the need of digitizing an analog signal and characteristics of different pulse modulation techniques and their applications
15EC 46	**Linear Integrated Circuits**	CO1: Able to explain op-amp circuit and its parameters. CO2 Able to design op-amp based DC &AC amplifiers. CO3: Able to develop Op-Amp based linear and non-linear circuits. CO4: Able to design first & Second Order Low Pass, High Pass, Band Pass, Band Stop Filters and Voltage Regulators. CO5: Able to explain applications of linear ICs in phase detector, VCO, DAC, ADC and Timer.
15ECL47	**Microprocessor Lab**	CO1: Able to write and execute 8086 assembly level programs to perform data transfer, arithmetic and logical operations. CO2: Able to write and execute 8086 assembly level programs to sort and search elements in a given array. CO3: Able to perform string transfer, string reversing, searching a character in a string with string manipulation instructions of 8086

		CO4: Able to utilize procedures and macros in programming 8086 CO5: Able to demonstrate the interfacing of 8086 with 7 segment display, matrix keyboard, logical controller, stepper motor, ADC, DAC, and LDR for simple applications
15ECL48	**Linear ICs and Communication Lab**	CO1: Able to evaluate the performance of instrumentation amplifier, oscillators, filters, DAC, adder, differentiator and integrator using linear ICs. CO2: Able to understand the application of 555 Timer to generate pulses. CO3: Able to apply pulse and flat top sampling techniques to generate digital signals with different characteristics. CO4: Able to analyze the performance of AM, FM, DSB-SC and Mixer for communication system. CO5: Able to analyze the performance of PLL.

III Year Electronics & Communication Engineering

Course Code	Course Name	Course Outcomes-On completion of this course the students will be
15ES51	**Management and Entrepreneurship Development**	CO1: Able to understand the fundamental concepts of Management and Entrepreneurship CO2: Able to select a best Entrepreneurship model for the required domain of establishment CO3: Able to describe the functions of Managers, Entrepreneurs and their social Responsibilities. CO4: Able to compare various types of Entrepreneurs CO5: Able to analyze the Institutional support by various state and central government agencies
15EC52	**Digital Signal Processing**	CO1: Able to compute DFT of real and complex discrete time signals.

		CO2: Able to determine response of LTI systems using time domain and DFT techniques. CO3: Able to compute DFT using FFT algorithms and appreciate the computational speed of the algorithms CO4: Able to realize the structure of digital filters using different forms and design the digital filters.
15EC53	**Verilog HDL**	CO1. Able to understand the need of HDL with different design styles and design methodologies in HDL CO2. Able to design combinational logic in Gate level and Data flow style using Verilog HDL. CO3. Able to design Combinational and sequential circuits in behavioural modelling using Verilog HDL. CO4. Able to design Combinational and sequential circuits in all the three design styles with VHDL.
15EC54	**Information Theory & Coding**	CO1: Able to explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source. CO2: Able to represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms. CO3: Able to determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes. CO4: Able to design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes and model the continuous and discrete communication channels using input, output and joint probabilities.
15EC553	**Operating System**	CO1: Able to explain the goals, structure, operation and types of operating systems. CO2: Able to apply scheduling techniques to find performance factors. CO3: Able to explain organization of file systems and IOCS. CO4: Able to apply suitable techniques for contiguous and non-contiguous memory

		Allocation. CO5: Able to describe message passing, deadlock detection and prevention methods
15EC563	**8051 Microcontroller**	CO1: Able to define an embedded system and describe the architecture of 8051 CO2: Able to apply the instructions in 8051 based embedded application programs. CO3: Able to apply the concepts of stack and subroutine in designing 8051 programming. CO4: Able to apply the concepts of timers and serial port UART in in generating delay and serial communication. CO5: Able to interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O ports and interrupts.
15EC562	**Object Oriented Programming Using C++**	CO1: Able to explain the basic concepts of object oriented programming language CO2: Able to explain and program object oriented design using design using classes, objects, constructors, destructors and operator overloading. CO3: Able to explain and program design using classes, objects, constructors, destructors and operator overloading. CO4: Able to explain and program Streams and Working with files.
15ECL57	**DSP Lab**	CO1: Able to understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals CO2: Able to modeling of discrete time signals and systems and verification of its properties and results. CO3: Able to implementation of discrete computations using DSP processor and verify the results. CO4: Able to realize the digital filters using a simulation tool and a DSP processor and verify the results.

15ECL58	**HDL Lab**	CO1: Able to write the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, behavioural and Gate level Abstractions. CO2: Able to describe sequential circuits like flip flops and counters in behavioural description and obtain simulation waveforms. CO3: Able to synthesize Combinational and Sequential circuits on programmable ICs and test the hardware. CO4: Able to interface the hardware to the programmable chips and obtain the required output.
15EC61	**Digital Communication**	CO1: Able to represent the signals mathematically and compare discrete PAM signals using different line coding formats.. CO2: Able to apply the concept of transmission of signals over AWGN channels CO3: Able to apply the concept of different digital communication techniques. CO4: Able to design and analyze the transmission of signals through band limited channels. CO5: Able to apply the principles of secured digital communication systems.
15EC62	**ARM Microcontroller & Embedded Systems**	CO1: Able to describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3. CO2: Able to describe the memory map of cortex m3 and apply the knowledge gained for Programming ARM Cortex M3 for different applications. CO3: Able to apply the knowledge in selecting basic hardware components in the design of embedded system based on the characteristics and attributes of an embedded system. CO4: Able to describe the development of an embedded system using the hardware /software co-design and firmware design approaches. CO5: Able to explain the need of real time operating system for embedded system applications.
15EC63	**VLSI Design**	CO1: Able to demonstrate MOS transistor theory, CMOS fabrication flow

		CO2: Able to draw stick diagram and layout for logic gates with knowledge of physical design aspects. CO3: Able to perform scaling of MOS devices and testing of VLSI circuits. CO4: Able to do designing of various Subsystems and issues related to designing.
15EC64	**Computer Communication Networks**	CO1: Able to identify the layering architecture of OSI reference model and TCP/IP protocol suite. CO2: Able to identify the protocols and functions associated with each layer services. CO3: Able to describe the different networking architectures and their representations. CO4: Able to explain the routing of packets using different routing algorithms.
15EC651	**Cellular Mobile Communication**	CO1: Able to Apply the understanding of statistical characterization of urban mobile channels to compute the performance for simple modulation schemes. CO2: Able to Describe how the trunking and interference affect the overall capacity of cellular system. CO3: Able to Demonstrate the limitations of GSM, GPRS and CDMA to meet high data rate requirements and limited improvements that are needed. CO4: Able to Analyze the call process procedure between a calling number and called number for all scenarios in GSM or CDMA based systems. CO5: Able to Test and validate voice and data call handling for various scenarios in GSM and CDMA systems for national and international interworking situations.
15EC654	**Digital Switching Systems**	CO1: Able to describe the electromechanical switching systems and its comparison with the digital switching CO2: Able to describe the telecommunication traffic and its measurements CO3: Able to explain the technologies associated with the data

		switching operations CO4: Able to describe the software aspects of switching systems and its maintenance
15EC663	**Digital System Design using Verilog**	CO1: Able to construct the combinational circuits and describe Verilog model for sequential circuits with test pattern generation. CO2: Able to design a semiconductor memory for specific chip design. CO3: Able to inspect IC's that are embedded in package and assembled in PCB's for different application. CO4: Able to synthesize different types of processor and I/O controllers that are used in embedded system. CO5: Able to use IC design methodologies to analyse complex digital systems.
15ECL67	**Embedded Controller Lab**	CO1: Able to explain the instruction set of 32 bit microcontroller ARM Cortex M3 and the software tool required for programming in Assembly and C language. CO2: Able to develop assembly language programs using ARM Cortex M3 for different applications. CO3: Able to interface external devices with ARM Cortex M3. CO5: Able to Develop C language programs and library functions for embedded system applications.
15ECL68	**Computer Networks Lab**	CO1: Able to use the network simulator for learning and practice of networking algorithms. CO2: Able to illustrate the operations of network protocols and algorithms using C Programming. CO3: Able to simulate the network with different configurations to measure the performance parameters. CO4: Able to implement the data link and routing protocols using C programming.

IV Year Electronics & Communication Engineering

15EC71	**Microwave And Antenna**	CO1: Able to explain microwave source, mode of oscillations and curves.Anlyse transmission line parameters such as Reflection ,Transmission Coefficient, Standing Wave Ratio. CO2: Able to explain all parameters of Microwave network and Microwave passive devices such as Coaxial Connectors and Adapters, Attenuators, Phase Shifters, Waveguide Tees, Magic tees. CO3: Able to explain different Microstrip lines and able to define all basic parameters of Antenna. CO4: Able to to derive Radiation resistance for short electric dipole and thin linear antenna from field components. CO5 : Able to explain different types of Antennas and their applications.
15EC72	**Digital Image Processing**	CO1: Able to understand the fundamental steps in digital image processing and apply some basic relationships between pixels to images CO2: Able to apply the different image transforms to images CO3: Able to understand different restoration techniques and methods used in digital image processing. CO4: Able to apply different color models, wavelet transforms and morphological operations to images. CO5: Able to apply different segmentation techniques to images.
15EC73	**Power Electronics**	CO1: Able to describe the characteristics of different power devices and identify the various applications associated with it. CO2: Able to illustrate the working of power circuit as DC-DC converter. CO3: Able to illustrate the operation of inverter circuit and static

		switches. CO4: Able to determine the output response of a thyristor circuit with various triggering options. CO5: Able to determine the response of controlled rectifier with resistive and inductive loads.
15EC741	**Multimedia Communication**	CO1: Able to understand basics of different multimedia networks and applications. CO2: Able to understand different compression techniques to compress audio and video. CO3: Able to analyze compression techniques required to compress text and image and gain knowledge of DMS CO4: Able to analyze compression techniques required to compress audio and video. CO5: Able to gain fundamental knowledge about multimedia communication across different networks
15EC751	**Digital Signal Processing Algorithm & Architecture**	CO1: Able to understand the basics of DSP ,multi rate sampling and architecture of DSP processor. CO2: Able to analyse different DSP processor and TMS320C54XX architecture. CO3: Able to list instruction set of TMS320C54XX and write assembly language programming. CO4: Able to implement FIR, IIR, interpolation, decimation filter and FFT algorithms. CO5: Able to design external memory architecture for TMS320C54XX and interfacing for the real time application and Implement Interfacing real time application using TMS320C54XX.
15ECL76	**Advanced Communication Lab**	CO1: Able to determine the characteristics and response of microwave devices and optical waveguide. CO2: Able to determine the characteristics of microstrip antennas and devices and compute the parameters associated with it. CO3: Able to Simulate the digital modulation schemes with the

		display of waveforms and computation of performance parameters. CO4: Able to design and test the digital modulation circuits/systems and display the waveforms
15ECL77	**VLSI Lab**	CO1: Able to write test bench to simulate various digital circuits. CO2: Able to Interpret concepts of DC Analysis, AC Analysis and Transient Analysis in analog circuits. CO3: Able to design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers. CO4: Able to use basic amplifiers and further design higher level circuits like operational amplifier and analog/digital converters to meet desired parameters. Co5: Able to Use transistors to design gates and further using gates realize shift registers and adders to meet desired parameters.
15ECP78	**Project Work Phase–I**	CO1: Identify, formulate and analyze engineering problems for the need of society. CO2: Design solutions for engineering problems using modern tool/technology to investigate with interpretation of data. CO3: Understand the impact of the engineering solutions in societal and environmental contexts for sustainable development with commit to professional ethics. CO4: Work individually and in team, Communicate effectively through reports and presentations. CO5: Apply engineering, management and ethical principles for Project management and finance.
15EC81	**Wireless Cellular and LTE 4G Broadband**	CO1: Able to understand the system architecture and the functional standard specified in LTE 4G. CO2: Able to Analyze the role of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users. · CO3: able to demonstrate the UTRAN and EPS handling processes from set up to release including mobility management for a variety of data call scenarios. CO4: Able to test and Evaluate the Performance of resource management and packet data processing and transport algorithms.

15EC82	**Fiber Optics & Networks**	CO1: Able to Classification and working of optical fiber with different modes of signal propagation. CO 2: Able to describe the transmission characteristics and losses in optical fiber communication. CO3.Able to describe the construction and working principle of optical connectors, multiplexers and amplifiers. CO4: Able to describe the constructional features and the characteristics of optical sources and detectors. CO5: Able to illustrate the networking aspects of optical fiber and describe various standards associated with it.
15EC834	**Machine learning**	CO1: Able to understand the core concepts of Machine learning. CO2: Able to Appreciate the underlying mathematical relationships within and across Machine Learning algorithms. CO3: Able to explain paradigms of supervised and un-supervised learning. CO4: Able to recognize a real world problem and apply the learned techniques of Machine Learning to solve the problem.
15EC835	**Network and Cyber security**	CO1: Able to explain network security protocols. CO2: Able to understand the basic concepts of cyber security . CO3: Able to discuss the cyber security problems. CO4:Able to explain Enterprise Security Framework CO5:Able to apply concept of cyber security framework in computer system administration
15EC84	**Internship/Professional Practice**	CO1: Apply gained knowledge and skills in engineering practice. CO2: Analyze and design solutions for engineering problems. CO3: Work individually, in team and communicate effectively through reports and presentations. CO4: Demonstrate and adapt to workplace attitude and ethics.

15ECP85	**Project Work phase-II**	CO1: Identify, formulate and analyze engineering problems for the need of society. CO2: Design solutions for engineering problems using modern tool/technology to investigate with interpretation of data. CO3: Understand the impact of the engineering solutions in societal and environmental contexts for sustainable development with commit to professional ethics. CO4: Work individually and in team, Communicate effectively through reports and presentations. CO5: Apply engineering, management and ethical principles for Project management and finance.
15ECS86	**Seminar**	CO1: Identify and explore recent trends in Electronics and communication engineering. CO2: Prepare effective report on the selected topic. CO3: Prepare power point presentation (PPT), communicate and answer the queries on the topic.

ECE 2017 scheme

II Year Electronics & Communication Engineering

Course Code	**Course Name**	**Course Outcomes-On completion of this course the students will be**
17MAT31	**Engineering Mathematics –III**	CO1: Able to find the Fourier series, half range Fourier series and Fourier coefficients of periodic functions. CO2: Able to find the Fourier and inverse Fourier transforms of aperiodic functions. CO3: Able to find Z-transforms and inverse Z-transform, and to solve the finite difference equations using Z-transforms. CO4: Able to apply the concept of statics for curve fitting, correlation and regression. CO5: Able to solve the algebraic/transcendental equation, interpolating polynomials, intermediate values and evaluation of

		integrals using appropriate numerical techniques. CO6: Able to evaluate the integrals using Green's, Stokes and Gauss divergence theorem and Able to apply Euler's equation to find the maxima or minima of the functional.
17EC32	**Electronic Instrumentation**	CO1: Able to explain Accuracy, precision, types of errors and calculate them , and describe ammeters, voltmeters and multi meters and develop circuits for multi range Ammeters and Voltmeters CO2: Able to describe functional concepts and operation of Digital voltmeters and instruments to measure frequency, time period, phase difference of signals, rotation speed, capacitance and pH of solutions. CO3: Able to describe the operation of analog oscilloscope, digital storage oscilloscope and different types of signal generators CO4: Able describe functional concepts of various Analog measuring instruments to measure field Strength, impedance, stroboscopic speed, in/out of phase, Q of coils, insulation resistance and analyze AC and DC bridges for passive component and frequency measurements. CO5: Able to explain working of different types of transducers, their applications, comparison between different transducers , select the transducers for different applications
17EC33	**Analog Electronics**	CO1: Able to explain the working principles and performance of BJT in different modes with different types of biasing structures CO2: Able to explain the working principles and performance of FET and MOSFET in different modes with different types of biasing structures. CO3: Able to explain the performance of BJT and FET amplifiers with respect to different frequencies. CO4: Able to classify different feedback systems and explain operation of different oscillators. CO5: Able to explain the performance and efficiency of different Power Amplifiers.
17EC34	**Digital Electronics**	CO1: Able to develop simplified switching equations using Karnaugh

		Maps and Quine McClusky techniques. CO2: Able to apply the knowledge of decoders, encoders, multiplexers and demultiplexers to generate specific functions and describe the operation of adders, subtractors and comparators CO3: Explain the working of Latches and Flip Flops (SR, D, T and JK) CO4: Able to design Synchronous/Asynchronous Counters and Shift registers using Flip Flops. CO5: Able to develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits. CO6: Able to apply the knowledge gained in the design of Counters and Registers.
17EC35	**Network Analysis**	CO1: Able to determine currents and voltages using source transformation/ source shifting/mesh/ nodal analysis and reduce given network using star-delta transformation/source transformation/ source shifting. CO2: Able to 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. CO3: Able to calculate current and voltages for the given circuit under transient conditions. Apply Laplace transform to solve the given network. CO4: Able to evaluate for RLC elements/ frequency response related parameters like resonant frequency, quality factor, half power frequencies, voltage across inductor and capacitor, current through the RLC elements, in resonant circuits. CO5: Able to solve the given network using specified two port network parameter like Z or Y or T or h.
17EC36	**Engineering Electromagnetics**	CO1: Able to evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law. CO2: Able to determine potential and energy with respect to point charge and capacitance using Laplace equation. CO3: Able to calculate magnetic field, force, and potential energy

		with respect to magnetic materials.. CO4: Able to derive Maxwell's equation for time varying fields and explain its significance. CO5: Able to apply Maxwell's equation for time varying fields, discuss the propagation of EM waves in free space and conductors and valuate power associated with EM waves using Poynting theorem.
17ECL37	**Analog Electronics Lab**	CO1: Able to design and Test rectifiers, clipping circuits, clamping circuits and voltage regulators. CO2: Able to compute the parameters from the characteristics of JFET and MOSFET devices. CO3: Able to design, test and evaluate BJT amplifiers in CE configuration as well as JFET/MOSFET amplifiers. CO4: Able to test a power amplifier and compute its conversion efficiency. CO5: Able to design and Test various types of oscillators
17ECL38	**Digital Electronics Lab**	CO1: Able to demonstrate the truth table of various expressions and combinational circuits using logic gates. CO2: Able to test various combinational circuits such as adders, subtractors, comparators, multiplexers, demultiplexers and decoders. CO3: Able to construct and test flips-flops, counters and shift registers. CO4: Able to simulate full adder and up/down counters.
17KL/CPH39/49	**Kannada/Constitution of India,** **Professional Ethics and Human Rights**	CO1: Read and understand the simple words in Kannada language CO2: Learn Vyavaharika Kannada (Kannada for Communication) CO3: Develop interest on Kannada Language and Literature
17KL39/49	**Kannada**	CO1: Use kannada grammar appropriately

		CO2: Use kannada language in administration CO3: Understand the kannada literature
17CPH39/49	**Constitution of India,** **Professional Ethics and Human** **Rights**	CO1: Have general knowledge and legal literacy about Indian Constitution and there by it helps to take up competitive examinations & to manage/face complex societal issues in society. CO2: Understand state and central policies(Union and State Excutive), fundamental Rights & their duties. CO3: Understand Electoral Process, Amendments and special provisions in Constitution. CO4: Understand powers and functions of Municipalities, Panchayats and Co-operative Societies, with Human Rights and NHRC. CO5: Understand Engineering & Professional ethics and responsibilities of Engineers.
17MAT41	**Engineering Mathematics –IV**	CO1: Able to apply the numerical methods to solve the linear ordinary differential equations of first and second order. CO2: Able to derive Bessel's function, Legendre's polynomials and its properties. Also able to apply Rodrigue's formula to find the polynomials. CO3: Able to solve problems on analytic functions using Cauchy – Riemann equations and to solve the complex line integrals, conformal and bilinear transformations. CO4: Able to analyze and solve the probability distribution problems. CO5: Able to define hypothesis, analyze and interpret the hypothesis for the given sampling distribution and to solve stochastic process problems.
17EC42	**Signals and Systems**	CO1: Able to classify the signals as continuous/discrete, periodic/aperiodic, even/odd, energy/power and deterministic/random signals. CO2: Able to determine the linearity, causality, time-invariance and

		stability properties of continuous and discrete time systems. CO3: Able to compute the response of a Continuous and Discrete LTI system using convolution integral and convolution sum. CO4: Able to determine the spectral characteristics of continuous and discrete time signal using Fourier analysis. CO5: Able to compute Z-transforms, inverse Z- transforms and transfer functions of complex LTI systems.
17EC43	**Control Systems**	CO1: Able to develop the mathematical model of mechanical and electrical systems CO2: Able to develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method CO3: Able to determine the time domain specifications for first and second order systems CO4: Able to determine the stability of a system in the time domain using Routh-Hurwitz criterion and Root-locus technique. CO5: Able to determine the stability of a system in the frequency domain using Nyquist and bode plots CO6: Able to develop a control system model in continuous and discrete time using state variable techniques
17EC44	**Principles of Communication** **Systems**	CO1: Able to Determine the performance of analog modulation schemes in time and frequency domains. CO2: Able to Determine the performance of systems for generation and detection of modulated analog signals. CO3: Able to Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms. CO4: Able to Characterize the influence of channel on analog modulated signals Determine the performance of analog communication systems. CO5: Able to Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.

17EC45	**Linear Integrated Circuits**	CO1: Able to Explain Op-Amp circuit and parameters including CMRR, PSRR, Input & Output Impedances and Slew Rate. CO2: Able to Design Op-Amp based Inverting, Non-inverting, Summing & Difference Amplifier, and AC Amplifiers including Voltage Follower. CO3: Able to Test circuits of Op-Amp based Voltage/ Current Sources & Sinks, Current, Instrumentation and Precision Amplifiers. CO4: Able to test circuits of Op-Amp based linear and non-linear circuits comprising of limiting, clamping, Sample & Hold, Differentiator/ Integrator Circuits, Peak Detectors, Oscillators and Multiplier & Divider. CO5: Able to design first & second order Low Pass, High Pass, Band Pass, Band Stop Filters and Voltage Regulators using Op-Amps. CO6: Able to explain applications of linear ICs in phase detector, VCO, DAC, ADC and Timer.
17EC46	**Microprocessor**	CO1: Able to explain the History of evaluation of Microprocessors, Architecture and instruction set of 8086, CISC & RISC, Von-Neumann & Harvard CPU Architecture, Configuration & Timing diagrams of 8086 and Instruction set of 8086. CO2: Able to write 8086 Assembly level programs using the 8086 instruction set CO3: Able to write modular programs using procedures. CO4: Able to write 8086 Stack and Interrupts programming. CO5: Able to interface 8086 to Static memory chips and 8255, 8254, 0808 ADC, 0800 DAC, Keyboard, Display and Stepper motors. CO6: Able to use INT 21 DOS interrupt function calls to handle Keyboard and Display.
17ECL47	**Microprocessor Lab**	CO1: Able to write and execute 8086 assembly level programs to perform data transfer, arithmetic and logical operations. CO2: Able to understand assembler directives, branch, loop operations and DOS 21H Interrupts. CO3: Able to write and execute 8086 assembly level programs to sort and search elements in a given array.

		CO4: Able to perform string transfer, string reversing, searching a character in a string with string manipulation instructions of 8086. CO5: Able to utilize procedures and macros in programming 8086. CO6: Able to demonstrate the interfacing of 8086 with 7 segment display, matrix keyboard, logical controller, stepper motor, ADC, DAC, and LDR for simple applications.
17ECL48	**Linear ICs and Communication Lab**	CO1: Able to illustrate the pulse and flat top sampling techniques using basic circuits. CO2: Able to demonstrate addition and integration using linear ICs, and 555 timer operations to generate signals/pulses. CO3: Able to demonstrate AM and FM operations and frequency synthesis. CO4: Able to design and illustrate the operation of instrumentation amplifier, LPF, HPF, DAC and oscillators using linear IC.

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Course Code	Course Name	Course Outcomes-On completion of this course the students will be
17ES51	**Management and Entrepreneurship Development**	CO1: Able to understand the fundamental concepts of Management and Entrepreneurship CO2: Able to select a best Entrepreneurship model for the required domain of establishment CO3: Able to describe the functions of Managers, Entrepreneurs and their social Responsibilities. CO4: Able to compare various types of Entrepreneurs CO5: Able to analyze the Institutional support by various state and central government agencies

17EC52	**Digital Signal Processing**	CO1: Able to compute DFT of real and complex discrete time signals. CO2: Able to determine response of LTI systems using time domain and DFT techniques. CO3: Able to compute DFT using FFT algorithms and appreciate the computational speed of the algorithms CO4: Able to realize the structure of digital filters using different forms and design the digital filters.
17EC53	**Verilog HDL**	CO1. Able to understand the need of HDL with different design styles and design methodologies in HDL CO2. Able to design combinational logic in Gate level and Data flow style using Verilog HDL. CO3. Able to design Combinational and sequential circuits in behavioural modelling using Verilog HDL. CO4. Able to design Combinational and sequential circuits in all the three design styles with VHDL.
17EC54	**Information Theory & Coding**	CO1: Able to explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source. CO2: Able to represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms. CO3: Able to determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes. CO4: Able to design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes and model the continuous and discrete communication channels using input, output and joint probabilities.
17EC553	**Operating System**	CO1: Able to explain the goals, structure, operation and types of operating systems. CO2: Able to apply scheduling techniques to find performance factors. CO3: Able to explain organization of file systems and IOCS. CO4: Able to apply suitable techniques for contiguous and non-

		contiguous memory Allocation. CO5: Able to describe message passing, deadlock detection and prevention methods
17EC563	**8051 Microcontroller**	CO1: Able to define an embedded system and describe the architecture of 8051 CO2: Able to apply the instructions in 8051 based embedded application programs. CO3: Able to apply the concepts of stack and subroutine in designing 8051 programming. CO4: Able to apply the concepts of timers and serial port UART in in generating delay and serial communication. CO5: Able to interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O ports and interrupts.
17EC562	**Object Oriented Programming Using C++**	CO1: Able to explain the basic concepts of object oriented programming language CO2: Able to explain and program object oriented design using design using classes, objects, constructors, destructors and operator overloading. CO3: Able to explain and program design using classes, objects, constructors, destructors and operator overloading. CO4: Able to explain and program Streams and Working with files.
17ECL57	**DSP Lab**	CO1: Able to understand the concepts of analog to digital conversion of signals and frequency domain sampling of signals CO2: Able to modeling of discrete time signals and systems and verification of its properties and results. CO3: Able to implementation of discrete computations using DSP processor and verify the results. CO4: Able to realize the digital filters using a simulation tool and a DSP

		processor and verify the results.
17ECL58	**HDL Lab**	CO1: Able to write the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, behavioural and Gate level Abstractions. CO2: Able to describe sequential circuits like flip flops and counters in behavioural description and obtain simulation waveforms. CO3: Able to synthesize Combinational and Sequential circuits on programmable ICs and test the hardware. CO4: Able to interface the hardware to the programmable chips and obtain the required output.
17EC61	**Digital Communication**	CO1: Able to represent the signals mathematically and compare discrete PAM signals using different line coding formats.. CO2: Able to apply the concept of transmission of signals over AWGN channels CO3: Able to apply the concept of different digital communication techniques. CO4: Able to design and analyze the transmission of signals through band limited channels. CO5: Able to apply the principles of secured digital communication systems.
17EC62	**ARM Microcontroller & Embedded Systems**	CO1: Able to describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3. CO2: Able to describe the memory map of cortex m3 and apply the knowledge gained for Programming ARM Cortex M3 for different applications. CO3: Able to apply the knowledge in selecting basic hardware components in the design of embedded system based on the characteristics and attributes of an embedded system. CO4: Able to describe the development of an embedded system using the hardware /software co-design and firmware design approaches. CO5: Able to explain the need of real time operating system for embedded system applications.

17EC63	**VLSI Design**	CO1: Able to demonstrate MOS transistor theory, CMOS fabrication flow CO2: Able to draw stick diagram and layout for logic gates with knowledge of physical design aspects. CO3: Able to perform scaling of MOS devices and testing of VLSI circuits. CO4: Able to do designing of various Subsystems and issues related to designing.
17EC64	**Computer Communication Networks**	CO1: Able to identify the layering architecture of OSI reference model and TCP/IP protocol suite. CO2: Able to identify the protocols and functions associated with each layer services. CO3: Able to describe the different networking architectures and their representations. CO4: Able to explain the routing of packets using different routing algorithms.
17EC651	**Cellular Mobile Communication**	CO1: Able to Apply the understanding of statistical characterization of urban mobile channels to compute the performance for simple modulation schemes. CO2: Able to Describe how the trunking and interference affect the overall capacity of cellular system. CO3: Able to Demonstrate the limitations of GSM, GPRS and CDMA to meet high data rate requirements and limited improvements that are needed. CO4: Able to Analyze the call process procedure between a calling number and called number for all scenarios in GSM or CDMA based systems. CO5: Able to Test and validate voice and data call handling for various scenarios in GSM and CDMA systems for national and international interworking situations.
17EC654	**Digital Switching Systems**	CO1: Able to describe the electromechanical switching systems and its comparison with the digital switching CO2: Able to describe the telecommunication traffic and its

		measurements CO3: Able to explain the technologies associated with the data switching operations CO4: Able to describe the software aspects of switching systems and its maintenance
17EC663	**Digital System Design using Verilog**	CO1: Able to construct the combinational circuits and describe Verilog model for sequential circuits with test pattern generation. CO2: Able to design a semiconductor memory for specific chip design. CO3: Able to inspect IC's that are embedded in package and assembled in PCB's for different application. CO4: Able to synthesize different types of processor and I/O controllers that are used in embedded system. CO5: Able to use IC design methodologies to analyse complex digital systems.
17ECL67	**Embedded Controller Lab**	CO1: Able to explain the instruction set of 32 bit microcontroller ARM Cortex M3 and the software tool required for programming in Assembly and C language. CO2: Able to develop assembly language programs using ARM Cortex M3 for different applications. CO3: Able to interface external devices with ARM Cortex M3. CO5: Able to Develop C language programs and library functions for embedded system applications.
17ECL68	**Computer Networks Lab**	CO1: Able to use the network simulator for learning and practice of networking algorithms. CO2: Able to illustrate the operations of network protocols and algorithms using C Programming. CO3: Able to simulate the network with different configurations to measure the performance parameters. CO4: Able to implement the data link and routing protocols using C programming.

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17EC71	**Microwave And Antenna**	CO1: Able to explain microwave source, mode of oscillations and curves.Anlyse transmission line parameters such as Reflection ,Transmission Coefficient, Standing Wave Ratio. CO2: Able to explain all parameters of Microwave network and Microwave passive devices such as Coaxial Connectors and Adapters, Attenuators, Phase Shifters, Waveguide Tees, Magic tees. CO3: Able to explain different Microstrip lines and able to define all basic parameters of Antenna. CO4: Able to to derive Radiation resistance for short electric dipole and thin linear antenna from field components. CO5 : Able to explain different types of Antennas and their applications.
17EC72	**Digital Image Processing**	CO1: Able to understand the fundamental steps in digital image processing and apply some basic relationships between pixels to images CO2: Able to apply the different image transforms to images CO3: Able to understand different restoration techniques and methods used in digital image processing. CO4: Able to apply different color models, wavelet transforms and morphological operations to images. CO5: Able to apply different segmentation techniques to images.
17EC73	**Power Electronics**	CO1: Able to describe the characteristics of different power devices and identify the various applications associated with it. CO2: Able to illustrate the working of power circuit as DC-DC converter.

		CO3: Able to illustrate the operation of inverter circuit and static switches. CO4: Able to determine the output response of a thyristor circuit with various triggering options. CO5: Able to determine the response of controlled rectifier with resistive and inductive loads.
17EC741	**Multimedia Communication**	CO1: Able to understand basics of different multimedia networks and applications. CO2: Able to understand different compression techniques to compress audio and video. CO3: Able to analyze compression techniques required to compress text and image and gain knowledge of DMS CO4: Able to analyze compression techniques required to compress audio and video. CO5: Able to gain fundamental knowledge about multimedia communication across different networks
17EC751	**Digital Signal Processing Algorithm & Architecture**	CO1: Able to understand the basics of DSP ,multi rate sampling and architecture of DSP processor. CO2: Able to analyse different DSP processor and TMS320C54XX architecture. CO3: Able to list instruction set of TMS320C54XX and write assembly language programming. CO4: Able to implement FIR, IIR, interpolation, decimation filter and FFT algorithms. CO5: Able to design external memory architecture for TMS320C54XX and interfacing for the real time application and Implement Interfacing real time application using TMS320C54XX.
17ECL76	**Advanced Communication Lab**	CO1: Able to determine the characteristics and response of microwave devices and optical waveguide. CO2: Able to determine the characteristics of microstrip antennas and devices and compute the parameters associated with it.

		CO3: Able to Simulate the digital modulation schemes with the display of waveforms and computation of performance parameters. CO4: Able to design and test the digital modulation circuits/systems and display the waveforms
17ECL77	**VLSI Lab**	CO1: Able to write test bench to simulate various digital circuits. CO2: Able to Interpret concepts of DC Analysis, AC Analysis and Transient Analysis in analog circuits. CO3: Able to design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers. CO4: Able to use basic amplifiers and further design higher level circuits like operational amplifier and analog/digital converters to meet desired parameters. Co5: Able to Use transistors to design gates and further using gates realize shift registers and adders to meet desired parameters.
17ECP78	**Project Work Phase–I**	CO1: Identify, formulate and analyze engineering problems for the need of society. CO2: Design solutions for engineering problems using modern tool/technology to investigate with interpretation of data. CO3: Understand the impact of the engineering solutions in societal and environmental contexts for sustainable development with commit to professional ethics. CO4: Work individually and in team, Communicate effectively through reports and presentations. CO5: Apply engineering, management and ethical principles for Project management and finance.
17EC81	**Wireless Cellular and LTE 4G Broadband**	CO1: Able to understand the system architecture and the functional standard specified in LTE 4G. CO2: Able to Analyze the role of LTE radio interface protocols and EPS Data convergence protocols to set up, reconfigure and release data and voice from users. · CO3: able to demonstrate the UTRAN and EPS handling processes from set up to release including mobility management for a variety of data call scenarios. CO4: Able to test and Evaluate the Performance of resource

		management and packet data processing and transport algorithms.
17EC82	**Fiber Optics & Networks**	CO1: Able to Classification and working of optical fiber with different modes of signal propagation. CO 2: Able to describe the transmission characteristics and losses in optical fiber communication. CO3.Able to describe the construction and working principle of optical connectors, multiplexers and amplifiers. CO4: Able to describe the constructional features and the characteristics of optical sources and detectors. CO5: Able to illustrate the networking aspects of optical fiber and describe various standards associated with it.
17EC834	**Machine learning**	CO1: Able to understand the core concepts of Machine learning. CO2: Able to Appreciate the underlying mathematical relationships within and across Machine Learning algorithms. CO3: Able to explain paradigms of supervised and un-supervised learning. CO4: Able to recognize a real world problem and apply the learned techniques of Machine Learning to solve the problem.
17EC835	**Network and Cyber security**	CO1: Able to explain network security protocols. CO2: Able to understand the basic concepts of cyber security . CO3: Able to discuss the cyber security problems. CO4:Able to explain Enterprise Security Framework CO5:Able to apply concept of cyber security framework in computer system administration
17EC84	**Internship/Professional Practice**	CO1: Apply gained knowledge and skills in engineering practice. CO2: Analyze and design solutions for engineering problems. CO3: Work individually, in team and communicate effectively through reports and presentations. CO4: Demonstrate and adapt to workplace attitude and ethics.

17ECP85	**Project Work phase-II**	CO1: Identify, formulate and analyze engineering problems for the need of society. CO2: Design solutions for engineering problems using modern tool/technology to investigate with interpretation of data. CO3: Understand the impact of the engineering solutions in societal and environmental contexts for sustainable development with commit to professional ethics. CO4: Work individually and in team, Communicate effectively through reports and presentations. CO5: Apply engineering, management and ethical principles for Project management and finance.
17ECS86	**Seminar**	CO1: Identify and explore recent trends in Electronics and communication engineering. CO2: Prepare effective report on the selected topic. CO3: Prepare power point presentation (PPT), communicate and answer the queries on the topic.