**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**			
Sl. No.	**Sub. Code**	**Subject Name**	**Course Outcomes**
01	23ES1002	Basic Electronics	CO-1	Describe the basic concept of Semiconductors and PN junction diode and transistors(BJT)
			CO-2	Understand the working principle and characteristics of Transistor (JFET,MOSFET)
			CO-3	Study of CMOS AND VLSI technology. Understand the structure and properties of feedback amplifier .
			CO-4	Classify the OP-AMP with its applications as Integrator, Differentiator & Summing Amplifier
			CO-5	Relate the various Number systems and logic gates and simplification of Boolean Algebra.
			CO-6	Study of CRO and DSO and principle of communication system.
02	23ES1202	Basic Electronics Lab	CO-1	Classify different types of components so that they can use them in designing a circuit.
			CO-2	Study the VI characteristics of a PN junction Diode and study the CRO and calculate its amplitude and frequencies
			CO-3	Study of Half wave and full wave rectifier output waveform.
			CO-4	Study the characteristics of n-p-n or p-n-p transistor
			CO-5	Design inverting and non-inverting amplifiers using OPAMP.
			CO-6	Study different logic gates and verify their corresponding truth tables.
03		DATA STRUCTU	CO-1	Understand the concept of dynamic memory management, datatypes, algorithms, Big O notation.

		RE	CO-2	Understand basic data structures such as arrays, linked lists, stacks and queues.
	REC4 G002		CO-3	Describe the hash function and concepts of collision and its resolution methods
			CO-4	Solve problem involving graphs, trees and heaps
			CO-5	Apply Algorithm for solving problem like sorting, searching , insertion and deletion of data.
			CO-6	To impart the base concepts of data structures and algorithms.
04	RMA 3A00 1	Math-III	CO-1	Apply the knowledge of calculus, Gamma and Beta functions for analyzing engineering problems.
			CO-2	Analyze the first order differential equations using standard methods and use its application in engineering fields.
			CO-3	Demonstrate various physical models through higher order differential equation
			CO-4	Solve linear differential equations with variation of parameters.
			CO-5	Obtain series solution of differential equations and explain application of Bessel's function.
			CO-6	Apply Laplace transformations to determine complete solution of ordinary differential equations.
05	REC3 C002	Signals & Systems	CO-1	Test and analyze discrete time elementary signals, systems and their classification.
			CO-2	Test and analyze discrete time LTI systems.
			CO-3	Apply the concepts of elementary signals to develop continous time Fourier series and Fourier transform.
			CO-4	Test and apply the concepts of Z-Transform to the analysis of LTI systems.
			CO-5	Test and analyze the concepts of inverse Z-Transform.

			CO-6	Apply the concepts of continuous time Fourier series and Fourier transform to analyze discrete Fourier transform (DFT).
06	REC3 C202	Signals & Systems Lab using Software	CO-1	Generate and plot different types of discrete time signals.
			CO-2	Apply the knowledge of Fourier transform to simulate a square pulse and find its amplitude with phase spectrum.
			CO-3	Design and simulate a rectangular periodic signal and find its trigonometric and exponential Fourier series coefficients.
			CO-4	Design and test the concept of Nyquist rate with respect to a discrete time signal.
			CO-5	Design and simulate a low and high pass filter.
			CO-6	Simulate and observe the convolution and correlation of two discrete time signals.
07	REC4 C002	Digital Systems Design	CO-1	Apply knowledge about logic gates to investigate the behavior of different logic gates and analyze the gate level minimization.
			CO-2	Design and implement different combinational circuits using NAND/NOR gates only or using minimized number of logic gates.
			CO-3	Design and implement different sequential circuits such as flip-flops, registers, and counters.
			CO-4	Investigate the behaviour of a RAM and its storage capacity.
			CO-5	Design, test, and implement a clock pulse generator, parallel adder, accumulator, and binary multiplier.
			CO-6	Implement different combinational and sequential circuits using VHDL/Verilog.
08	REC4 C202	Digital Systems	CO-1	Apply knowledge about logic gates to investigate the behaviour of different logic gates and analyse the gate level minimization.

		Design Lab	CO-2	Design and implement different combinational circuits using NAND/NOR gates only or using minimized number of logic gates.
			CO-3	Design and implement different sequential circuits such as flip-flops, registers, and counters.
			CO-4	Investigate the behaviour of a RAM and its storage capacity.
			CO-5	Design, test, and implement a clock pulse generator, parallel adder, accumulator, and binary multiplier.
			CO-6	Implement different combinational and sequential circuits using VHDL/Verilog.
09	REC4 D003	Sensors and Transducers	CO-1	Investigate static and dynamic characteristics of a measurement system.
			CO-2	Design and Implement resistive, inductive, and capacitive sensing elements.
			CO-3	Design and Test different deflection bridges.
			CO-4	Design and Test different amplifiers and filters.
			CO-5	Design and Implement thermoelectric sensing elements.
			CO-6	Design and Investigate electromagnetic sensing elements.
11	REC4 C001	Electromagnetic Theory	CO-1	Discuss different types of coordinate systems and Describe electrostatic and magneto static laws .
			CO-2	Describe energy density and potential gradient on electric or magnetic fields.
			CO-3	Derive the Maxwell's equations in static and dynamic fields and pointing theorem.
			CO-4	Analyze the EM wave propagation in different mediums

			CO-5	Classify the transmission lines and Formulate the wave propagation through transmission lines .
			C0-6	Classify the waveguides and study the radiation properties of different antennas.
11	REC4 C201	Electronic Device Lab	CO-1	Simulate wave propagation in conductors and dielectrics using HFSS/CST/MATLAB.
			CO-2	Design, test, and implement a rectangular wave guide using HFSS/CST/MATLAB.
			CO-3	Simulate uniform plane wave propagation and transverse electric waves.
			CO-4	Determine Dispersion, Group velocity, azimuth, elevation patterns, input impedance, and output impedance.
			CO-5	Design a cavity resonator.
			CO-6	Simulate reflection of plane waves.
12	REC3 C001	Analog Electronics Circuit	CO-1	Apply the basic concept of MOSFET, Biasing of BJT and FET to analysis and design of basic transistor amplifier circuits.
			CO-2	Test and Analyze the behavior of BJT/FET in low and high frequency regions by performing frequency analysis of BJT and FET.
			CO-3	Analyze BJT/FET in small signal models.
			CO-4	Apply principle of Feedback Amplifiers and Oscillators.
			CO-5	Apply basic concepts of transistors to design different oscillator and power amplifier circuits of desired frequency and gain.
			CO-6	Implement knowledge of op-amp with basic circuits.
		Analog	CO-1	Design and simulate BJT/JFET/MOSFET bias circuits

13	REC3C201	Electronics Circuit Lab			and compare the results.
			CO-2		Design and simulate BJT/JFET/MOSFET common emitter circuit and compare their DC and AC performance.
			CO-3		Apply the knowledge about a common emitter amplifier to simulate its frequency response and compare the performance in low-frequency, mid-frequency, and high-frequency regions.
			CO-4		Design a differential amplifier circuit with/without current source and compare its performance during DC and AC operation.
			CO-5		Design a differentiator, integrator, square wave generator using a OPAMP.
			CO-6		Design oscillators and power amplifiers using the knowledge of OPAMPs and transistors.
14	REC4C003	Network Theory	CO-1		Understanding basic electrical circuits and can apply different electrical laws and theorems to solve complex electrical networks
			CO-2		Analyze the transient and steady state response of 1st and 2nd order differential equations for series and parallel R-L, R-C and R-L-C networks.
			CO-3		Recognize the need of sinusoidal steady state response of single phase and three phase circuits
			CO-4		Analyze the electrical networks using Laplace transform for standard inputs.
			CO-5		Evaluate the stability of electrical circuit using frequency domain analysis.

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			CO-6	Understanding two port circuit behaviour and inter connection of two-port networks.	
15	REC4 C203	Network Theory Laboratory	CO-1	Apply the knowledge of network theorems to solve complex electrical engineering problems.	
			CO-2	Apply the knowledge of network theorems to solve complex electrical engineering problems.	
			CO-3	Evaluate the circuit parameters of different two-port networks.	
			CO-4	Analyze the frequency response of different filters.	
			CO-5	Evaluate the inductance parameter of coupled circuit.	
			CO-6	Analyze the response circuit using oscilloscope.	
16	ROP3 B001	Object Oriented Programmi ng	CO-1	Distinguish between top-down and bottom-up programming approach and apply bottom-up approach to solve real world problems.	
			CO-2	Use and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using C++ language.	

			CO-3	Apply concepts of operator overloading, constructors and destructor to solve various problems using C++ language.
			CO-4	Interpret the difference between static and dynamic binding. Apply both techniques to solve problems.
			CO-5	Interpret and design the Exception Handling Techniques for resolving run-time errors and handle large data set using file I/O
			CO-6	Design real world projects with object oriented system.
17	REC5 C003	Microproce ssors and Microcontro llers	CO-1	Apply knowledge on organization of microprocessor and its hardware to interface with memory and I/O devices.
			CO-2	Apply the knowledge of instruction set, addressing mode, and assembler directives to write a program and execute it for different applications.
			CO-3	Design embedded systems for real time application by interfacing Intel 8086 Microprocessor with peripherals such as Intel 8255, Intel 8279, ADC, DAC, Printer, CRT terminal etc.
			CO-4	Apply the knowledge about the pin description and architecture of Intel 8051 Microcontroller to interface with Memory and I/O devices.
			CO-5	Design embedded systems for real time applications by programming the Intel 8051 microcontroller with the knowledge about its instruction set, addressing mode, and assembler directives.
			CO-6	Apply the knowledge about advanced microprocessors, such as Intel 80386, and 80486 microprocessors to design an embedded system for practical applications.
18	REC5 D001	Fiber Optics & Optoelectro nics Devices	CO-1	Investigate the construction of an optical fibre and its application in communication systems.
			CO-2	Apply the basic knowledge about optical fibre in studying wave propagation.

			CO-3	Apply the basic knowledge about optical fibre in investigating different optoelectronic sources.
			CO-4	Investigate about optoelectronic detectors and modulators.
			CO-5	Apply the basic knowledge about optical fibres in investigating optical amplifiers.
			CO-6	Investigate different WDM components.
19	REC5 D006	Digital VLSI Design	CO-1	Investigate about the fabrication and operation of a MOSFET.
			CO-2	Apply the basic knowledge about MOSFETs to investigate the static and switching characteristics of a MOS inverter.
			CO-3	Apply the basic knowledge about MOSFETS to design and test different combinational MOS logic circuits.
			CO-4	Apply the basic knowledge about MOSFETs to design and test disfferent sequencial MOS logic circuits.
			CO-5	Investigate a VLSI design for testability.
			CO-6	Investigate different semiconductor memories.
20	REC5 C201	Analog and Digital Communication Lab	CO-1	Simulate and analyze spectrum of different signals.
			CO-2	Design and test a AM/FM modulation and demodulation.
			CO-3	Simulate the process of frequency division multiplexing and frequency division demultiplexing.
			CO-4	Simulate different channel coding and decoding techniques.
			CO-5	Transmit and receive a signal through a satelite link.
			CO-6	Simulate and compare different forms of BPSK, QPSK, and OQPSK anlyze the spectrum with spectrum analyzer.
21		Digital Signal	CO-1	Familiarization with the architecture of a a standard DSP kit.

	REC5 C202	Processing Lab	CO-2	Generate different types of waveforms using MATLAB and DSP kit.
			CO-3	Compute the linear, circular convolution, and correlation of two sequences using MATLAB and verify the result using a DSP kit.
			CO-4	Implement DIT-FFT and DIF-FFT algorithm using MATLAB.
			CO-5	Design and implement a FIR & IIR filter using MATLAB.
			CO-6	Compute convolution of long duration sequences using overlap save and overlap add method in MATLAB.
22	REC5 C203	Microprocessors and Microcontrollers Lab	CO-1	Apply knowledge about instruction set of Intel 8086 to perform 16 bit arithmetic operation, searching and sorting operation, and string manipulation operation.
			CO-2	Implement a digital clock and stop watch using Intel 8086 Microprocessor.
			CO-3	Apply knowledge about instruction set of Intel 8086 to interface and program Intel 8279, Intel 8259, Intel 8253, stepper motor, DC motor, ADC, and DAC.
			CO-4	Apply knowledge about Intel 8255 and Intel 8251 to perform parallel and serial communication between two MP Kits in Mode 1 and Mode 2.
			CO-5	Apply knowledge about instruction set of Intel 8051 microcontroller to perform arithmetic, bit manipulation, and logical operations.
			CO-6	Design multi-parameter data acquisition system, voltmeter, power meter, frequency counter, traffic control system using Intel 8051 microcontroller.
23	REC6 C201	Microwave Engineering	CO-1	Investigate high frequency transmission lines.
			CO-2	Investigate different waveguides and the components used.
			CO-3	Design different types of waveguides and test them.

			CO-4	Investigate the principle of operation as an amplifier at high frequencies.
			CO-5	Design and test different microwave antennas.
			CO-6	Investigate about microwave propagation and its measurement.
24	REC6 C002	Wireless Communica tion	CO-1	Investigate high frequency transmission lines.
			CO-2	Investigate different waveguides and the components used.
			CO-3	Design different types of waveguides and test them.
			CO-4	Investigate the principle of operation as an amplifier at high frequencies.
			CO-5	Design and test different microwave antennas.
			CO-6	Investigate about microwave propagation and its measurement.
25		Micro Electronic Mechanical Systems	CO-1	Investigate about basics of MEMS and Microsystems.
			CO-2	Apply knowledge about basics of MEMS to investigate about different micromachining techniques.
			CO-3	Investigate about mechanics of deformable bodies and energy method.
			CO-4	Design and model a electromechanical system and estimate the stiffness and damping of different micro-structures.
			CO-5	Design different MEMS applications such as mechanical sensors and actuators.
			CO-6	Apply the basics knowledge about MEMS to investigate about optical and radio-frequency MEMS.
26	REC6 C201	Microwave Engineering Lab	CO-1	To simulate the characteristics of reflex klystron, gunn diode, and directional coupler.
			CO-2	Measure the voltage standing wave ratio and radiation pattern of a horn antenna.

			CO-3	Measure the impedance, wavelength, and frequency.
			CO-4	Determine the polarization of horn antenna and measure scattering parameters.
			CO-5	Measure coupling of H-plane, E-plane, and Magic Tee junctions.
			CO-6	Measurement of dielectric constant, phase shift, and scattering parameters of circulators/isolators.
27	REC5 C002	Analog and Digital Communication	CO-1	Investigate the basics of signals, systems, and different modulation schemes.
			CO-2	Apply the basic knowledge about different modulation schemes to investigate the effect of noise in them.
			CO-3	Apply the basic knowledge about modulation to investigate Pulse Code Modulation (PCM) and Delta modulation.
			CO-4	Investigate about the time division multiplexing and digital multiplexers.
			CO-5	Apply the basic knowledge about modulation to investigate different digital modulation techniques.
			CO-6	Investigate about the detection theory.
28	REC5 D001	Digital Signal Processing	CO-1	Apply knowledge of basic signals and systems to analyse different LTI Systems.
			CO-2	Apply knowledge of Z - transformation techniques to analyse the signal in LTI Systems.
			CO-3	Apply the knowledge of Discrete Fourier Transform (DFT), its properties in linear filtering.
			CO-4	Apply the knowledge about DFT for its efficient computation using different FFT algorithms.
			CO-5	Apply the basic knowledge about signals and systems to design and implement different filters.
			CO-6	Design different adaptive filters and implement them using MATLAB.

29	REL5 C005	Renewable Power Generation Systems	CO-1	Explain renewable energy sources & systems.
			CO-2	Apply engineering techniques to build solar, wind, tidal, geothermal, biofuel, fuel cell, Hydrogen, and sterling engine.
			CO-3	Analyze and evaluate the implication of renewable energy.
			CO-4	Concepts in solving numerical problems about solar radiation geometry and wind energy systems.
			CO-5	Demonstrate self -learning capability to design & establish renewable energy systems.
			CO-6	Conduct experiments to assess the performance of solar PV, solar thermal, and biodiesel systems
30	REC7 D001	Digital Image Processing	CO-1	Apply basic knowledge of digital image processing system.
			CO-2	Analyze images in the frequency domain using various transforms.
			CO-3	Apply basic knowledge of different techniques for image enhancement.
			CO-4	Implement and analyze different techniques for image restoration.
			CO-5	Acquired knowledge about color image processing.
			CO-6	Acquired knowledge about various compression techniques.
31	REC7 D006	Radar and TV Engineering	CO-1	To study the functions of various blocks of CW Radar, FM-CW Radar, MTI and Pulse Doppler Radars, Tracking radar and their limitations and applications.
			CO-2	To study the functions of various blocks of Radar receivers and detection of Radar signals in noise in

				detail.
			CO-3	To study the analysis and synthesis of TV Pictures, Composite Video Signal, Receiver Picture Tubes and Television Camera Tubes
			CO-4	To study the principles of Monochrome Television Transmitter and Receiver systems and various Colour Television systems with a greater emphasis on PAL.
			CO-5	Apply Transmission line principles for Digital TV.
			CO-6	Analyse channel coding, errors, interferences and modulation techniques for Digital TV.
32	ROP3 B201	Object Oriented Programming lab.	CO-1	Identify classes, objects, members of a class and the relationships among them for a specific problem.
			CO-2	Understand and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using C++ language.
			CO-3	Build programs for automatic initialization of objects and destroy objects that are no longer required.
			CO-4	Understand and implement programs on dynamic memory management using new, delete operators.
			CO-5	Apply exception handling and use major C++ features such as Templates for data type independent designs.
			CO-6	Implement the file I/O (Sequential and random file) to deal with large data set.
33	REI5 D002	Biomedical Instrumentation	CO-1	Study the introductions of Bioengineering.
			CO-2	Analyze the utilization of basic medical instrumentation..
			CO-3	Study the Bioelectrical signals and electrodes.
			CO-4	Analyze the utilization of electrodes for ECG.
			CO-5	Analyze the physiological Transducer and pressure transducers.

			CO-6	Study the recording systems.