

**TERNA ENGINEERING COLLEGE**

**ELECTRONICS & TELECOMMUNICATION ENGINEERING**

Sr. No.	SUBJECT CODE	Subject	CO NO	CO Statements
<b>SEMESTER III</b>				
1	ECC301	Engineering Mathematics-III	CO1	Understand the concept of Laplace transform and its application to solve the real integrals in engineering problems
			CO2	Understand the concept of inverse Laplace transform of various functions and its applications in engineering problems
			CO3	Expand the periodic function by using Fourier series for real life problems and complex engineering problems.
			CO4	Understand complex variable theory, application of harmonic conjugate to get orthogonal trajectories and analytic function
			CO5	Use matrix algebra to solve the engineering problems
			CO6	Apply the concepts of vector calculus in real life problems.
2	ECC302	Electronic Devices & Circuits	CO1	Know functionality and applications of various electronic devices.
			CO2	Explain working of various electronics devices with the help of V-I characteristics.
			CO3	Derive expressions for performance parameters of BJT and MOSFET circuits.
			CO4	Evaluate performance of Electronic circuits (BJT and MOSFET based).
			CO5	
			CO6	Design electronic circuit (BJT, MOSFET based) circuits for given specifications.
3	ECC303	Digital System Design	CO1	Understand types of digital logic, digital circuits and logic families.
			CO2	Analyze, design and implement combinational logic circuits
			CO3	Analyze, design and implement sequential logic circuits.
			CO4	Develop a digital logic and apply it to solve real life problems
			CO5	Classify different types of memories and PLDs.
			CO6	Simulate and implement basic combinational and sequential circuits using VHDL/Verilog.
4	ECC304	Network Theory	CO1	Apply their knowledge in analyzing Circuits by using network theorems.
			CO2	Apply the time and frequency method of analysis.
			CO3	Evaluate circuit using graph theory
			CO4	Find the various parameters of two port network.
			CO5	Apply network topology for analyzing the circuit
			CO6	Synthesize the network using passive elements
5	ECC305	Electronic Instrumentation & Control Systems	CO1	Identify various sensors, transducers and their brief performance specification.
			CO2	Understand the principle of working of various transducer used to measure temperature, displacement, level, pressure and their application in industry
			CO3	Determine the models of physical systems in forms suitable for use in the analysis and design of control systems.
			CO4	Obtain the transfer functions for a given Control system
			CO5	Understand the analysis of systems in time domain and frequency domain
			CO6	Predict stability of given system using appropriate criteria.
6	ECL301	Electronic Devices & Circuits Lab	CO1	Know various equipments, electronics devices and components, and measuring instruments used to perform laboratory work
			CO2	Students will be able to explain functionality of various equipment's, electronics devices and components and measure instruments used to perform laboratory work.
			CO3	Students will be able connect various equipments, devices, components and measuring devices using bread board as per the circuit diagram for experiment to be performed.
			CO4	Students will able to perform experiment to gather appropriate data.
			CO5	Students will able to analyze data obtained from experiment to relate theory with experiment results
			CO6	Students will able to prepare laboratory report (Journal) to summarise the outcome each experiment.
7	ECL302	Digital System Design Lab	CO1	Identify various Digital ICs and basic building blocks of digital system design
			CO2	Design and implement combinational circuits like adder, subtractor, multiplexer, code converters etc.
			CO3	Identify and understand working of various types of flip flops and their inter conversions.
			CO4	Design and implement basic sequential circuits such as counters, registers etc
			CO5	Acquire basic knowledge of VHDL/Verilog basic programming.
8	ECL303	Electronic Instrumentation & Control Systems Lab.	CO1	Plot and validate the performance characteristics of transducers.
			CO2	Validate the characteristics of various temperature, pressure and level transducers.
			CO3	Plot frequency response of first-order electrical system
			CO4	Plot time response of second-order electrical system and calculate the steady-state error.
			CO5	Validate the effect of damping factor on the response of second order system.
			CO6	Inspect the frequency response specifications of systems by using bode-plot, Polar plot, Nyquist-plot techniques, and comment on the stability of system
9	ECL304	Skill Lab: C++ and Java Programming	CO1	To use and implement fundamental concepts of object oriented programming
			CO2	To illustrate the concept of control structure in object oriented languages
			CO3	To implement the concepts of method, constructors, destructors, arrays, inheritance to understand fundamental features of an object oriented language.
			CO4	To illustrate the concept of classes and objects, methods in Java
			CO5	To study and implement inheritance and polymorphism
			CO6	To develop Applet for any user friendly, social, legal, ethical applications
10	ECM301	Mini Project 1A	CO1	Create the electronics circuit for particular application/experiment.
			CO2	Design and simulate the circuits by putting together the analog and digital components
			CO3	Learn the technique of soldering and circuit implementation on general purpose printed circuit board (GPP).
			CO4	Realize the PCB design process and gain up-to-date knowledge of PCB design software.
			CO5	Utilize the basic electronic tools and equipment's (like DMM, CRO, DSO etc.
			CO6	Analysis of hardware fault (Fault detection and correction)
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<b>SEMESTER IV</b>				
1	ECC401	Engineering Mathematics-IV	CO1	Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
			CO2	Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning and AI.
			CO3	Apply the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.
			CO4	Apply the concept of vector spaces and orthogonalization process in Engineering Problems.
			CO5	Use the concept of Quadratic forms and Singular value decomposition which are very useful tools in various Engineering applications.
			CO6	Find the extremals of the functional using the concept of Calculus of variation.
2	ECC402	Microcontrollers	CO1	Understand Computer and its memory System
			CO2	Understand the detailed architecture of 8051 and ARM7 Core.
			CO3	Write programs for 8051 microcontrollers

			CO4	Design an applications using microcontroller
3	ECC403	Linear Integrated Circuits	CO1	Outline and classify all types of integrated circuits
			CO2	Understand the fundamentals and areas of applications for the integrated circuits
			CO3	Develop the ability to design practical circuits that perform the desired operations
			CO4	Understand the differences between theoretical & practical results in integrated circuits.
			CO5	Identify the appropriate integrated circuit modules for designing engineering application
4	ECC404	Signals and Systems	CO1	Classify and Analyze different types of signals and systems
			CO2	Analyze continuous time LTI signals and systems in transform domain
			CO3	Analyze and realize discrete time LTI signals and systems in transform domain
			CO4	Represent signals using Fourier Series and Analyze the systems using the Fourier Transform.
			CO5	Demonstrate the concepts learnt in Signals and systems Course using the modern engineering tools.
5	ECC405	Principles of Communication Engineering	CO1	Understand the basic components and types of noises in communication system
			CO2	Analyze the concepts of amplitude modulation and demodulation.
			CO3	Analyze the concepts of angle modulation and demodulation.
			CO4	Compare the performance of AM and FM receivers
			CO5	Describe analog and digital pulse modulation techniques
			CO6	Illustrate the principles of multiplexing and demultiplexing techniques.
6	ECL401	Microcontrollers Lab	CO1	Understand different development tools required to develop microcontroller based systems
			CO2	Write assembly language programs for arithmetic and logical operations, code conversion & data transfer operations
			CO3	Write assembly language programs for general purpose I/O, Timers & Interrupts
			CO4	Interface & write programs for Input and Output devices
			CO5	Develop microcontroller based Applications
7	ECL402	Linear Integrated Circuits Lab	CO1	Understand the differences between theoretical, practical and simulated results in integrated circuits.
			CO2	Apply the knowledge to do simple mathematical operations
			CO3	Apply knowledge of op-amp, timer and voltage regulator ICs to design simple applications
8	ECL403	Principles of Communication Engineering Lab	CO1	Analyze analog modulation techniques
			CO2	Analyze the waveforms of Radio receivers
			CO3	Implement analog pulse modulation and demodulation circuits
			CO4	Demonstrate digital pulse modulation and demodulation techniques
			CO5	Verify the concepts of TDM and FDM
9	ECL404	Skill Lab: Python Programming	CO1	Describe syntax and semantics in Python
			CO2	Illustrate different file handling operations
			CO3	Interpret object oriented programming in Python
			CO4	Design GUI Applications in Python
			CO5	Express proficiency in the handling Python libraries for data science
			CO6	Develop machine learning applications using Python
10	ECM401	1 Mini-Project 1B: Arduino & Raspberry Pi based Projects	CO1	Write basic codes for the Arduino board using the IDE for utilizing the onboard resources
			CO2	Apply the knowledge of interfacing different devices to the Arduino board to accomplish a given task
			CO3	Design Arduino based projects for a given problem
			CO4	Write code using python language using IDE for utilizing the onboard resources.
			CO5	Apply the knowledge of interfacing different devices to raspberry Pi board to accomplish a given task
			CO6	Design Raspberry Pi based projects for a given problem.
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			SEMESTER V	
1	ECC501	Digital communication	CO1	Apply the concepts of information theory in source coding.
			CO2	Compare different error control systems and apply various error detection codes.
			CO3	Analyze different error correction codes.
			CO4	Compare various baseband transmission methods for digital signals.
			CO5	Evaluate the performance of optimum baseband detection in the presence of white noise.
			CO6	Compare the performances of different digital modulation techniques
2	ECC502	Discrete-Time Signal Processing	CO1	Recall the system representations and understand the relation between different transforms
			CO2	Understand the concepts of discrete-time Fourier transform, fast Fourier transform and apply in system analysis.
			CO3	Design digital IIR and FIR filters to satisfy the given specifications and evaluate the frequency response and polezero representations to choose a particular filter for the given application.
			CO4	Interpret the different realization structures of Digital IIR and FIR filters.
			CO5	Analyze the impact of hardware limitations on the performance of digital filters.
			CO6	Apply signal processing concepts, algorithms in applications related to the field of biomedical and audio signal processing.
3	ECC503	Digital VLSI	CO1	Know various tools and processes used in VLSI Design.
			CO2	Explain working of various CMOS combinational and sequential circuits used in VLSI Design
			CO3	Derive expressions for performance parameters of basic building blocks like CMOS inverter.
			CO4	Relate performance parameters with design parameters of VLSI circuits.
			CO5	Select suitable circuit and design style for given application.
			CO6	. Design and realize various combinational and sequential circuits for given specifications.
4	ECC504	Random Signal Analysis	CO1	Apply theory of probability in identifying and solving relevant problems.
			CO2	Differentiate continuous and discrete random variables and their distributions.
			CO3	Analyze mean, variance, and distribution function of random variables and functions of random variables
			CO4	Define a random process, determine the type of the process and find the response of LTI system for WSS process
			CO5	Explain linear regression algorithms and apply for predictive applications.
8	ECCDLO 5014	Data Structure & Algorithm	CO1	Compare functions using asymptotic analysis and describe the relative merits of worst-, average-, and best-case analysis
			CO2	Apply various operations on Stack and Queue.
			CO3	Ability to demonstrate the operation of Linked list.
			CO4	Ability to demonstrate and apply Trees & Graph data structures.
			CO5	Become familiar with various Sorting and Searching Algorithms and their performance characteristics.
			CO6	Describe the hash function and concepts of collision and its resolution methods
10	ECL501	Digital Commu	CO1	Compare various source coding schemes
			CO2	Design and implement different error detection codes
			CO3	Design and implement different error correction codes
			CO4	. Compare various line coding techniques
			CO5	Illustrate the impulse response of a matched filter for optimum detection
			CO6	Demonstrate various digital modulation techniques
11	ECL502	Discrete-Time Signal Processing Laboratory	CO1	Perform basic discrete time signal processing operations such as Linear Convolution, Circular Convolution, Auto Correlation, Cross Correlation, etc. and interpret the results
			CO2	Demonstrate their ability towards interpreting and performing frequency analysis of different discrete time sequences and systems.
			CO3	Design and implement the FIR and IIR Filters for given specifications.
			CO4	Implement and analyse applications related to the field of biomedical signal processing and audio signal processing.
12	ECL503	Digital VLSI La	CO1	. Write spice code for given combinational and sequential CMOS circuits
			CO2	Perform various analysis like operating point, dc, transient etc of given CMSO circuits.
			CO3	. transient etc of given CMSO circuits. 3. Evaluate performance of given CMOS circuits.



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SEMESTER VII				
1	ECC701	Microwave Engineering	CO1	Describe the types of waveguides, rectangular waveguides and field equations
			CO2	Understand the coupling mechanisms in waveguides and analyze the waveguide multipoint junctions
			CO3	Explore the microwave linear tubes and analyze with microwave cross field tubes
			CO4	Understand the microwave solid state devices and avalanche transit time devices
			CO5	Demonstrate the microwave bench set up and conducting measurements of different parameter
2	ECC702	Mobile Communication System	CO1	Explain the cellular fundamentals and estimate the coverage and capacity of cellular systems
			CO2	Classify different types of propagation models and analyse the link budget.
			CO3	Compare and contrast GSM, GPRS, HSCSD, EDGE and IS-95 Technologies
			CO4	Apply the concepts of 3G technologies for UMTS and CDMA 2000.
			CO5	Describe the features and working principle of 3GPP LTE.
			CO6	Discuss the emerging technologies for upcoming mobile communication systems.
3	ECCDLO7013	Cloud Computing and Security	CO1	Explain the fundamentals of cloud computing
			CO2	Interpret the significance of virtualization in the context of cloud computing
			CO3	Describe cloud computing services working on AWS, Azure and Google cloud platforms
			CO4	Explain application design aspects of cloud computing
			CO5	. Interpret security aspects to cloud computing
			CO6	Explain advances in cloud computing in terms of multimedia cloud, fog, edge computing and real applications of cloud.
4	ECCDLO7014	Big Data Analytics	CO1	Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
			CO2	Acquire fundamental enabling techniques and scalable algorithms like Hadoop, MapReduce and NoSQL in big data analytics.
			CO3	Interpret business models and scientific computing paradigms, and apply software tools for big data analytic
			CO4	Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc
			CO5	Develop applications for Big Data analysis using Hadoop and NoSQL etc.
5	ECL701	Microwave Engineering Laboratory	CO1	Able to handle microwave equipments
			CO2	Able to understand microwave measurements and test the characteristics of microwave components
			CO3	Able to understand Wave guide and transmission line measurements
			CO4	Demonstrate working of microwave semiconductor devices
			CO5	Demonstrate the microwave bench set up and conducting measurements of different parameters
			CO6	
6	ECL702	Mobile Communication System Laboratory	CO1	Demonstrate the effect of cellular system design parameters on system capacity and quality of service
			CO2	Compare and contrast trunking radio systems
			CO3	Examine the effect of small-scale fading parameters on the performance of radio channel characteristics
			CO4	Analyze link budget for various propagation path-loss models
			CO5	Summarize the attributes of OFDM, MIMO, and Cognitive radio
			CO6	Evaluate the performance of different MIMO systems
7	ECCDLO7023	Internet Communication Engineering	CO1	Compare the protocols at each layer of TCP/IP protocol suite.
			CO2	Explain the internet security aspects of protocols at various layers of TCP/IP protocol suite
			CO3	Apply the various compression algorithms for audio, image & video coding.
			CO4	Categorize and design simple networked multimedia systems.
			CO5	Compare integrated & differentiated services for quality of service
			CO6	Explain a software defined Network.
8	ILO 7013	Management Information System	CO1	Explain how information systems Transform Business
			CO2	Identify the impact information systems have on an organization
			CO3	Describe IT infrastructure and its components and its current trend
			CO4	Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making
			CO5	Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses
9	ECP701	Major Project-1	CO1	Identifying Societal and Research oriented problems
			CO2	Researching Literature connected to the identified problem
			CO3	Finding the latest and innovative solutions
			CO4	Identifying modern tools & techniques for the solution
			CO5	Creating Block Diagram and flow charts of the solution
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SEMESTER VIII				
1	ECC801	Optical Communication and Networks	CO1	Understand optical networks at large by identifying the types of fibers, cables and deployment.
			CO2	Design point to point optical fiber communication links using appropriate optical fibers, light sources, couplers, detectors, and multiplexers
			CO3	Design a short haul or long-haul optical network with repeater by incorporating suitable amplifiers
			CO4	Compare SDH, PDH and WDM techniques and implement
			CO5	Explore concepts of designing and operating principles of modern optical communication systems and networks.
			CO6	Apply the knowledge acquired to design the next generation fiber and FSO networks for indoor and outdoor applications
2	ECCDLO8012	Natural Language Processing	CO1	Have a broad understanding of the field of natural language processing.
			CO2	Understand the mathematical and linguistic preliminaries necessary for various processes in NLP
			CO3	Be able to Design, implement and test algorithms for NLP problems
			CO4	Perform Word-Level, Syntax-Level and Semantic-Level Analysis
			CO5	Develop basic understanding of Pragmatics in NLP
			CO6	Be able to apply NLP techniques to design real world NLP applications
3	ECCDLOC801	Wireless Networks	CO1	Explain fundamental architecture, design issues and standards of wireless networks
			CO2	Compare different types of Personal Area Network (PAN) technologies such as ZigBee, Bluetooth, UWB, NFC and 6LoWPAN.
			CO3	Analyze different LAN topologies and technologies and ad hoc networks
			CO4	Compare various types of network protocols, ad hoc vehicle networks and Wireless MANs
			CO5	Evaluate the planning and design of performance of GSM and CDMA system in Wireless WANs.
			CO6	Understand the basic network architecture of Wireless sensor networks concepts to develop an IoT applications.
4	ECCDLO8022	Satellite and Nano Satellite Communication	CO1	Understand the basic concepts of satellite communication system and orbital parameters.
			CO2	Explain various satellite sub-systems, earth station technologies and launching mechanisms
			CO3	Analyze and evaluate link budget and various performance parameters of satellite signal for proper communication.
			CO4	Understand Nano satellite's structure design, payloads, Thermal control system and space segment
5	ECCDLOC802	Network Management in Telecommunication	CO1	Explain the need for interoperable network management and analyze the trends and development of the Telecommunications Network Management.
			CO2	Demonstrate broad knowledge of fundamental principles and technical standards underlying NMT.
			CO3	Describe the concepts and architecture behind standards-based network management associated with SNMP and CMP.
			CO4	Apply basics of telecommunication, networking and information technologies and architect and implement networked informative systems.
			CO5	Continuously improve their knowledge of technology and communication skills.
6		Project Management	CO1	Apply selection criteria and select an appropriate project from different options.
			CO2	Write work break down structure for a project and develop a schedule based on it.
			CO3	Identify opportunities and threats to the project and decide an approach to deal with them strategically
			CO4	Use Earned value technique and determine & predict status of the project
			CO5	Capture lessons learned during project phases and document them for future reference
7	ILO 8019	Environmental	CO1	Understand the concept of environmental management

		Management	CO2	Understand ecosystem and interdependence, food chain etc.
			CO3	Understand and interpret environment related legislations
8	ECL801	Optical Communication and Networks Laboratory	CO1	Acquire proficiency in identifying the different types of fibers and understanding their properties
			CO2	To measure the losses, dispersion and compensation techniques in all optical network.
			CO3	. Learn to design all optical network with amplifiers and modern lasers for error free transmission.
			CO4	To design or implement point to point optical fiber network, WDM or DWDM Network
			CO5	To design free space optical system with atmospheric impairments and propose mitigation technique for minimum BER.
9	ECP 801	Major Project-II	CO1	Implementing the identified Societal and Research oriented problems
			CO2	Design the solution
			CO3	Developing innovative solutions with modern tools
			CO4	To measure and compare the desired output
			CO5	Creating working prototype of desired solution