

## Department of Electronics and Communications Engineering

### B.E. Program Outcomes (PO's)

1. Engineering Knowledge  
Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems
2. Problem Analysis  
Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/Development of Solutions  
Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4. Conduct Investigations of Complex Problems  
Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern Tool Usage  
Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.
6. The Engineer and Society  
Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and Sustainability  
Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics  
Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and Teamwork  
Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication  
Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project Management and Finance  
Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long Learning  
Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

R20:

**Department Vision**

To emerge as a vibrant model of excellence in education, research and innovation in Electronics and Communication Engineering.

**Department Mission**

**The mission of the Electronics and Communication Engineering Department is to:**

1. To impart strong theoretical and practical knowledge of the state of art technologies to meet growing challenges in the industry.
2. To carry out the advanced and need based research in consultation with the renowned research and industrial organizations.
3. To create entrepreneurship environment including innovation, incubation and encourage to patent the work.

**PROGRAM EDUCATION OBJECTIVES (PEOs):** After the completion of the program, our:

1. Engage successfully in professional career and/or pursue higher education in Electronics and Communication and allied areas.
2. Pursue research, design and development of state-of-the art systems applying the knowledge of Electronics and Communication engineering
3. Begin start-ups and involve in entrepreneurship activities by adopting changing professional and societal needs.
4. Exhibit professional ethics and values with lifelong learning and work effectively as individuals/team members in multidisciplinary projects.

**PROGRAM SPECIFIC OUTCOMES (PSOs):** At the end of the program

1. Ability to apply the acquired knowledge of core subjects in design and development of Communications/Signal processing/ VLSI/ Embedded systems.
2. Analyze and solve the complex Electronics and Communication engineering problems using state-of-art hardware and software tools
3. Develop innovative technologies for Entrepreneurship based on the research outcomes of Electronics and Communication engineering.

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## R18:

**Vision :** To develop the department into a full-fledged center of learning in various fields of Electronics & Communication Engineering, keeping in view the latest developments.

**Mission :** To impart value based technical education and train students and to turn out full pledged engineers in the field of Electronics & Communication Engineering with and overall background suitable for making a successful career either in industry/research or higher education in India/Abroad.

### Program Educational Objectives of B.E(ECE) Programme

1. Student will excel in analysing, design and development of systems in the area of Electronics and Communications.
2. Student will have hand on experience in executing software related applications pertaining to Electronics and Communication Engineering.
3. Student will carry out research in new technologies with modern relevant tools.
4. Student will develop with professional ethics, effective communication skills and knowledge of societal impacts of computing technologies.

### Program Specific Outcomes of B.E(ECE) Programme

**PSO1:** Student will demonstrate the knowledge and understanding of basic principles of mathematics, science, electronic devices, networks and signal processing procedures in simulation, modelling, and describing the behaviour of analog and digital electronic circuit or system.

**PSO2:** Student will be able to select and apply appropriate techniques, resources and Hardware and Software tools for design, analysis and testing the various analog and digital electronic circuits and networks.

**PSO3:** Student will demonstrate self-confidence to work independently or in a team and his/her ability to Analyze, synthesize, design and test analog & digital components, process, system or sub-systems of electronics and communication Engineering used in peace as well as war applications as per the specifications.

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**R16:**

**Vision:** To develop the department into a full-fledged center of learning in various fields of Electronics & Communication Engineering, keeping in view the latest developments.

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# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (Autonomous)

Gandipet, Hyderabad -75

Department Of Electronics and Communication Engineering

**Course Outcomes Statements for BE (ECE)-R20**

SNo	Course		Course Outcomes Statements
	Code	Name	
1.	20MTC07	Applied Mathematics	Find Laplace, Inverse Laplace and solution of engineering problems.
			Find the solution of Difference Equation.
			Understand the methods to find solution of linear and non-linear PDE and solution of wave equation.
			Solve Non-Linear algebraic and transcendental equations and first order differential equations.
			Understand the methods for analyzing the random fluctuations using probability distribution and also identify the importance of Principles of Least Squares approximations for predictions.
2.	20CSC06	Basics of Data Structures	Identify various data structures, searching & sorting techniques and their applications.
			Describe the linear and non-linear data structures, searching and sorting techniques.
			Apply suitable data structures to solve problems.
			Analyze various searching and sorting techniques.
3.	20ECC01	Electromagnetic Theory and Transmission Lines	Evaluate the linear and non-linear data structures.
			Comprehend mathematically the coordinate systems and solve simple static Electromagnetic problems using various laws and theorems.
			Understand Maxwell's equations in different forms (differential and integral) and apply them to diverse engineering problems.
			Demonstrate the Electromagnetic wave properties with respect to different transmission mediums.
			Predict the behavior of reflection and refraction of the waves in different mediums.
4.	20ECC02	Electronic Devices	Estimate the transmission line properties, reflection, and matching concepts.
			Demonstrate understanding of the characteristic behaviour of various electronic devices such as Diodes, Transistors etc.
			Apply the acquired knowledge in the analysis of various diode and Transistor circuits.
			Compare and Contrast the characteristics of BJT and FET in various configurations.
			Evaluate the performance parameters of various diode circuits (rectifiers, clippers and clampers) and Transistor circuits.
5.	20ECC03	Network Theory	Choose an appropriate electronic device for a specific application and discuss IC fabrication process
			Recall basics of electrical circuits with nodal and mesh analysis.
			Illustrate electrical theorems for AC and DC Circuits.
			Develop time domain and frequency domain analysis for circuits.
			Analyze the electrical network and two port network parameters for different applications i.e., magnetic coupled circuits, Filters.
6.	20ECC04	Signals and Systems	Synthesize different network functions using Foster and Cauer form.
			Classify signals, systems and analyse the signals using Transform techniques.
			Evaluate signal characteristics using time and frequency domain analysis.
			Assess the system stability and causality using ROC and Pole-Zero Plot.
			Describe the sampling process and analyse the DT Signal/systems using DTF and Z-Transform.
			Apply the Convolution and correlation concept for analysis of Signal and systems

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SNo	Course		Course Outcomes Statements
	Code	Name	
7.	20CEM01	Environmental Science	Identify the natural resources and realise the importance of water, food, forest, mineral, energy, land resources and effects of over utilisation.
			Understand the concept of ecosystems and realise the importance of interlinking of food chains.
			Contribute for the conservation of biodiversity.
			Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
			Follow the environmental ethics and contribute to the mitigation and management of environmental disasters.
8.	20CSC07	Basics of Data Structures Lab	Implement the abstract data type
			Demonstrate the operations on stacks, queues using arrays and linked lists.
			Apply the suitable data structures including stacks, queues to solve problems.
			Analyse various searching and sorting techniques.
			Choose proper data structures, sorting and searching techniques to solve real world problems.
9.	20ECC05	Electronic Devices Lab	Demonstrate the characteristic behaviour of PN junction diode, Zener diode and special purpose semiconductor diodes.
			Design various non-linear wave shaping circuits using diodes for a given specification.
			Analyse the behaviour of non-linear wave shaping circuits using diodes.
			Examine the characteristics of BJT and FET in various configurations.
			Evaluate and compare the significant parameters obtained from the characteristics of BJT and FET
10.	20ECC06	Electronic Workshop and Networks Lab	Identify and measure the passive and active components using electronic equipment.
			Apply Network theorems to AC and DC Circuits.
			Determine and analyze two port network parameters.
			Design and verification of attenuator and filters.
			Simulation of different networks and circuits using the simulation software
11.	20ECI01	MOOCs/Training /Internship	
12.	20ECC07	Analog Circuits	Recall and relate the knowledge of BJT and FET behavior in the design of various biasing and amplifier circuits.
			Apply low and high frequency models of transistor in the analysis of single stage and multistage amplifiers.
			Design and analyze amplifier and oscillator circuits
			Compare and Contrast different types of biasing, Multistage, Feedback and Power amplifiers.
			Interpret a given analog circuit and evaluate its performance parameters by applying acquired knowledge.

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	Code	Name	
13.	20ECC08	Analog Communication	Understand the various linear and nonlinear modulation schemes.
			Design various transmitters and receivers.
			Assess a random signal by computing various statistical properties.
			Evaluate the performance of analog communication system through the estimation of noise.
			Infer the concepts of various pulse modulation schemes.
14.	20ECC09	Antennas and Wave Propagation	Understand the basic parameters of an antenna.
			Extend current distribution concept in order to estimate the field patterns.
			Appraise the concepts of broad side and end fire arrays..
			Understand the working principle and characteristics of various antennas.
			Study the behavior of radio waves in various modes of wave propagation
15.	20ECC10	Control Systems	Distinguish the closed-loop control systems from open-loop control systems and develop mathematical models in time domain (differential equations, state equations) and S-domain (Transfer function using Laplace transform).
			Evaluation of transfer function from block diagram and signal flow graph by using block diagram reduction techniques and Mason gain formula, respectively.
			Investigate the stability of control system via Routh-Hurwitz criteria, Root-locus method and Nyquist Plot..
			Utilize standard test signals to analyze the time response of first and second-order control systems and frequency response analysis of the control system.
			Design and develop various controllers and compensators to control the steady state error, stability and transient response
16.	20ECC11	Digital Systems Design	Understand the basic concepts related to digital system design.
			Design the combinational and sequential circuits.
			Analyze the behavior of the digital system design
			Develop the digital system using various Verilog HDL modeling.
			Apply the design concepts of digital system using Verilog HDL.
17.	20EGM03	Universal Human Values II: Understanding Harmony	Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
			They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
			They would have better critical ability.
			They would also become sensitive to their commitment towards what they have understood (human values, human relationship, and human society).
			It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction
18.	20EGM01	Indian Constitution and Fundamental Principles	Understand the making of the Indian Constitution and its features.
			Identify the difference among Right To equality, Right To freedom and Right to Liberty.
			Analyze the structuring of the Indian Union and differentiate the powers between Union and States.
			Distinguish between the functioning of Lok Sabha and Rajya Sabha while appreciating the importance of Judiciary.
			Differentiate between the functions underlying Municipalities, Panchayats and Co-operative Societies.

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19.	20EGM02	Indian Traditional Knowledge	Understand philosophy of Indian culture
			Distinguish the Indian languages and literature.
			Learn the philosophy of ancient, medieval, and modern India.
			Acquire the information about the fine arts in India.
			Know the contribution of scientists of different eras.
20.	20ECC12	Analog Circuits Lab	Design various BJT/FET biasing circuits to identify the appropriate circuit for faithful amplification.
			Experiment with single stage and multistage BJT/FET amplifiers including large signal amplifiers.
			Compare and contrast different types of feedback topologies.
			Develop and test various oscillator circuits.
			Evaluate and compare the significant parameters obtained from the Frequency response plots of BJT and FET amplifier circuits.
21.	20ECC13	Analog Communication Lab	Demonstrate the generation and detection of various analog modulated signals.
			Illustrate the sampling concept and interpret the generation and detection of various pulse modulated signals.
			Obtain and Analyze frequency response of Pre-Emphasis and De Emphasis circuits
			Experiment with Mixer, Radio receiver and PLL characteristics, FDM and TDM.
			Estimate the Power spectral density of noise and SNR and analyze the spectra of AM and FM signals.
22.	20ECC14	Digital Systems Design Lab	Design a Digital circuit using Verilog HDL.
			Understand various abstraction levels of a digital design.
			Verify the functionality of a design using Test bench
			Simulate and synthesize combinational logic circuits.
			Simulate and synthesize sequential logic circuits.
23.	20ECC15	Computer Architecture and Microprocessors	Apply fixed and floating-point arithmetic algorithms.
			Understand how the computer works.
			Classify different organizations of CPU and I/O.
			Compare various memories and memory access techniques.
			Understand the architecture and instruction set of a microprocessor.
24.	20ECC16	Digital Communication	Understand the concept of pulse digital modulation schemes and compare their performance.
			Interpret the concept of information theory and apply source coding schemes.
			Demonstrate various error control schemes and develop the encoding and decoding techniques to detect and correct the errors.
			Analyze different digital modulation schemes and can compute the bit error performance.
			Identify and apply spread spectrum modulation techniques.
25.	20ECC17	Digital Signal Processing	Apply the concept of DFT and FFT for signal processing applications.
			Implementation of IIR filters for the given specifications.
			Design FIR filters for the given specifications.
			Interpret the concepts of Multi-rate digital signal processing and its applications.
			Understand the architecture features of TMS320C67XX processor.
26.	20ECC18	Linear and Digital Integrated Circuits	Understand the basic construction, characteristics and parameters of Op-Amp.
			Analyze the linear and nonlinear applications of Op-Amp.
			Explain the concepts of IC555 timer, IC723 regulator, memories and PLD
			.Classify and describe the characteristics of different logic families
			Design logic functions of Combinational and Sequential circuits with ICs.



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27.	20MBC01	Engineering Economics and Accountancy	Apply fundamental knowledge of Managerial Economics concepts and tools.
			Analyze various aspects of Demand Analysis, Supply and Demand Forecasting
			Understand Production and Cost relationships to make best use of resources available
			Apply Accountancy Concepts and Conventions and preparation of Final Accounts.
			Evaluate Capital and Capital Budgeting decision based on any technique
28.	20ECE01	CAD for VLSI Verification	Justify the importance and use of CAD tools.
			Differentiate design flow for different types of ASIC.
			Understand the design flows of CADENCE Virtuoso, CADENCE NCLaunch and XILINX ISE
			Understand the importance of design for testability
			Differentiate various type of simulators.
29.	20ECE02	Optical Communication	Select necessary components required in modern optical communications systems.
			Analyze various distortions in optical fibers.
			Distinguish the various Optical sources and Optical detectors
			Examine the Power Launching and Coupling and fiber optical receiver.
			Determine the performance of Optical Communication link.
30.	20ECE03	Signal Detection Techniques	Apply and analyse discrete random process concepts in communications.
			Understand binary hypothesis techniques
			Analyse the various statistical decision techniques.
			Demonstrate the various binary detection techniques and M-ary detection.
			Evaluate various CFAR detectors.
31.	20ECE04	Embedded C Programming	Analyze the various functions used in embedded C programming
			Understand the evaluation of Arduino family and its development board details.
			Interface the sensors and various i/o devices to embedded development board
			Apply the concepts of IoT to embedded development board
			Demonstrate and design embedded C based applications
32.	20ECE05	Software Defined Radio	Understand and compare the Super-heterodyne receiver, SDR and CR.
			Analyze the basic architecture of SDR
			Determine the processor based on the application
			.Evaluate and choose the various spectrum sensing methods based on application.
			Choose the USRP and WARP boards based on the facilities required for an SDR application.
33.	20ECE06	Principles and Applications of AI	Understand the basics of AI and intelligent agents.
			Apply Expert Systems to solve real time problems
			Understand knowledge representation methods.
			Build algorithms using neural network techniques for various applications
			Solve the various classification problems like object recognition

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34.	20ECC20	Digital Signal Processing Lab	Illustrate linear convolution and correlation using MATLAB.
			Design the digital filters using MATLAB.
			Examine the performance of multirate techniques using MATLAB.
			Experiment with decimator and interpolator on DSP processor.
35.	20ECC21	Linear and Digital Integrated Circuits Lab	Implement the digital filters on DSP processor
			Analyze the configurations, parameters of Op-Amp (IC741).
			Demonstrate the circuits of Op-Amp for various applications.
			Design the circuits using IC555 timer, IC723 and data converters.
36.	20ECI02	Industrial/Rural Internship	Determine the characteristics of TTL and CMOS gates
			Develop various combinational circuits and sequential circuits using digital ICs.
			Understand Engineer's responsibilities and ethics
			Use various materials, processes, products and quality control
37.	20ECC22	Microcontrollers	Provide innovative solutions to solve real world problems
			Acquire knowledge in technical reports writing and presentation
			Apply technical knowledge to real world industrial/rural situations
			Understand the architectures of different microcontrollers to enable to design of applications using them.
38.	20ECC23	VLSI Design	Develop code both in assembly and in high level language for various applications of microcontrollers.
			Analyze and develop applications by using on-chip peripherals of different microcontrollers.
			Interface various I/O Modules with 8051 microcontrollers.
			Apply theoretical learning to practical real time problems for automation.
39.	20ECE13	CPLD and FPGA Architectures	Model a digital design using Advanced Verilog HDL constructs.
			Analyse the characteristic behavior of MOSFET and discuss CMOS circuit Design Process
			Explain various process steps involved in IC fabrication.
			Design various NMOS and CMOS based logic circuits.
40.	20ECE14	Coding Theory and Techniques	Discuss the concepts of subsystem designs and Testing.
			Explain the concepts of PLDs, CPLDs and FPGAs
			.Analyze and compare the various architectures of CPLD and FPGA and its programming technologies.
			Implement various logic functions on PLDs, CPLDs and FPGAs.
40.	20ECE14	Coding Theory and Techniques	Understand the concepts of placement and routing and classifying ASICs.
			Demonstrate VLSI tool flow for CPLDs and FPGAs.
			Recall the theory and principles of information theory and channel Coding.
			Design and analyze the encoding and decoding circuits for various coding techniques.
40.	20ECE14	Coding Theory and Techniques	Apply the principles of abstract algebra, finite fields and its extension to design related codes.
			Examine the error detection and correction capability of coding techniques for digital communication.
			Evaluate the performance of error control codes using different decoding algorithms.

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41.	20ECE15	Multirate and Wavelet Signal Processing	Interpret the basics concepts of multirate digital signal processing.
			Implement the multirate filter bank structures.
			Explore the MRA and classes of wavelets
			.Understand the basic concepts of the continuous and discrete wavelet transform.
			Explain the special topics such as wavelet packets and Biorthogonal wavelets.
42.	20ECE16	Real Time Operating Systems	Understand Real-time operating system requirements and applications.
			Categorize different scheduling approaches for real time scheduler.
			Differentiate various RTOS features and POSIX standards
			Analyze the inter task communication in RTOS.
			Apply the Linux based embedded system design process
43.	20ECE17	Green Communication	Understand the challenges in energy efficiency and spectral efficiency for digital data transmission.
			Conceptualize significant energy efficiency trade off in green wireless networks. Apply the basics of Python programming language, which is used in many IoT devices.
			Apply the methods to manage the dynamic loads of mobile communications for energy saving.
			Indicate the design practices for power minimization at cellular base station.
			Implement cell deployment strategies for efficient network management.
44.	20ECE18	Cryptography and Block Chain Technology	Comprehend the key concepts of fundamental cryptography techniques which are required for Blockchain Technology.
			Describe the key concepts and compare various models of Blockchain Technology.
			Understand consensus mechanism in Blockchain.
			Acquire knowledge regarding cryptocurrency transactions and their validation.
			Apply the concepts of Blockchain technology in real world scenario.
45.	20ECE19	Design for Testability	Understand the concepts of testing for VLSI circuits.
			Apply techniques to improve testability of VLSI circuits.
			Utilize logic simulation methods such as ATPG in testing of VLSI circuits.
			Analyze the concepts of BIST in testing of VLSI circuits.
			Evaluate various Testing methods
46.	20ECE20	Satellite Communication	Demonstrate the fundamental concepts of Orbital Aspects and Orbital Mechanics
			Identify the mechanisms for placing satellites and examine the orbital effects on satellites, launch mechanisms.
			Compare the Multiple access techniques for satellite communications and demonstrate the satellite subsystems.
			Design an appropriate satellite communication link for the given specifications
			Inspect the working principle and related aspects of DBSTV and VSAT.

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47.	20ECE21	Image and Video Processing	To Learn image representation.
			Apply Image enhancement and segmentation techniques both in spatial and frequency domain.
			To reduce the redundancy in both lossy and lossless compression models.
			Apply 2D-Motion estimation algorithms and develop predictive coding.
			Creatively apply contemporary theories, processes and tools in the development and evolution of solutions to problems related to image and video processing.
48.	20ECE22	Embedded Systems	Understand the fundamentals of the embedded systems.
			Analyze the hardware and software details of the embedded systems.
			Design interfacing of the systems with other data handling / processing systems.
			Evaluate the performance of an embedded system using various debugging tools.
			Apply the embedded design approach for various applications.
49.	20ECE23	Smart Antennas	Understand the basic principles of Non Uniform and Planar antenna arrays.
			Comprehend the necessity of smart antenna and smart antenna configuration.
			Understand the DOA estimation methods and compare different algorithms for DOA estimation
			Analyze various beamforming algorithms used in a smart antenna system
			Describe the fundamentals of the MIMO and RDA antenna systems.
50.	20ECE24	Data Analytics for Signal Processing	Explain data science fundamentals
			Explore the principles of probability and statistical theory
			Understand various machine learning algorithms using applied statistics
			Analyze supervised and unsupervised learning models with regression and classification techniques
			Construct various applications of image and speech processing using MATLAB/Python
51.	20ECE25	CMOS Data Converters	Understand Op-Amp based designs
			Explain various performance measures of Data converters
			Design and analyze mixed mode circuits such as Comparator, switched capacitor and sample & hold circuits
			Design and analyze an A/D or D/A converter circuits.
			Explain principles of oversampling
52.	20ECE26 5G	Communications	Recall the requirements and key functionalities of 4G LTEA/5G NR technology.
			Compare various channel access technologies, modulation techniques used in 5G wireless systems
			Illustrate the architecture of 5G and its NextGen core network.
			Apply the 5G concepts to D2D communications.
			Demonstrate the concept of massive MIMO

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53.	20ECE27	DSP Processors and Architectures	Classify the differences between DSP Processor and General-Purpose processor.
			Understand the basic architectural needs of Programmable DSPs
			Explain the architecture features of TMS320C55XX processor.
			Develop on interface with TMS320C55XX processor to external peripherals.
54.	20ECE28	Advanced Microprocessors and Applications	Design and implement of various signal processing algorithms using 55xx processor.
			Understand the historic evaluation of 80286,386,486
			Explain the basic and advance Pentium features & architecture.
			Analyze the Memory Management mechanisms employed in advanced Microprocessors.
55.	20ECE29	Principles of GNSS	Understand the concepts related to SoC Design
			Demonstrate and design a microprocessor based applications
			Demonstrate the fundamental concepts of communications in understanding of GPS architecture, operation and signal structure.
			Apply the principles of orbital mechanics, time references, coordinate systems and range measurements in estimating user position
			Examine the effect of various error sources and satellite geometry on position estimates and analyze the suitability of a given data format.
56.	20ECE30	Pattern Recognition using Machine Learning	Compare the architecture and working of other GNSS systems and make use of GNSS systems in a variety of civilian and defense applications
			Relate the knowledge of DGPS techniques in understanding augmentation systems
			Understand the concepts of pattern recognition.
			Apply the parametric and linear models for classification.
			Design algorithms using neural networks for machine learning problems.
57.	20BTO01	Biology for Engineers	Implementation of Support Vector Machines (SVM) algorithm for real time applications.
			Evaluate various unsupervised clustering techniques.
			Appraise the values of Biology in classical and modern time
			Develop modern instruments related to skeletal, nervous, and circulatory system
			Apply concept of respiratory, excretory and assisted reproductive process for developing related instruments
58.	20CSO08	Basics of Machine Learning	Illustrate the modern interdisciplinary tools related to medical biotechnology and bioremediation
			Summarize the basic knowledge about nucleic acids, proteins and their sequencing
			Define the basic concepts related to Python and Machine Learning.
			Describe the feature engineering methods, regression techniques and classification methods
			Apply Python packages for data visualization, text and time series data analysis using NLP toolkit
			Evaluate and interpret the results of the various machine learning techniques
			Solve real world problems using deep learning framework

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59.	20MEO07	Intellectual Property Rights	Understand the evolution of IP, working of organization's at global level to protect and promote IP.
			Familiarize with the patent filing process at national and international level.
			Draw the logical conclusion of research, innovation and patent filing.
			Compare different kinds of IP and their patenting system.
			Understand the techno-legal-business angle of IP, infringement and enforcement mechanisms for protection.
60.	20ITO01	Object Oriented Programming Using JAVA	To understand fundamentals of object-oriented programming paradigm.
			To apply knowledge of string handling, interfaces, packages and inner classes.
			To implement Exception handling mechanisms and Multithreading.
			To demonstrate knowledge on collection framework, stream classes.
			To develop web applications using Servlets and JSP.
61.	20MTO03	Quantum Computing	Compute basic mathematical operations on Quantum bits.
			Will be able to execute Quantum operations of Quantum computing
			To built quantum programs
			Develop quantum Logical gates and circuits.
			Develop the quantum algorithm
62.	20CSO09	Fundamentals of DBMS	Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS. Design the database logically using ER modeling
			Outline the schema of the relational database and key constraints. Develop queries using DDL, DML and DCL of SQL.
			Identify the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database
			.Summarize the concepts of dense, sparse, ISAM and B+ tree indexing and get familiar with states and properties of transactions.
			Interpret the locking, time stamp, graph and validation-based protocols for concurrency control. 6. Summarize log-based recovery techniques to increase the robustness of the database, identify to resolve the deadlocks in the transactions.
63.	20ECC24	Electronic Design and Automation Lab	Demonstrate the process steps required for simulation /synthesis
			Develop HDL codes/scripts with appropriate syntax
			Apply an appropriate modelling style to describe various combinational and sequential circuits in Verilog HDL
			Examine the successful execution of the codes/ schematic using various Simulation Tools
64.	20ECC25	Microcontrollers Lab	Build various digital circuits on hardware boards like FPGA.
			Develop the programs of 8051 and ARM using their respective instruction set.
			Understand the usage of various debugging tools available to program different microcontrollers
			Build code for 8051 and ARM7 to interface various input/output modules
			Analyze the hardware and software interaction and integration.
			Design and develop the 8051 and ARM 7 based embedded systems for various applications

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SNo	Course		Course Outcomes Statements
	Code	Name	
65.	20ECC26	Mini Project	Formulate mini project proposal through literature survey.
			Plan, design and analyze the proposed mini project
			To simulate and execute the mini project for validation.
			Enhance oral presentation skills.
			Prepare and submit the mini project report.
66.	20EGC03	Employability Skills	Become effective communicators, participate in group discussions with confidence and be able to make presentations in a professional context
			.Write resumes, prepare and face interviews confidently.
			Be assertive and set short term and long term goals, learn to manage time effectively and deal with stress.
			Make the transition smoothly from campus to work, use media with etiquette and understand the academic ethics
			.Enrich their vocabulary, frame accurate sentences and comprehend passages confidently.
67.	20ECC27	Computer Networks	Relate the communication tasks with basic concept of networking, protocols and Service models at different layers and Interpret the Design issues of Data link layer using protocols and services.
			Apply random accessing Protocols for Medium Access Control.
			Examine the performance of network and Internetworking with routing algorithms and the congestion control approaches
			Understand the transport layer and Application Layer concepts.
			Demonstrate the Application layer Protocols
68.	20ECC28	Microwave and Radar Engineering	Apply the wave equations and their solutions to analyze the waves in the waveguides
			.Determine the scattering matrix for various microwave components.
			Analyze the interaction of electron beam and RF field for various microwave sources.
			Examine the principles of operation of pulse, CW and MTI radar system.
			Compare different types of tracking radars.
69.	20ECE31	VLSI Technology	Describe the various processing steps (including base materials, layers, clean room) involved in the IC fabrication
			Illustrate the crystal growth, wafer processing and cleaning methods
			Analyze the oxidation and lithography processes with its parameters
			Explain the doping and etching methods used in IC fabrication
			Outline the deposition, packaging and testing concepts applied for VLSI circuits
70.	20ECE32	Mobile Adhoc and Sensor Networks	Understand the concepts of Ad Hoc Networks and Wireless Sensor Networks.
			Analyse different routing algorithm for Ad Hoc Networks and Wireless Sensor Networks.
			Acquire the knowledge of various protocols of Mobile Ad Hoc and Sensor Networks
			Discuss various security practices in Ad Hoc and sensor networks.
			Comprehend various sensor network platforms, tools and applications.

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SNo	Course		Course Outcomes Statements
	Code	Name	
71.	20ECE33	Speech Processing	Understand the basic characteristics of speech signal in relation to production and hearing of speech by humans.
			Analyze speech and extract features for speech applications.
			Distinguish between different speech coding techniques.
			Use dynamic warping and HMM for real time problems.
72.	20ECE34	IoT and its Applications	Design the various applications like recognition, synthesis, and coding of speech
			Understand the terminology, enabling technologies, and various protocols of IoT.
			Illustrate the concepts of Machine to Machine, SDN, and NFV and build simple IoT systems using Raspberry Pi board, NodeMCU, and BeagleBone Black.
			Apply the basics of Python programming language, which is used in many IoT devices.
73.	20ECE35	Remote Sensing	Create the steps involved in IoT system design methodology.
			Develop web applications using a python-based framework called Django and IoT technologies for domain-specific applications.
			Understand the fundamental concepts of remote sensing.
			Apply Microwave remote sensing techniques and understand the process of photogrammetry
74.	20ECE36	Network Security	Interpret images visually.
			Apply Digital image processing techniques.
			Familiarize the basic concepts of Computer Security and Security Attacks, Services, Mechanisms, Design principles.
			Understand the Symmetric Encryption and Message Confidentiality principles and operation.
75.	20CEO02	Disaster Risk Reduction and Management	Demonstrate the Public-Key Cryptography and Message Authentication algorithms
			Examine the Key Distribution using symmetric and asymmetric encryption and User Authentication using PublicKey Infrastructure.
			Apply Network Security and System Security approaches for different applications.
			Identify and understand the concepts of hazards, causes and impacts of disasters.
76.	20MEO04	Principles of Entrepreneurship	Develop a critical capacity to evaluate the principles and practices of disaster risk reduction and management
			Develop a deep awareness of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe;
			Apply knowledge about existing global frameworks and existing agreements and role of community in successful Disaster Risk Reduction
			Evaluate DM study including data search, analysis and presentation as a case study
76.	20MEO04	Principles of Entrepreneurship	Understand the concept and essence of entrepreneurship
			.Identify business opportunities and nature of enterprise.
			Analyze the feasibility of new business plan.
			Apply project management techniques like PERT and CPM for effective planning and execution of projects
76.	20MEO04	Principles of Entrepreneurship	Use behavioral, leadership and time management aspects in entrepreneurial journey

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SNo	Course		Course Outcomes Statements
	Code	Name	
77.	20CSO01	Fundamentals of Virtual Reality	Define Virtual Reality and describe the components of a VR system, input and output devices of virtual reality systems.
			Apply geometric modeling to model real world scenarios.
			Develop interfaces by using visual physiology, visual perception and audio.
			Evaluate virtual reality systems for usability.
			Explore the applications of VR systems in defense and telerobotics.
78.	20ADO01	Introduction to Python Programming	Explore data operations on list, tuple and dictionary in python.
			Understand deployment of models on different datasets.
			Apply supervised, unsupervised, resembling and NLP models on different datasets.
			Perform data analysis using python packages.
			Build and evaluate the models using python programming
79.	20EGO01	Technical Writing Skills	Communicate effectively, without barriers and understand aspects of technical communication.
			Differentiate between general writing and technical writing and write error free sentences using technology specific words
			Apply techniques of writing in business correspondence and in writing articles.
			Draft technical reports and technical proposals.
			Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills
80.	20CSO02	Introduction to Web Technology	Understand the technologies required for developing web application.
			Identify and choose XHTML tags, CSS and java scripts to develop well-structured and easily maintained web pages.
			Design and Develop interactive and innovative web pages using various platforms/technologies like XHTML, CSS, XML, JAVASCRIPT.
			Create and deploy web applications in web server by using server-side programming concepts like PHP
			Build a data driven web site using Databases. 6. Evaluate different web applications to implement optimal solutions for real time problems
81.	20EGM04	Gender Sensitization	Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
			Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity"
			Appreciate women's contributions to society historically, culturally and politically.
			Analyze the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
			Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.
82.	20ECC29	Computer Networks Lab	Apply fundamental principles of computer networking
			Examine the performance of design issues of Link layer
			Construct a network and measure its performance with different routing algorithms.
			Create a wired and wireless Network.
			Analyze performance of various Network protocols.

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SNo	Course		Course Outcomes Statements
	Code	Name	
83.	20ECC30	IoT and Simulation Lab	Analyse various software and hardware components required for IoT technology.
			Interface analog and digital sensing & actuating equipment using Raspberry Pi
			.Learn how to build basic applications in the LabVIEW graphical programming environment.
			Develop an ability for programming in LabVIEW using various program structures, plotting the graphs and charts for system monitoring, processing, and controlling.
			Apply knowledge of IoT and Virtual Instruments to solve engineering problems.
84.	20ECC31	Microwave Engineering Lab	Examine the characteristics of RKO and Gunn Oscillator.
			Compare the relation between guide wavelength, free space wavelength and cut off wavelength.
			Measure VSWR for various loads at microwave frequencies.
			Estimate the microwave power ratios at various ports of microwave components.
			Evaluate unknown impedance of various microwave loads.
85.	20ECC32	Project: Part-1	List the various approaches to the selected problem.
			Interpret the advantages and disadvantages of various approaches.
			Apply the selected approach for simulating / modeling / designing the problem
			Analyse and write a report on the results of the simulation/modeling of the problem selected.
			Justify and present the results of the simulation/modeling / design before the departmental committee.
86.	20ECI03	Industrial Internship	Understand Engineer's responsibilities and ethics
			Use various materials, processes, products and quality control
			Provide innovative solutions to solve real world problems
			Acquire knowledge in technical reports writing and presentation
			Apply technical knowledge to real world industrial situations
87.	20CSO10	Basics of Cyber Security	Analyze and evaluate the cyber security needs of an organization.
			Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
			Measure the performance and troubleshoot cyber security systems.
			Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.
			Applying operational and cyber security strategies and policies.
88.	20CSO14	Fundamentals of Computer Vision	Recognize the basic fundamentals of vision and describe the scope of challenges.
			Develop algorithms to analyze feature detection and feature alignment.
			Analyze images and videos for problems such as tracking and structure from motion.
			Choose object, scene recognition and categorization algorithms for real time images.
			Apply various techniques to build computer vision applications

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SNo	Course		Course Outcomes Statements
	Code	Name	
89.	20ADO02	Data Analysis and Visualisation	Efficiently store and manipulate dense data in arrays with Numpy
			Apply high level mathematical functions to aggregate, broadcast, index and sort multidimensional arrays.
			Create Series and DataFrame objects to operate on datasets
			Perform Data cleaning, transformation, merging, aggregation on datasets.
			Apply 2-D and 3-D plotting techniques on datasets
90.	20MEO01	Robotics	Describe the basic components, specifications and applications of the Robots.
			Understand transformations, direct and inverse kinematics of robots.
			Calculate forces in links and joints of a robot and find the singularities, Jacobian and trajectory planning of a robot for various tasks
			Classify drives, sensors and grippers for various applications.
			Program a robot to predict motions for a given task with machine vision and sensors.
91.	20MEO15	Principles of Industry 4.0	Understand the Basics and applications of Digital Manufacturing and Industry 4.0.
			Understand the role of Additive Manufacturing, Virtual prototyping and Reverse Engineering processes and their adaptability to Digital Manufacturing.
			Understand the concepts of digital manufacturing based product life cycle and its management.
			Understand the concept of Industry 4.0 and allied technologies
			Understand the basics of Internet of things and cloud computing pertaining the fourth industrial revolution
92.	20ADO03	Fundamentals of Data Science	Explain the need of Data Science to analyze the skill sets of data scientists.
			Describe the Data Science Process and its components interact.
			Apply basic machine learning algorithms for predictive modeling.
			Simplify a real-world problem into mathematical terms.
			Create effective visualization of given data
93.	20ECC33	Technical Seminar	Collect, Organize, Analyze and Consolidate information about emerging technologies from the literature.
			Exhibit effective communication skills, stage courage, and confidence.
			Demonstrate intrapersonal skills.
			Explain new innovations/inventions in the relevant field.
			Prepare and experience in writing the Seminar Report in a prescribed format.
94.	20ECC37	Project: Part-2	Recall the details of the approach for the selected problem.
			Interpret the approach to the problem relating to the assigned topic.
			Determine the action plan to conduct investigation.
			Analyze and present the model / simulation /design as needed.
			Evaluate, present and report the results of the analysis and justify the same

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**CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (Autonomous)**  
**Gandipet, Hyderabad -75**  
**Department Of Electronics and Communication Engineering**  
**Course Outcomes Statements for BE (ECE)-R18**

S.no.	Course		Course Outcomes Statements
	Code	Name	
1	18MT C07	Applied Mathematics	Solve Linear and Non-Linear PDE and wave equations.
			Use Laplace transforms to solve initial value problems and Z transforms to difference equations.
			Calculate the approximate roots of transcendental equations.
			Analyse the analytical and empirical solution of first order ordinary differential equations.
			Identify the random phenomena by various probability distributions
2	18CS C05	Basics of Data Structures	Upon completion of this course, the student will be able to Understand the basic concepts of data structures
			Upon completion of this course, the student will be able to Understand the notations used to analyze the performance of algorithms.
			Upon completion of this course, the student will be able to Choose and apply an appropriate data structure for a specified application
			Upon completion of this course, the student will be able to Understand the concepts of recursion and its applications in problem solving.
			Upon completion of this course, the student will be able to Develop the suitable data structure for real world problem.
3	8EC C01	Electromagnetic Theory and Transmission Lines	comprehend mathematically the coordinate system and solve simple static electromagnetic problems using various laws and theorems
			Understand Maxwell Equations in different forms (differential and integral) and apply them to diverse engineering problems
			Demonstrate the Electromagnetic wave properties with respect to different transmission mediums
			Predict the behaviour of reflection and refraction of the waves in different mediums
			Estimate the transmission line properties, reflection and matching concepts

4	8EC C02	18EC C02_Electronic Devices	Demonstrate understanding of the characteristic behaviour of various electronic devices such as Diodes, Transistors etc.
			Apply the acquired knowledge in the analysis of various diode and Transistor circuits.
			Compare and Contrast the characteristics of BJT and FET in various configurations
			Evaluate the performance parameters of various diode circuits (rectifiers, clippers and clampers) and Transistor circuits.
			Choose an appropriate electronic device for a specific application and discuss IC fabrication process
5	18EC C03	Network Theory	Apply basic concepts of electric circuits and also simplify using network theorems. They will also be able to find Solution to networks using topological description.
			Analyze RL,RC,RLC circuits using Transient and Steady State Responses for dc and ac input signals.
			Represent vector, phasor diagrams and also find power calculations for ac circuits. They will be able to classify dot convention rules, self and mutual inductance for simple magnetic coupled circuits.
			Discuss complex frequency analysis to series and parallel resonant circuits. Students will be able to compare Z,Y,H, two port network parameters and their interconnections.
			Classify and define symmetrical and asymmetrical network characteristics.
6	18EC C04	Signals and Systems	Design and calculate parameters of passive filters.
			classify signals, systems and analyze them using Transform techniques.
			Evaluate signal characteristics using time and frequency domain analysis.
			Assess the systems stability and causality
			describe the Sampling process and analyze the DT Signals/Systems using DTFT and Z Transform.
7	18CE M01	Environmental Science	Apply the Convolution and correlation concepts for analysis of signals and systems
			Identify the natural resources and realize the importance of water, food, forest, mineral, energy, land resources and effects of over utilization.

			Understand the concept of ecosystems and realize the importance of interlinking of food chains.
			Contribute for the conservation of bio-diversity.
			Suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
			Follow the environmental ethics and contribute to the mitigation and management of environmental disasters.
8	18CS C06	Basics of Data Structures Lab	Upon completion of this course, the student will be able to Implement the abstract data type.
			Upon completion of this course, the student will be able to Implement linear data structures such as stacks, queues using array and linked list.
			Upon completion of this course, the student will be able to Understand and implement non-linear data structures such as trees, graphs and its traversal techniques.
			Upon completion of this course, the student will be able to Implement various kinds of searching, sorting techniques.
			Upon completion of this course, the student will be able to Develop the suitable data structure for real world problem.
9	18EC C05	Electronic Devices Lab	Demonstrate the characteristic behaviour of PN junction diode, Zener diode and special purpose semiconductor diodes
			Design various non-linear wave shaping circuits using diodes for a given specification
			Analyze the behaviour of non-linear wave shaping circuits using diodes.
			Examine the characteristics of BJT and FET in various configurations
			Evaluate and compare the significant parameters obtained from the characteristics of BJT and FET.
10	18EC C06	Electronic Workshop and Networks Lab	Identify and measure the passive and active components using electronic equipment.
			Apply Network theorems to AC and DC Circuits.
			Determine and analyze two port network parameters.
			Design and verification of attenuators and filters.
			Simulation of different networks and circuits using the simulation software.
11	18EG C03	Soft Skills	Demonstrate effective time and stress management techniques while being assertive and setting short term and long-term goals.
			Identify problems and construct an argument in given case studies and write abstracts.

			Analyze and assess their skills, strengths, weaknesses and face interviews confidently and be able to draft resumes.
			Adapt to corporate culture by personal and professional sensitivity and also be able to draft an effective SOP.
			Design a mini-live project by collecting and analyzing data and making oral and written presentations.
12	18EC C07	Analog Circuits	Recall and relate the knowledge of BJT and FET behaviour in the design of various biasing and amplifier circuits.
			Apply low and high frequency models of BJT/FET in the analysis of single stage and multistage amplifiers.
			Design and analyse amplifier and oscillator circuits.
			Compare and Contrast different types of biasing, Multistage, Feedback, Power amplifiers and Multi-vibrators circuits.
			Interpret a given analog circuit and evaluate its performance parameters by applying acquired knowledge.
13	18EC C08	Analog Communication	Understand the need for modulation and various linear modulation schemes.
			Infer the concepts of various nonlinear modulation schemes.
			Design various transmitters and receivers.
			Assess a random signal by computing various statistical properties.
			Evaluate the performance of analog communication system through the estimation of noise.
14	18EC C09	Antennas and Wave Propagation	Understand the basic parameters of an antenna
			Analyze the antenna using current distribution concept in order to estimate the field patterns
			Appraise and compare the concepts of broadside and end fire array
			Understand the working principle and characteristics of various antennas
			Classify and study of radio wave propagation
15	18EC C10	Control Systems	Find the transfer function of a system represented by a block diagram and signal flow graph.
			Evaluate the time domain specifications and steady state error of a system.
			Investigate stability of the system using different tests.
			Compare various controllers and compensators.
			Apply State Space Concept to analyse and

			design a control system.
16	18EC C11	Digital Systems Design	Understand the basic concepts related to digital system design.
			Design the combinational and sequential circuits.
			Analyze the behavior of the digital system design.
			Develop the digital system using various Verilog HDL modeling.
			Apply the design concepts of digital system using Verilog HDL.
17	18EG M01	Indian Constitution	Understand the making of the Indian Constitution and its features.
			Identify the difference among Right To equality, Right To freedom and Right to Liberty.
			Analyze the structuring of the Indian Union and differentiate the powers between Union and States.
			Distinguish between the functioning of Lok Sabha and Rajya Sabha while appreciating the importance of Judiciary.
			Differentiate between the functions underlying Municipalities, Panchayats and Co-operative Societies.
18	18EE M01	Indian Traditional Knowledge	Understand the culture, civilization, and heritage of Ancient, Medieval and Modern India.
			Distinguish various Languages and Literature existing in India
			Discuss and Compare Philosophy and Religion in Indian since ancient times
			Explore various Fine arts in Indian History, and Illustrate the development of Science and Technology in India.
			Describe the Indian Education System, and recognize the efforts of scientist to the development of India
19	18EC C12	Analog Circuits Lab	Design various BJT/FET biasing circuits to identify the appropriate circuit for faithful amplification.
			Experiment with single stage and multistage BJT/FET amplifiers including large signal amplifier
			Compare and contrast different types of feedback topologies.
			Develop and test various multi-vibrator and oscillator circuits for generating non sinusoidal and sinusoidal waveforms.
			Evaluate and compare the significant parameters obtained from the Frequency response plots of BJT and FET amplifier circuits.
20	18EC C13	Analog Communication Lab	Demonstrate the generation and detection of various analog modulated signals.
			Understand the sampling concept and further they can generate and detect various pulse



			modulated signals.
			Obtain and analyze frequency response of Pre-Emphasis and DeEmphasis circuits
			Understand Mixer, Radio receiver and PLL characteristics and also compare FDM and TDM.
			Estimate the Power spectral density of noise and Signal to Noise ratio and further able to analyze spectrums of AM and FM signals.
21	18EC C14	Digital Systems Design Lab	Design a Digital circuit using Verilog HDL.
			Understand various abstraction levels of a digital design.
			Verify the functionality of a design using Test bench.
			Simulate and synthesize combinational logic circuits.
			Simulate and synthesize sequential logic circuits.
22	18EC C15	Computer Architecture and Microprocessors	Understand how computer works
			Apply fixed and floating point arithmetic algorithms
			Compare various memories, memory access techniques
			Assess the performance of computers.
			Analyze architecture and instruction set of microprocessors.
23	18EC C16	Digital Communication	Understand the concept of pulse digital modulation schemes and compare their performance.
			Interpret the concept of information theory and apply source coding schemes
			Demonstrate various error control schemes and develop the encoding and decoding techniques to detect and correct the errors.
			Analyze different digital modulation schemes and can compute the bit error performance.
			Identify and apply spread spectrum modulation techniques.
24	18EC C17	Linear and Digital Integrated Circuits	Understand the basic construction, characteristics and parameters of Op-Amp
			Analyze the linear and nonlinear applications of Op-Amp
			Explain the concepts of IC555 timer, IC723 regulator, memories and PLD
			Classify and describe the characteristics of different logic families
			Design logic functions of Combinational and Sequential circuits with ICs
25	18ME C09	Principles of Management	Identify and evaluate the principles of management
			Demonstrate the ability to have an effective and realistic planning
			Identify the nature and type of organization

			Apply the tools and techniques of directing
			Explain and evaluate the necessity for controlling and further refinement of an organization.
26	18EC C18	Digital Communication Lab	Demonstrate various pulse digital modulation techniques.
			Examine different line coding techniques.
			Detect and correct errors in cyclic codes.
			Assess the errors in convolutional encoder and decoder.
			Demonstrate digital carrier modulation techniques experimentally.
27	18EC C19	Linear and Digital Integrated Circuits Lab	Analyze the configurations, parameters of Op-Amp (IC741)
			Demonstrate the circuits of Op-Amp for various applications
			Design the circuits using IC555 timer, IC723 and data converters
			Determine the characteristics of TTL and CMOS gates
			Develop various combinational circuits and sequential circuits using digital ICs.
28	18EC E01	Electronic Measurements and Instrumentation	Define the characteristics and analyze the errors of measurement systems.
			Select the appropriate passive or active transducers for measurement of physical phenomenon.
			Relate and apply the appropriate measuring techniques to real time applications.
			Interpret the usage of DVM, Spectrum Analyzer and DSO instruments for appropriate measurements.
			Develop an understanding of construction and working of different AC and DC bridges and their applications.
29	18EC E02	Industrial Electronics	Understand Industrial Semiconductor devices DIAC, TRIAC, THYRISTOR using SCR, and MOS respectively.
			Comprehend DC amplifiers, Operational amplifier and Instrumentation amplifier.
			Design and analysis of DC to DC converters and DC to AC converters and different type of Choppers.
			Develop skills to build and trouble shoot power electronic circuits.
			Synthesis of PWM Inverters, UPS and Switched mode regulators
30	18EC E03	Optical Communication	Select necessary components required in modern optical communications systems.
			Analyze various distortions in optical fibers.
			Distinguish the various Optical sources and fiber optical receivers.
			Examine the Power Launching and coupling,

			Lensing schemes.
			Determine the performance of optical communication link.
31	18EC E04	Telecommunication Switching Systems	students will be able to Understand the fundamental concepts of various signaling and switching involved in telecommunication switching systems.
			students will be able to. Elaborate the basic principle of time and space division switching in telecommunication networks.
			students will be able to Design the multistage switch by inclusion of space and time switching technique.
			students will be able to Analyze the performance comparison of Control signaling schemes in circuit switching systems.
			students will be able to Evaluate the performance of packet switching and cell relay.
32	18BT O01	Basics of Biology	Explain the theories of origin and evolution of life.
			Describe the anatomical structure and physiological functions of the human organ systems.
			Outline the principle and applications of medical devises.
			Discuss the technology advancements in improving human health and environment
33	18ME O07	Intellectual Property Rights	Explain the biological information, sequencing and evolutionary relationship among organisms.
			Understand the evolution of IP, working of organization's at global level to protect and promote IP.
			Familiarize with the patent filing process at national and international level.
			Draw the logical conclusion of research, innovation and patent filing.
			Compare different kinds of IP and their patenting system.
34	18IT O01	Object Oriented Programming Using Java	Understand the techno-legal-business angle of IP, infringement and enforcement mechanisms for protection.
			Understand the concepts of Object-Oriented Programming and class concept in Java.
			Apply concepts of OOP such as Inheritance, Interfaces, Packages and Inner classes.
			Handle exceptions and demonstrate the concepts of Multithreading and Generic classes.
			Develop programs using Java Collection API and Stream classes.
			Design and Develop GUI applications with JDBC.

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35	18CS O05	Principles of Virtual Reality	Define Virtual Reality and describe the components of a VR system
			Apply geometric modeling and transformation techniques to model real world scenarios
			Use visual physiology, visual perception and audio for developing interfaces
			Analyse tracking and rendering for building VR systems
			Evaluate virtual reality systems for usability 6. Illustrate the applications of VR systems in Medical, Military and Robotics domains
36	18MT O04	Quantum Computing	Identify the working of a Quantum Computing Program, its architecture and program model.
			Compute basic mathematical operations.
			Demonstrate quantum logic gate circuits.
			Develop quantum algorithm.
37	18EC C20	Digital Signal Processing	Appraise quantum algorithm on major toolkits
			Understand the concept of DFT and FFT for signal processing applications.
			Design FIR filters for the given specifications.
			Implementation of IIR filters for the given specifications.
			Interpret the concepts of Multirate digital signal processing and its applications.
38	18EC C21	Microcontrollers	Explain the architecture features of TMS320C67XX processor.
			Acquire an overview of how a processor and a controller are distinguished.
			Understand the architectures of different microcontrollers to enable to design applications using them.
			Develop code both in assembly and in high level language for various applications of microcontrollers.
			Analyze and design real world applications by using on/off chip peripherals of different microcontrollers.
			Apply theoretical learning to practical real time problems for automation.
39	18EC C22	Microwave and Radar Engineering	Apply the wave equations and their solutions to analyze the waves in the waveguides
			Determine the scattering matrix for various microwave components.
			Analyze the interaction of electron beam and RF field for various microwave sources.
			Examine the principles of operation of pulse, CW and MTI Radar systems
			Compare different types of tracking radars.
40	18EC E05	Analog and Mixed Signal Design	Recall the elementary concepts of MOS device, MOS amplifiers and Op-Amp
			Classify and Relate the performance of different types of MOS Amplifiers, Current Mirrors, Op-

			Amps and data converters
			Model the behavior of MOS device for different scenarios.
			Distinguish different types of Op- Amp configurations and their applications.
			Design and develop data converter for the given specifications
41	18EC E06	Mobile Cellular Communication	Choose an appropriate concept, Propagation model and multiple access technique to improve the capacity
			Demonstrate various technologies and their specifications for mobile communication.
			Distinguish the system architecture of Mobile Communication Systems.
			Estimate path loss of fading channel and performance measures of antenna and receiver.
			Compare the technology trends changing from generation to generation
42	18EC E07	Principles and Applications of AI	Understand the basics of AI and intelligent agents
			Apply Expert Systems to solve real time problems
			Understand knowledge representation methods
			Build algorithms using Clustering techniques for various applications
			Solve the various classification problems like object recognition
43	18EC E08	Principles of Optimization Techniques	Understand importance of optimization of industrial process management.
			Illustrate the basic concepts of linear programming and application to real life problems.
			Demonstrate the principles of nonlinear programming to one dimensional problem.
			Apply basic concepts of mathematics to formulate an optimization problem.
			Examine the working of Genetic Algorithm for nonlinear function.
44	18EC E09	System Automation and Control Engineering	Understand the need of automation in industrial environments
			Classify different types of industrial Sensors with their applications.
			Explain how advanced instructions can be used in industrial automation to implement and maintain the PLC systems
			Elaborate the significance of process controllers in industrial automation
			Identify various applications of robots in industrial automation
45	18EC E10	Coding Theory and Techniques	Recall the theory and principles of information theory and channel Coding.
			Design and analyze the encoding and decoding

			circuits for various coding techniques.
			Apply the principles of abstract algebra, finite fields and its extension to design related codes.
			Examine the error detection and correction capability of coding techniques for digital communication.
			Evaluate the performance of error control codes using different decoding algorithms
46	18EC E11	CPLD and FPGA Architectures	Recall fundamental concepts of digital logic and PLDS
			Compare performance of various types of PLDs.
			Understand the architecture and design aspects of various CPLs and FPGAs
			Implement various logic functions using PLDs and FPGAs
			Demonstrate the VLSI tool flow for CPLD and FPGA
47	18EC E12	Data Analytics for Signal Processing	Explain data science fundamentals.
			Explore the principles of probability and statistical theory
			Understand various machine learning algorithms using applied statistics
			Analyze supervised and unsupervised learning models with regression and classification techniques.
			Construct various applications of image and speech processing using MATLAB/Python.
48	18EC E13	Satellite Communication	Extend the fundamental concepts of analog and digital communications in understanding a basic communication satellite system and satellite orbits.
			Apply the principles of orbital mechanics to locate the satellite and examine the orbital effects on satellites.
			Compare the Multiple access techniques for satellite communications and demonstrate the understanding of launch mechanisms and satellite subsystems.
			Design an appropriate satellite communication link for the given specifications
			Appraise the working principle and related aspects of DBSTV and VSAT.
49	18EC E14	Spread Spectrum Communication	Understand the fundamental concepts of Spread Spectrum Communication Systems.
			Interpret the requirement of diversity in fading channels.
			Integrate various synchronization techniques in Spread Spectrum Communication.
			Analyze various multiple access schemes.
			Devise various code generators required for estimating tracking loops.
50	18MB C01	Engineering Economics and Accountancy	Apply fundamental knowledge of Managerial Economics concepts and tools.

			Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
			Understand Production and Cost relationships to make best use of resources available.
			Apply Accountancy Concepts and Conventions and preparation of Final Accounts.
			Evaluate Capital and Capital Budgeting decision based on any technique.
51	18EC C23	Digital Signal Processing Lab	Illustrate linear convolution and correlation using MATLAB.
			Design the digital filters using MATLAB.
			Examine the performance of multirate techniques using MATLAB.
			Experiment with decimator and interpolator on DSP processor.
			Implement the digital filters on DSP processor.
52	18EC C24	Microcontrollers Lab	Develop the programs of 8051 and ARM using their respective instruction set.
			Understand the architectures of different microcontrollers to enable to design applications using them.
			Build code for 8051 and ARM7 to interface various input/output modules
			Analyze the hardware and software interaction and integration.
			Design and develop the 8051 and ARM 7 based embedded systems for various applications.
53	18EC C25	Microwave Engineering Lab	Examine the characteristics of RKO and Gunn Oscillator
			Compare the relation between guide wave length, free space wavelength and cutoff wavelength
			Measure VSWR for various loads at microwave frequencies
			Estimate the microwave power ratios at various ports of microwave components
			Evaluate unknown impedance of various microwave loads
54	18EC C26	Computer Networks	Relate the communication tasks with basic concept of networking, protocols and Service models at different layers.
			Interpret the principle and function of each layer using protocols and
			Model a network for random accessing to route the packets
			Examine the performance of network with routing algorithms and the congestion control approaches.
			Explain the importance of protocols in each layer and layering concepts.
55	18EC C27	VLSI Design	Model a digital design using Advanced Verilog HDL constructs

			Analyse the characteristic behaviour of MOSFET and discuss CMOS circuit Design Process
			Explain various process steps involved in IC fabrication.
			Design various NMOS and CMOS based logic circuits.
			Discuss the concepts of subsystem designs and Testing.
56	18EC E15	Cryptography and Blockchain Technology	Comprehend the key concepts of fundamental cryptography techniques which are required for Blockchain Technology.
			Describe the key concepts and compare various models of Blockchain Technology.
			Understand consensus mechanism in Blockchain.
			Acquire knowledge regarding cryptocurrency transactions and their validation.
			Apply the concepts of Blockchain technology in real world scenario.
57	18EC E16	DSP Processors and Architectures	Classify the differences between DSP Processor and General-Purpose processor.
			Understand the basic architectural needs of Programmable DSPs
			Explain the architecture features of TMS320C55XX processor.
			Develop on interface with TMS320C55XX processor to external peripherals.
			Design and implement of various signal processing algorithms using 55xx processor.
58	18EC E17	Principles of Computational Electromagnetics	Understand the basic concepts of computational Electromagnetics
			Interpret the variational methods.
			Apply the process of moment methods using appropriate weighing functions
			Devise Quasi Static, Scattering and Radiation problems using Method of Moments.
			Solve the Laplace's equation, Poisson's equation and wave equations using finite element methods.
59	18EC E18	Semiconductor Memory Design and Testing	Comprehensive Understanding of Static Random-Access Memory (SRAM) and Dynamic Access Memory (DRAM).
			Design of Non-Volatile Memory Architectures and their future comparison.
			Applying the memory Fault modelling and memory for testability.
			Analyze the Memory Fault Modelling, Testing of memory design.
			Enhance the advanced memory technologies and packaging technologies.
60	18EC E19	Speech Processing	Understand the basic characteristics of speech signal in relation to production and hearing of speech by humans. (HEAD)



			Analyze speech and extract features for speech applications.
			Design the various applications like recognition, synthesis, and coding of speech.
			Use HMM for speech recognition.
			Implement dynamic warping technique in real time problems.
61	18EC E20	CMOS RF IC Design	Define the characteristics RF systems, Tuned circuits, LNA, Mixers.
			Understand the behaviour of RF systems, Reflection Coefficient and Noise in RF Systems.
			Apply the concepts of noise and reflection coefficient to characterize RF Systems.
			Analyse different Wideband Amplifiers, LNA, Mixers and Power Amplifiers.
			Design and Development of LNA, Power amplifier, PLL.
62	18EC E21	Digital Image Processing	Describe basic concepts of image processing system
			Summarize and compare various digital image transform techniques
			Demonstrate and survey digital image enhancement in practical applications.
			Analyse the case study related to various techniques of image restoration
			Apply compression techniques on digital image.
63	18EC E22	Embedded Systems	Understand the fundamentals of the embedded systems
			Analyze the hardware and software details of the embedded systems
			Design interfacing of the systems with other data handling / processing systems.
			Evaluate the performance of an embedded system using various debugging tools.
			Apply embedded design approach for various applications.
64	18EC E23	Software Defined Radio	Understand and compare the Super-heterodyne receiver, SDR and CR.
			Analyze the basic architecture of SDR
			Determine the processor based on the application.
			Evaluate and choose the various spectrum sensing methods based on application.
			Choose the USRP and WARP boards based on the facilities required for a SDR application.
65	18EC E24	5G Communications	Recall the requirements and used cases of 5G technology
			Illustrate the architecture of 5G
			Apply the 5G concepts to D2D communications
			Compare various Radio-Access Technologies
			Explain the concept of massive MIMO
66	18CE O02	Disaster Mitigation and	Identify and understand the fundamental

		Management	<p>terminologies in disaster management.</p> <p>Distinguish between the Hydro-meteorological disasters and apply the concepts of structural and non- structural mitigation measures.</p> <p>Categorize different Geographical Disasters and apply the knowledge in utilizing the early warning systems.</p> <p>Analyze various mechanisms and consequences of human induced disasters.</p> <p>Develop an awareness of disaster management phases and formulating effective disaster management plans, ability to understand various participatory roles of stakeholders- Central and State Government bodies at different levels.</p>
67	18ME 004	Entrepreneurship	<p>Understand the concept and essence of entrepreneurship.</p> <p>Identify business opportunities and nature of enterprise.</p> <p>Analyze the feasibility of new business plan.</p> <p>Apply project management techniques like PERT and CPM for effective planning and execution of projects.</p> <p>Use behavioural, leadership and time management aspects in entrepreneurial journey</p>
68	18CS 006	Fundamentals of DBMS	<p>Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS. Design the database logically using ER modeling</p> <p>Outline the schema of the relational database and key constraints. Develop queries using DDL, DML and DCL of SQL.</p> <p>Identify the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.</p> <p>Summarize the concepts of dense, sparse, ISAM and B+ tree indexing and get familiar with states and properties of transactions.</p> <p>Interpret the locking, time stamp, graph and validation-based protocols for concurrency control.</p> <p>Summarize log-based recovery techniques to increase the robustness of the database, identify to resolve the deadlocks in the transactions</p>
69	18IT 002	Python Programming	<p>Understand the fundamental concepts and control structures of python programming.</p> <p>Write user defined iterative &amp; recursive functions, identify appropriate predefined functions and perform file handling Operations.</p>

			Use suitable data structures such as sequences, dictionaries and sets in python programming.
			Apply concepts of OOP, exception handling and build regular expressions using Python.
			Design and develop GUI based applications and visualize the data.
70	18EG O01	Technical Writing Skills	Understand the channels of communication and define nature and aspects of Technical communication
			Compare and contrast technical communication to that of general communication while constructing error free sentences applying features of technical writing.
			Analyze data, draw inferences to write Journal articles and conference papers and to compose business letters.
			Evaluate data to draft technical reports and technical proposals.
			Design a technical presentation by understanding the nuances of presentation skills and also transfer data from verbal to graphic and vice versa
71	18EC C28	Computer Networks Lab	Apply fundamental principles of computer networking.
			Examine the performance of design issues of Link layer.
			Construct a network and measure its performance with different routing algorithms.
			Create a wired and wireless Network using NS-2.
			Analyze performance of various Network protocols using NS-2
72	18EC C29	Electronic Design and Automation Lab	Demonstrate the process steps
			Develop HDL codes/scripts with appropriate syntax
			Apply an appropriate modelling style to describe various combinational and sequential circuits in Verilog HDL
			Examine the successful execution of the codes/ schematic using various Simulation Tools
			Build various digital circuits on hardware boards like FPGA.
73	18EC C30	Electronics Measurement and Simulation Lab	Understanding of the operational features of various analog and digital test and measurement equipment.
			Analysis of various standard bridges and ability to measure temperature
			Learn how to develop basic applications in the LabVIEW graphical programming environment.
			Develop ability for programming in LabVIEW using various data structures, program structures, plotting the graphs and charts for system monitoring, processing and controlling.

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			Apply knowledge of mathematics and engineering to formulate and study or solve engineering problems, including problems at the interface of engineering.
74	18EC C31	Project: Part – 1	List the various approaches to the selected problem.
			Interpret the advantages and disadvantages of various approaches.
			Apply the selected approach for simulating / modelling / designing the problem.
			Analyse and write a report on the results of the simulation / modelling of the problem selected.
			Justify and present the results of the simulation / model / design before the departmental committee.
75	18EC C32	INDUSTRIAL VISIT	Know the importance of visiting an engineering industry from the point of view of process of manufactory procedures and setup.
			Summarize the required information with regard to materials, source of supply in respect to the product.
			Know the stages in manufactory of a product.
			Prepare the 'industry visit' technical report covering the details of visit and its importance.
			Visualize the safety precautions to be followed in industry, confidentiality of the product processing as the man power required.
76	18EC E25	IoT and its Applications	Understand the terminology, enabling technologies and applications of IoT
			Apply the concept of M2M and understand the basics of modern networking with the concepts of SDN and NFV.
			Understand the basics of Python Scripting Language which is used in many IoT devices.
			Describe the steps involved in IoT system design methodology.
			Design simple IoT systems using Raspberry Pi board with sensors, actuators and develop web applications using python-based framework called Django.
77	18CS 007	Basics of Cyber Security	List the different types of cybercrimes and analyze legal frameworks to handle cybercrimes.
			Identify the Tools and Methods used in cybercrimes.
			Analyze and resolve cyber security issues and laws governing Cyberspace.
			Describe the need of Digital Forensics and the importance of digital evidence in prosecution.
			Interpret the commercial activities in the event of significant information security incidents in the Organization.
			Discuss the vulnerabilities in networking protocols and their mitigation techniques.

78	18EC E26	Principles of GNSS	Demonstrate the fundamental concepts of communications in understanding of GPS architecture, operation and signal structure.
			Apply the principles of orbital mechanics, time references, coordinate systems and range measurements in estimating user position.
			Examine the effect of various error sources and satellite geometry on position estimates and analyze the suitability of a given data format.
			Compare the architecture and working of other GNSS systems and make use of GNSS systems in a variety of civilian and defense applications.
			Relate the knowledge of DGPS techniques in understanding augmentation systems.
79	18EG O02	Gender Sensitization	Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
			Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
			Appreciate women's contributions to society historically, culturally and politically.
			Analyze the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
			Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.
80	18EC E27	Principles of Wireless Sensor Networks	Recall the features, characteristics, Technology, Data transmission, protocols and design issues of wireless Sensor networks.
			Illustrate the function of Network architecture, Routing, Protocol structure, and node problems
			Apply the appropriate protocols and routing algorithms to solve issues in Network.
			Analyze data processing, aggregation and routing, Protocol overheads, Throughput, Security challenges in a WSN.
			Compare the performance of WSN in terms of topologies, technology, protocols, design principles, and security
81	18PY O01	History of Science and Technology	Demonstrate the process of beginning of science and civilization, knowledge acquisition and philosophical approach of science and its advancements in the Stone Ages and Antiquity period.
			Illustrate the advancements in science and technology in the medieval period across Asia and Arab countries and decline and revival of science in Europe.
			Explain the scientific approach and its advances of the Europeans and how the role of engineer

			during the industrial revolution and the major advancements.
			Make use of the advancements in the field of science and technology by adopting new philosophies of 19th and first half of 20th century in finding ethical solutions to the societal problems.
			Interpret the changes in specializations of science and the technology and build the relation between information and society from second half of 20th century onwards.
82	18EC E28	Real Time Operating Systems	Understand Real-time operating system requirements and applications.
			Categorize different scheduling approaches for real time scheduler.
			Differentiate various RTOS features and POSIX standards
			Analyze the inter task communication in RTOS.
			Apply the Linux based embedded system design process.
83	18CS O10	Machine Learning using Python	Define the basic concepts related to Python and Machine Learning
			Describe the feature engineering methods, regression techniques and classification methods
			Apply Python packages for data visualization, text and time series data analysis using NLP toolkit
			Evaluate and interpret the results of the various machine learning techniques
			Solve real world problems using deep learning framework
84	18ME O01	Robotics	Describe the basic components, specifications and applications of the Robots.
			Understand transformations, direct and inverse kinematics of robots.
			Calculate forces in links and joints of a robot and find the singularities, Jacobian and trajectory planning of a robot for various tasks.
			Classify drives, sensors and grippers for various applications.
			Program a robot to predict motions for a given task with machine vision and sensors.

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R16:

**CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (Autonomous)**  
**Gandipet, Hyderabad -75**  
**Department Of Electronics and Communication Engineering**  
**Course Outcomes Statements for BE (ECE)-R16**

Sl No	Course		Course Outcomes Statements
	Code	Name	
1	16MTC05	Engineering Mathematics-III	Expand functions in the given intervals.
			Solve linear and non linear PDEs.
			Solve one-dimension, two-dimension, Heat steady state equations and also one-dimension wave equation.
			Solve problems on Analytic functions, Cauchy's theorem and Cauchy's integral formula.
			Expand functions by using Taylor's and Laurent's series.
			Solve Real and Complex integrals by using Cauchy Theorems.
2	16EC C02	Network Theory	Apply basic concepts of electric circuits and also simplify using network theorems. They will also be able to find Solution to networks using topological description.
			Analyze RL, RC, RLC circuits using Transient and Steady State Responses for dc and ac input signals.
			Represent vector, phasor diagrams and also find power calculations for ac circuits. They will be able to classify dot convention rules, self and mutual inductance for simple magnetic coupled circuits.
			Discuss complex frequency analysis to series and parallel resonant circuits. Students will be able to compare Z,Y,H, two port network parameters and their interconnections.
			Classify and define symmetrical and asymmetrical network characteristics.
			Design and calculate parameters of passive filters.
3	16EC C03	Electronic Devices and Circuits	The concepts of semiconductor devices like PN junction diode, Transistor, and special diodes.
			The applications of diodes.
			The various configurations, characteristics and biasing techniques of transistors – BJT, JFET & MOSFET.
			The applications of transistor as a switch and an amplifier.
			The analysis of BJT & FET in various configurations using small signal equivalent models.
			The frequency response of various amplifiers.
4	16EC C04	Signals and Systems	classify signals, systems and analyse the signals using Fourier series.
			Understand signal spectrums and characterize the systems.
			Represent the signals by generalized exponentials using Laplace
			Demonstrate conversion of continuous time signal to discrete time signal
			Compare the signals using correlation

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			Relate input and output response of the system using Convolution
5	16EC C05	Electromagnetic Theory and Transmission Lines	Comprehend mathematically the coordinate systems and solve simple static electromagnetic problems using various laws and theorems.
			Understand Maxwell's equations in different forms (differential and integral) and apply them to diverse engineering problems.
			Demonstrate the electromagnetic wave properties with respect to different transmission mediums
			Compare the plane wave transmission and reflection at different boundaries
			Predict the behaviour of reflection and refraction of the waves in different mediums
			Estimate the transmission line properties, reflection and matching concepts
6	16EC C06	Electronic Workshop and Network Lab	Measure R,L,C components using electronic equipment.
			Use CRO and power devices.
			Conduct experiments on DC and AC circuits and also verify the network theorems.
			Design passive filters.
			Measure two port parameters.
			Simulate a circuit using the simulation software
7	16EC C07	Electronic Devices Lab	Recall the elementary concepts of diode, BJT, FET
			Classify and relate the performance of different types of rectifiers. Compare and contrast the biasing techniques, different configurations, characteristics of BJT & FET.
			Model different amplifier circuits
			Examine different non-linear wave shaping circuits and draw an inference for their outputs. Distinguish different types of rectifying circuits and amplifier circuits and their performance parameters.
			Choose the best configuration for the specifications provided.
			Design, develop and improve the performance of the amplifier circuits
8	16EG C03	Soft Skills and Employability Enhancement Lab	Be effective communicators and participate in group discussions and case studies with confidence. Also be able to make presentations in a professional context.
			Write Resumes, prepare and face interviews confidently.
			Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
			Make the transition smoothly from Campus to Corporate. Also use media with etiquette and know what academic ethics are.
			To do a live, mini project by collecting and analysing data and making oral and written presentation of the same.
9	16EC C08	Digital Logic Design	The Various switching algebra theorems and minimization of switching functions.
			The Structure of different digital logic elements like gates, multiplexers, encoders, decoders, adders and subtractors to build simple applications.
			Different types of flip-flops and sequential circuits.
			The Design of FSM.



			The Design and simulation of various combinational and sequential logic circuits using Verilog HDL.
			The Simulation and synthesis of digital logic design using Verilog HDL.
10	16EC C09	Analog Electronic Circuits	Define the high frequency model of BJT and FET
			Compare and contrast different types of multistage, feedback, power and tuned amplifiers
			Apply the concepts of BJT in multivibrators, feedback, multistage amplifiers and tuned amplifiers
			Categorize different types of feedback amplifiers, power amplifiers and voltage regulators.
			Choose the best configuration for the specifications (like conversion efficiency in case power amplifiers, input and output impedance, resonating frequency and bandwidth)
			Build narrow band amplifiers and improve the performance of the transistors voltage regulators
11	16EC C10	Analog Communication	Understand the need for modulation, representation of various AM modulation schemes and further they will be able to generate and demodulate various types of AM signals
			Represent, analyze and distinguish FM and PM signals and also they will be able to generate and demodulate FM signals.
			Understand the functioning of transmitters. They will be able to evaluate the radio receiver characteristics. To understand the necessity of Pre-emphasis and De-emphasis in FM broadcasting.
			Understand and analyze the concept of Random Variable and Random Process. Further they will be able to evaluate the Response of Linear Systems for random signals.
			Know the various sources of noise. They will be able to represent and analyze noise. Further they can evaluate and compare its effect on analog modulation schemes.
			Demonstrate the Sampling theorem and analyze various sampling processes. Further they will be able to understand the various pulse modulation schemes.
12	16EC C11	Antenna and Wave Propagation	Understand the basic parameters of antenna
			Extend current distribution concept in order to estimate the field patterns.
			Apprise the concepts of broad side and end fire arrays
			Identify the significance of antenna array with respect to working principle and radiation pattern
			Understand the working principle and characteristics of various antennas
			Study the behaviour of radio waves in various modes of wave propagation.
13	16EC C12	Electronic Instrumentation	Understand the various standards available for the measurement process.
			Evaluate and perform accurate measurements for any engineering system with clear idea of the potential errors.
			Understand the working principles of various transducers.
			Select an appropriate transducer for given application.
			Use instruments like spectrum analyzer, DSO and other virtual instrumentation techniques for appropriate measurements.

			Understand the fundamentals of various Biomedical instrumentation systems.
14	16MB C01	Engg. Economics and Accountancy	apply fundamental knowledge of Managerial economics concepts and tools
			understand various aspects of demand analysis and forecasting.
			understand price determination for different markets.
			study production theory and analyze various costs & benefits involved in it so as to make best use of resources available.
			analyze different opportunities and come out with best feasible capital investment decisions.
			apply accountancy concepts and conventions, Final accounts and financial analysis.
15	16EC C13	Digital Logic Design Lab using Verilog	Design a Digital circuit using Verilog HDL.
			Understand various abstraction levels of a digital design.
			Verify the functionality of a design using Test bench.
			Simulate and synthesize combinational logic circuits
			Simulate and synthesize sequential logic circuits.
16	16EC C14	Analog Electronic Circuits Lab	Define the bandwidth of multistage amplifiers using BJT and FET
			Compare and contrast different types of multistage configurations, feedback, power, tuned amplifiers
			Apply the concepts of analysis of BJT and compare the results in the lab for multi-vibrators, feedback, multistage amplifiers and tuned amplifiers
			Categorize different types of feedback amplifiers, power amplifiers and voltage regulators
			Choose the best configuration for the specifications (like conversion efficiency in case power amplifiers, input and output impedance, resonating frequency and band-width)
			Build narrow band amplifiers and improve the performance of the transistors voltage regulators
17	16EC C15	Analog Communication Lab	Demonstrate the generation and detection of various analog modulated signals.
			Understand the sampling concept and further they can generate and detect various pulse modulated signals.
			Obtain and analyze frequency response of Pre-Emphasis and De-Emphasis circuits.
			Evaluate Mixer, Radio receiver and PLL characteristics.
			Understand the concept of multiplexing and also can compare FDM and TDM techniques.
			Estimate the Power spectral density of noise and Signal to Noise ratio and further able to analyze spectrums of AM and FM signals.
18	16EC C18	Digital Communications	Understand the concept of pulse digital modulation schemes and compare their performance.
			Interpret the concept of information theory and apply source coding schemes
			Demonstrate various error control schemes.
			Develop the encoding and decoding techniques to detect and correct the errors.
			Evaluate the performance of digital modulation schemes with probability of error.

			Identify and apply spread spectrum modulation techniques
19	16EC C19	Integrated Circuits and Applications	Understand the basic construction, characteristics and parameters of OpAmp.
			Analyze the linear and nonlinear applications of Op-Amp.
			Understand the concepts of IC555 timer, IC723 regulator and PLL
			Classify and describe the characteristics of different logic families
			Design the Combinational and Sequential circuits with ICs.
			Understand the concepts of memories, design of PLD's
20	16EC C20	Microprocessors and Microcontrollers	Understand the architecture of 8086 microprocessor and 8051 microcontroller.
			Write an assembly language program for different applications by using instruction set of 8086 microprocessor.
			Understand different programmable peripheral devices for a given application.
			Distinguish between Microprocessor and Microcontroller based systems.
			Identify and explain the operations of peripherals, typically used with interfacing microprocessors / microcontrollers.
			Develop the microcontroller based programs for various applications.
21	16EC C21	Control Systems	Find the transfer function of a system represented by a block diagram and signal flow graph.
			Evaluate the time domain specifications and steady state error of a system.
			Analyze the stability of a system.
			Analyze the system in frequency domain.
			Compare various controllers and compensators.
			Apply State Space Concept to analyze and design a control system. models, block diagrams and signal flow graphs.
22	16EC E01	Computer Organization and Architecture	Discuss the basic structure and organization of computer system.
			Apply fixed and floating point arithmetic algorithms.
			Explain Instruction cycle, register transfer and micro operations.
			Discuss about RISC/CISC architectures, pipeline and vector processing.
			Explain Input/output organization.
			Discuss about Memory organization and Management.
23	16EC C22	Digital Communications Lab	Experiment with various pulse digital modulation techniques.
			Examine different line coding techniques.
			To detect and correct errors in cyclic codes.
			Assess the errors in convolutional encoder and decoder
			Demonstrate digital carrier modulation techniques experimentally.
			Know the importance of MODEM characteristics.
24	16EC C23	Integrated Circuits and Applications Lab	Analyze the configurations, parameters of Op-Amp (IC741).
			Demonstrate the circuits of Op-Amp for various applications.
			Analyze and design the circuits using IC555 timer, IC723 and data converters.
			Analyze the characteristics of TTL and CMOS gates
			Analyze and design various combinational circuits using digital ICs.

			Analyze and design various sequential circuits using digital ICs.
25	16EC C24	Microprocessors and Microcontrollers Lab	Write the 8086 assembly language programs on arithmetic, logical operations and DOS function calls.
			Know about different assemblers available for programming 8086 Microprocessor.
			Understand the advantage of various debugging tools available to program 8086 microprocessor.
			Write and test embedded C programming on interfacing modules.
			Learn the hardware and software interaction and integration.
			Design and develop the 8051 based embedded systems for various applications.
26	16EC C25	Embedded System Design	Know the fundamentals of the embedded system design.
			Understand the ARM architecture and its instruction set.
			Analyze various features of ARM7 microcontroller
			Able to interface various I/O devices to ARM 7 microcontroller
			Understand the Embedded system design cycle
			Develop and Debug various embedded system applications
27	16EC C26	Digital Signal Processing	Understand the concept of DTFT and DFT for signal processing applications
			Implement linear filtering using FFT.
			Design and implement FIR and IIR filters for the given specifications.
			Interpret the concepts of Multirate digital signal processing and its applications
			Demonstrate the design of digital filters using DSP Processor.
			Examine the functionality of decimator and Interpolator on DSP Processor
28	16EC C27	Microwave Engineering	Apply wave equations and their solutions to analyze the waves between the parallel planes and waveguides
			determine the scattering matrix for various microwave components
			Analyze the interaction of electron beam, RF Field for various microwave sources
			Know the characteristics of IMPATT and TRAPATT diodes
			Understand the microwave power measurement techniques
			Gain the knowledge on microwave applications
29	16EC C28	Wireless Mobile Communication	To make the student understand the wireless communication systems and features of 4G mobile standards and their comparison with 1G, 2G, 2.5G and 3G technologies
			To give the student an understanding of Cellular system for Mobile.
			To enable the student to understand the Mobile radio propagation models
			To provide the student with an understanding of small scale fading and diversity reception.
			To make the student to learn the salient features of various multiple access systems
			To make the student to learn concepts of GSM, IS-95 CDMA and OFDM
30	16EC E03	Analog and Mixed IC Design	Recall the elementary concepts of MOS device, MOS amplifiers and Op- Amp

			Classify and relate the performance of different types of MOS Amplifiers, Current Mirrors, Op-Amps and data converters
			To Model MOS device under different cases
			Examine different MOS amplifier configurations, Op-Amp, Data converters, will be able to distinguish different types of Op- Amp configurations and their performance parameters.
			Choose the best configuration for the specifications Slew rate, conversion speed.
			Design, develop and improve the performance of the data converters and Op-Amp.
31	16EC E04	Coding Theory and Techniques	understand the theory and principles of information theory and channel coding
			Design and analysis of encoding and decoding circuits for block codes
			Apply the principles of abstract algebra, finite fields and its extension to design related codes
			Develop and execute encoding and decoding algorithms associated with Rs codes
			Demonstrate the ability to select and design simple convolutional codes
			Analyze modern capacity approaching codes like Turbo codes
32	16IT E27	Data Structures	Understand basic data structures arrays and linked lists
			Analyse time complexity of algorithms
			Understand the basic operations of Stacks and Queues
			Implement basic operations on data structures
			Understand applications of binary trees and graphs
			Understand various kinds of searching and sorting techniques
33	16IT E25	Java Programming	Achieve proficiency in object-oriented concepts and also learns to incorporate the same into the Java programming language.
			Create Java application programs using sound OOP practices e.g. Inheritance, interfaces and proper program structuring by using packages, access control specifiers.
			Understand and Implement the concepts of Exception Handling and Multithreading in java.
			Develop the ability to solve real-world problems through software development in high-level programming language using Large APIs of Java as well as the Java standard class library.
			Understand File, Streams, Input and Output Handling in java.
			Create graphical user interfaces in java as well as apply the knowledge of Event Handling.
34	16IT E26	Python Programming	Understand basic data structures of python.
			Perform operations on strings.
			Understand the concepts of file I/O.
			Understand exception handling in Python.
			Plot data using appropriate Python visualization libraries.
			Develop basic Python applications.
35	16EC E05	CPLD and FPGA Architectures	Understand the concept of programmable logic devices and differences
			between these devices.
			Analyze various CPLD architectures and their programming technologies

			Analyze various FPGA architectures and their programming technologies
			Implement various logic functions on PLDs, CPLDs and FPGAs
			Understand the concepts of placement and routing and classifying ASICs.
			Demonstrate VLSI tool flow for CPLDs and FPGAs.
36	16EC C29	Embedded System Design Lab	Develop the ARM7 C programs using arithmetic, logical and branch operations
			Understand the usage of various debugging tools available to program ARM7
			Program ARM7 to interface various input/output modules
			Know about the data transfer using serial communication protocols.
			Analyze the hardware and software interaction and integration.
			Design and develop the ARM 7 based embedded systems for various applications
37	16EC C30	Digital Processing Lab	Design and analyze the digital filters using MATLAB.
			Implement FFT algorithms for linear filtering and correlation using MATLAB
			Experiment with multirate techniques using MATLAB
			Perform spectral analysis of noisy signal using welch's method
			Design and Implement the digital filters on DSP processor
			Obtain response of a LTI system to a ramp/step input on DSP processor
38	16EC C31	Microwave Lab	Know the characteristics of RKO and GUNN Oscillator
			Understand the relation between the guide wavelength, free space wavelength and cutoff wave length
			Measure VSWR for various loads at microwave frequencies
			Estimate the power ratios at various ports of microwave components
			Calculate the unknown impedance of various microwave loads
			Understand measurement of radiation patterns.
39	16EC C32	Data Communication and Computer Networks	Relate different tasks of computer communications networks and protocol architectures.
			Classify the switching concepts and illustrate the services of each layer.
			Analyze the services and functions of the different layers and categorize different internetworking devices and their functions.
			Compare the principle operation of major internet routing protocols.
			Identify the importance of basic network security and Internet applications.
40	16EC C33	Principles of GNSS	Understand the principle of operation of GPS and GPS ephemerides
			Analyze GPS signal structure and significance of various coordinate systems
			Estimate the various errors and their effect on position estimation.
			Compare other global and regional navigational systems
			Apply DGPS principle and also analyze various augmentation systems. Use of GPS in Surveying, Mapping and Navigation.

41	16EC C34	Radar and Satellite Communication	Identify various building blocks of pulse radar, analyze its operation and predict the range performance
			Measure the speed and direction of moving targets in spite of blind speeds
			compare various tracking radar mechanisms
			Understand basic satellite construction, sub systems, launching mechanisms and its operation
			Analyse LOS Propagation and calculate the pathloss in a satellite link. Calculation of G/T and C/N Ratios of a path link and understand
42	16EC C35	VLSI Design	Simulate and synthesize digital logic designs.
			Understand characteristic behavior of MOSFET and layout design rules.
			Analyze the process steps in IC fabrication
			Design CMOS based logic circuits.
			Understand the design concepts of memories and VLSI testing.
43	16EC E09	Real Time Operating Systems	Understand Real-time operating system requirements and applications
			Categorize different scheduling approaches for real time scheduler
			Compare different real time systems
			Analyse the inter task communication in RTOS
			Apply the Linux based embedded system design process.
44	16EC E10	Speech Processing	Understand the basic characteristics of speech signal in relation to production and hearing of speech by humans.
			Analyze speech and extract features for speech applications.
			Design the various applications like recognition, synthesis, and coding of speech.
			Use HMM for speech recognition.
			Implement dynamic warping technique in real time problems.
45	16EC E12	Application of IoT in ECE	Understand the terminology, enabling technologies and applications of IoT
			Apply the concept of M2M and understand the basics of modern networking with the concepts of SDN and NFV.
			Understand the basics of Python Scripting Language which is used in many IoT devices.
			Describe the steps involved in IoT system design methodology.
			Design simple IoT systems using Raspberry Pi board with sensors, actuators and develop web applications using python-based framework called Django.
46	16EC E13	Digital Image Processing	Understand how images are formed, sampled and quantized.
			Apply various transforms like Fourier, DCT, Haar, DWT and Hadamard
			Transform to different applications.
			Apply image enhancement techniques for practical applications
			Implement the image restoration techniques
			Implement image compression techniques by removing the redundancy.
47	16EC C36	Advanced Simulation Lab	Understand basic applications in the LabVIEW graphical programming environment

			Develop ability for programming in LabVIEW using various data structures, program structures, plotting the graphs and charts for system monitoring, processing and controlling
			Apply knowledge of mathematics and engineering to formulate and study or solve engineering problems, including problems at the interface of engineering
			Analyze LabVIEW skills to engineer basic computer-based instrumentation
			Create applications that are scalable, readable, maintainable and reliable
48	16EC C37	Electronic Design and Automation Lab	Analyze simulation and synthesis reports of combinational and sequential logic circuits
			Obtain gate level net-list and RTL diagrams
			Implement sequence detector using FSM on FPGA
			Design adders using UDP and Tasks & Functions.
			Implement mini projects on FPGA/CPLD
49	16EC C38	Project Seminar	List the various approaches to the selected problem.
			Interpret the advantages and disadvantages of various approaches.
			Apply the selected approach for simulating / modelling / designing the problem.
			Analyse and write a report on the results of the simulation / modelling of the problem selected.
			Justify and present the results of the simulation / model / design before the departmental committee.
50	16EC E16	DSP Processors and Architectures	Differentiate between DSP Processor and General Purpose processor
			Select the most appropriate processor for the given application.
			Design and implement various signal processing algorithms using 55xx processor.
			Interface the TMS320C55XX processor to external devices.
			Take up research projects using DSP processors
51	16EC E18	VLSI Technology	Recall the concepts of various processes used in the IC fabrication
			Analyze the base materials, clean room Technology and functions of layers used in the IC fabrication.
			Explain the importance of processes and material used for the IC fabrication with suitable reasoning
			Evaluate the fabrication process aspects to determine various technology related concepts.
			Outline the packaging and testing concepts applied for VLSI circuits.
52	16EC E19	Voice over IP	Identify architectures used in the enterprise environment and interpret the key VoIP industry protocols
			Apply and rephrase the different protocol like SIP, H.323 and VoIP.
			Examine the importance of QoS with regard to availability and reliability of a voice network.
			Relate the technologies, architectures, and protocols used in the VoIP environment.
			Familiarize with Voice over IP Benefits, Applications and Services.

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53	16CS O10	Machine Learning Using Python	Understand the basics concepts of Machine Learning and Python
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			Analyze the various types of data by using python based machine learning techniques.
			Identify and evaluate various recommender systems.
			Design solutions to real world problems using deep learning algorithms.
			Design solutions to real world problems using deep learning algorithms.
54	16ME O01	Entrepreneurship	Identify opportunities and deciding nature of industry
			Brainstorm ideas for new and innovative products or services
			Analyze the feasibility of a new business plan and preparation of Business plan
			Use project management techniques like PERT and CPM
55	16EG O02	Gender Sensitization	Analyze behavioural aspects and use time management matrix
			Develop a better understanding of important issues related to what gender is in contemporary India.
			Be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film
			Attain a finer grasp of how gender discrimination works in our society and how to counter it. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
			Understand what constitutes sexual harassment and domestic violence and be made aware of New forums of Justice
			Draw solutions as to how men and women, students and professionals can be better equipped to work and live together as equals.
56	16PY O01	History of Science and Technology	Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
			Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
			Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
			Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
			Demonstrate academic rigor and sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context
57	16CE O02	Disaster Mitigation and Management	Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS. Design the database logically using ER modeling
			Outline the schema of the relational database and key constraints. Develop queries using DDL, DML and DCL of SQL.
			Identify the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.

			Summarize the concepts of dense sparse ISAM and B+ tree indexing and get familiar with states and properties of transactions.
			Interpret the locking time stamp graph and validation-based protocols for concurrency control.
			Summarize log-based recovery techniques to increase the robustness of the database identify to resolve the deadlocks in the transactions.
58	16CS O06	Fundamentals of DBMS	Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS. Design the database logically using ER modeling
			Outline the schema of the relational database and key constraints. Develop queries using DDL, DML and DCL of SQL.
			Identify the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.
			Summarize the concepts of dense sparse ISAM and B+ tree indexing and get familiar with states and properties of transactions.
			Interpret the locking time stamp graph and validation-based protocols for concurrency control.
			Summarize log-based recovery techniques to increase the robustness of the database identify to resolve the deadlocks in the transactions.
59	16EC C39	Seminar	Collect, Organize, Analyze and Consolidate information about emerging technologies from the literature
			Exhibit effective communication skills, stage courage, and confidence.
			Demonstrate intrapersonal skills.
			Explain new innovations/inventions in the relevant field.
			Prepare and experience in writing the Seminar Report in a prescribed format.
60	16EC C40	Project	Recall the details of the approach for the selected problem.
			Interpret the approach to the problem relating to the assigned topic.
			Determine the action plan to conduct investigation.
			Analyze and present the model / simulation /design as needed.
			Evaluate, present and report the results of the analysis and justify the same.

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