CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
DEPARTMENT OF ECE

PG - COMMUNICATION ENGINEERING

Program Outcomes

PO1	An ability to independently carry out research / investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO4	Students will be able to use modern engineering tools/software to design and develop advanced communication systems.
PO5	Students will be able to develop self-confidence, team work, skills for lifelong learning and committed to social responsibilities.

R22: DEPARTMENT OF ECE

VISION OF THE DEPARTMENT

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

MISSION OF THE DEPARTMENT

M1	To impart strong theoretical and practical knowledge of the state of art technologies to meet growing challenges in the industry.
M2	To carry out the advanced and need based research in consultation with the renowned research and industrial organizations.
M3	To create entrepreneurship environment including innovation, incubation and encourage to patent the work.

PROGRAM EDUCATIONAL OBJECTIVES

The PEOs are to facilitate the graduating students to:

PEO1	Graduates will Design & Develop Communication Systems either independently or in a group.

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PEO2	Graduates will able to learn and adopt the emerging technologies in the area of Communication Engineering.
PEO3	Graduates will demonstrate the ability to do research and become a lifelong learner.
PEO4	Graduates will Develop rational approach to solve real world problems with Self-confidence and ethical & Societal Responsibilities.

COURSE OUTCOMES

S.No	Year / Sem	Name of the course	
1	I / I	**23ECC101 - ADVANCED DIGITAL SIGNAL PROCESSING**	
		23ECC101.1	Design digital filters for the given specifications.
		23ECC101.2	Interpret the concepts of multirate digital signal processing.
		23ECC101.3	Understand the concepts of linear prediction filters.
		23ECC101.4	Analyze various power spectral estimation methods for random signals.
2	I / I	**23ECC102 - WIRELESS AND MOBILE COMMUNICATION**	
		23ECC102.1	Understand the requirements and technical challenges of current wireless systems.
		23ECC102.2	Analyze path loss, shadowing, and multipath effects on wireless channels.
		23ECC102.3	Interpret the capacity of wireless channels.
		23ECC102.4	Appreciate the underlying principles of diversity techniques.
3	I / II	**23ECC105 - ADVANCED COMMUNICATION NETWORKS**	
		23ECC105.1	Recall the concepts and issues of real-time communications over the Internet.
		23ECC105.2	Classify protocols and algorithms for communication networks.
		23ECC105.3	Identify the mechanisms for quality of service in networking.
		23ECC105.4	Analyze IP addressing challenges and services in the Internet.
4	I / II	**23ECC106 - INDUSTRIAL IOT AND APPLICATIONS**	
		23ECC106.1	Understand the Industrial Internet of Things and Cyber Physical manufacturing.
		23ECC106.2	Analyze the Cyber Physical and Cyber Manufacturing systems.
		23ECC106.3	Evaluate the Architectural design patterns for industrial Internet of Things.
		23ECC106.4	Apply the AI and data Analytics for Industrial Internet of Things.

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		23ECC106.5	Evaluate Workforce and Human Machine Interaction and Application of Industrial Internet of Things.
5	I / II	**23ECC107 - 5G AND BEYOND**	
		23ECC107.1	Recall the requirements and key functionalities of 4G LTEA/5G NR technology.
		23ECC107.2	Compare various channel access technologies and modulation techniques used in 5G wireless systems.
		23ECC107.3	Illustrate the architecture of 5G and its NextGen core network.
		23ECC107.4	Apply the 5G concepts to D2D communications.
		23ECC107.5	Demonstrate the concept of massive MIMO, V2X & THz.
6	I / I	**23ECC103 - ADVANCED DIGITAL SIGNAL PROCESSING LAB**	
		23ECC103.1	Implement FFT algorithms for linear filtering and correlation using MATLAB.
		23ECC103.2	Design and realize digital filters using MATLAB.
		23ECC103.3	Experiment with multirate techniques using MATLAB.
		23ECC103.4	Perform parametric and non-parametric estimation of PSD using MATLAB.
		23ECC103.5	Design and Implement adaptive filters using MATLAB.
7	I / I	**23ECC104 - WIRELESS AND MOBILE COMMUNICATION LAB**	
		23ECC104.1	Appraise Cellular concepts, GSM and CDMA networks.
		23ECC104.2	Experiment with GSM handset and fault insertion techniques.
		23ECC104.3	Illustrate 3G communication system by means of various AT commands usage in GSM.
		23ECC104.4	Test DSSS kit for implementing CDMA concept.
		23ECC104.5	Develop concepts of Software Radio in real-time environment.
8	I / II	**23ECC108 - ADVANCED COMMUNICATION NETWORKS LAB**	
		23ECC108.1	Identify the different types of network devices and their functions within a network.
		23ECC108.2	Understand and build the skills of sub-netting and routing mechanisms.
		23ECC108.3	Understand basic protocols of computer networks, and how they can be used to assist in Network design and implementation.
		23ECC108.4	Configure a network using Linux and a mail server for IMAP/POP protocols.
		23ECC108.5	Design and configure UDP Client Server.
9	I / II	23ECC109 - ADVANCED IOT AND APPLICATIONS LAB	
		23ECC109.1	Analyze various software and hardware components required for IoT technology.

		23ECC109.2	Interface analog and digital sensing & actuating equipment using Raspberry Pi.
		23ECC109.3	Apply knowledge of IoT to solve engineering problems.
		23ECC109.4	Implement security mechanisms for IoT systems.
		23ECC109.5	Evaluate the performance of IoT systems
10	I / II	**23ECC110 - MINI PROJECT**	
		23ECC110.1	Familiarize with searching suitable literature in the chosen field.
		23ECC110.2	Develop skills to understand and summarize the contents from the literature.
		23ECC110.3	Synthesize knowledge/skills gained and apply them in executing a chosen technical problem.
		23ECC110.4	Enhance oral presentation skills through PowerPoint presentations.
		23ECC110.5	: Present the findings of their technical solution in a written report.
11	II / III	**23ECC111 - Industrial Project / Dissertation Phase I**	
		23ECC111.1	Review the literature from standard books, refereed journals, and conference proceedings in the area of interest.
		23ECC111.2	Identify the problem statement based on existing gaps.
		23ECC111.3	Define the aim of the project and derive the objectives to fulfill the aim.
		23ECC111.4	Formulate an innovative methodology and identify the resources to carry out the objectives.
		23ECC111.5	Present the details of the problem statement, thorough literature survey, and methodology in a detailed technical report.
12	II / IV	**23ECC112 - INDUSTRIAL PROJECT / DISSERTATION PHASE II**	
		23ECC112.1	Plan the experimental set-up, initiate the design process, and devise the algorithms required to fulfill the objectives.
		23ECC112.2	Realize the objectives by carrying out suitable experiments and implementing modern techniques through the usage of relevant hardware/software tools.
		23ECC112.3	Validate the results and draw the inferences.
		23ECC112.4	Present the findings in the form of a good technical report/thesis and publish the findings in a reputed journal /conference proceedings.
		23ECC112.5	Develop skills to independently carry out research/investigation and development for problem solving while being committed to ethical and social responsibilities.
13	I / I	**23ECE101 - DATA AND OPTICAL NETWORKS**	

		23ECE101.1	Identify performance issues for Data networks.
		23ECE101.2	Analyze the Queuing Models of Networks.
		23ECE101.3	Understand the performance of end-to-end protocols for Data networks.
		23ECE101.4	Explain the architecture of SONET/SDM and measure the performance comparison between SONET and SDM networks.
		23ECE101.5	Understand the network survivability with different protection schemes and design simple WDM networks.
14	I / I	**23ECE102 - GNSS AND AUGMENTATION SYSTEMS**	
		23ECE102.1	Apply the concepts of satellite-based navigation in various emerging technologies.
		23ECE102.2	Analyze GPS signal structure and receiver functioning and compare coordinate systems and datum.
		23ECE102.3	Interpret the effect of various error sources and satellite geometry on the performance of GNSS and explain the necessity of GPS modernization and integration aspects.
		23ECE102.4	Develop data processing methods using observation and navigation data for GNSS and Augmentation Systems.
		23ECE102.5	Compare the performance of all GNSS systems and augmentation systems.
15	I / I	**23ECE103 - RADIATING SYSTEMS FOR RF COMMUNICATION**	
		23ECE103.1	Understand the radiation properties of antenna and analyze different types of wire antennas.
		23ECE103.2	Analyze the linear arrays for uniform and nonuniform distribution.
		23ECE103.3	Learn the concept of different types of planar antennas.
		23ECE103.4	Understand the field equivalence principle for aperture antenna.
		23ECE103.5	Learn about different types of MIMO and wearable antenna systems and measurement techniques.
16	I / I	**23ECE104 - HIGH PERFORMANCE NETWORKS**	
		23ECE104.1	Understand and design the types of networks and apply the services.
		23ECE104.2	Distinguish and analyze various VoIP Protocols.
		23ECE104.3	Design, implement, and analyze Protocols for the transport of voice media over IP networks.
		23ECE104.4	Identify the types of VPN and tunneling protocols for security.
		23ECE104.5	Familiarize the various networks by applying the Network security principles.
17	I / I	**23ECE105 - MIMO WIRELESS COMMUNICATIONS**	

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		23ECE105.1	Understand the Concepts of MIMO, OFDM, Diversity, and generic MIMO problem.
		23ECE105.2	Compare the diversity techniques, Multicarrier techniques.
		23ECE105.3	Apply Diversity Techniques and Pre-Coding techniques in MIMO.
		23ECE105.4	Analyze MIMO, OFDM, space-time Block, and Trellis coding.
		23ECE105.5	Understand and Compare Channel Estimation techniques.
18	I / I	**23ECE106 - STATISTICAL DECISION AND ESTIMATION THEORY**	
		23ECE106.1	Apply random variables and random process concepts in communications.
		23ECE106.2	Demonstrate mathematical modelling of random processes such as noise.
		23ECE106.3	Analyze various random processes modeling such as AR processes, MA processes, ARMA processes, and Markov chains.
		23ECE106.4	Understand binary hypothesis techniques.
		23ECE106.5	Compare parameter estimation techniques.
19	I / II	**23ECE107 - INFORMATION THEORY AND CODING TECHNIQUES**	
		23ECE107.1	Illustrate the notion of information in the quantitative sense to construct compact codes for a given data ensemble.
		23ECE107.2	Describe the mathematical modelling and calculate the capacity of typical digital communication channels and interpret the result in terms of theoretical limits to channel coding performance.
		23ECE107.3	Recall the fundamental coding theorem for noisy channels (Shannon's Second Theorem) and relate its implications in coding mechanism.
		23ECE107.4	Apply the principles of abstract algebra to design error control codes.
		23ECE107.5	Make use of error control coding to achieve error detection and correction in digital transmission systems.
20	I / II	**23ECE108 - MARKOV CHAIN AND QUEUING SYSTEMS**	
		23ECE108.1	Compute the characteristics of the random variables with the given probabilities.
		23ECE108.2	Solve different cases of stochastic processes along with their properties.
		23ECE108.3	Understand Markov Chains and regenerative processes used in modelling a wide variety of systems and phenomena.
		23ECE108.4	Model a system as a queuing system with some aspect of the queue governed by a random process.

		23ECE108.5	Understand systems modelling using Markov chains with special emphasis on developing queuing models.
21	I / II	**23ECE109 - NETWORK SECURITY AND CRYPTOGRAPHY**	
		23ECE109.1	Identify and utilize different forms of cryptography techniques.
		23ECE109.2	Analyze solutions for effective key management and distribution and conduct cryptoanalysis.
		23ECE109.3	Predict Encrypt and decrypt data using Symmetric key and Asymmetric ciphers.
		23ECE109.4	Assess authentication and security in the network applications.
		23ECE109.5	Interpret different types of threats to the system and handle the same.
22	I / II	**23ECE110 - MACHINE LEARNING FOR NEXT GENERATION COMMUNICATION SYSTEMS**	
		23ECE110.1	Develop a comprehensive understanding of machine learning and deep learning techniques for wireless communication networks.
		23ECE110.2	Design machine learning algorithms for spectrum access and sharing and reinforcement learning algorithms for resource allocation.
		23ECE110.3	Design deep learning algorithms for optimizing coverage and channel capacity.
		23ECE110.4	Apply machine learning algorithms for optimizing energy efficiency, modulation, coding, channel equalization, and signal detection.
		23ECE110.5	Analyze and evaluate the performance of machine learning and deep learning algorithms in wireless communication networks.
23	I / II	**23ECE111 - SIGNAL INTELLIGENCE SYSTEMS**	
		23ECE111.1	Apply the knowledge of Communication and Antenna concepts in understanding the operating principles of Radar and Drones.
		23ECE111.2	Analyze the intricacies of ELINT Systems.
		23ECE111.3	Discuss the salient features of EW Systems and identify the type of Electronic Jamming.
		23ECE111.4	Estimate the DF and position of ELINT/COMINT Systems for simple cases.
		23ECE111.5	Interpret the type of modulation of COMINT systems.
24	I / II	**23ECE112 - WIRELESS SENSOR NETWORKS AND PROTOCOLS**	
		23ECE112.1	Recall the Network Architecture, hardware details, programming tools, Protocols and Special features of WSN.
		23ECE112.2	Demonstrate hardware and Programming Tools for Performance comparison of wireless sensor

			networks simulation and experimental platforms.
		23ECE112.3	Analyze Sensor Network Protocols and Security Challenges, Sensor deployment mechanisms.
		23ECE112.4	Identify open issues for future research, and enabling technologies in wireless sensor network.
		23ECE112.5	Design wireless sensor network system for different applications under consideration.
25	II /I	**23ECE113 - COGNITIVE RADIO**	
		23ECE113.1	Understand the fundamental concepts of cognitive radio networks.
		23ECE113.2	Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
		23ECE113.3	Understand technologies to allow an efficient use of radio communications based on two spectrum sharing business models/policies.
		23ECE113.4	Understand fundamental issues regarding dynamic spectrum access, radio-resource management and trading, as well as a number of optimization techniques for better.
		23ECE113.5	Explore the challenges of dynamic spectrum sensing and optimization techniques.
26	II /I	**23ECE114 - DEEP LEARNING TECHNIQUES FOR SIGNAL PROCESSING**	
		23ECE114.1	Understand fundamentals of Machine Learning and Deep Learning.
		23ECE114.2	Analyze Various Deep Learning Architectures.
		23ECE114.3	Analyze the deep learning methods for speech processing.
		23ECE114.4	Analyze the deep learning methods for Image processing.
		23ECE114.5	Analyze the deep learning methods for Biomedical signal processing.
27	II /I	**23ECE115 - PROGRAMMABLE NETWORKS – SDN, NFV**	
		23ECE115.1	Differentiate between traditional networks and software defined networks and understand the key benefits and use cases of SDN.
		23ECE115.2	Interpret the SDN data plane devices and OpenFlow Protocols.
		23ECE115.3	Implement the operation of SDN control plane with different controllers.
		23ECE115.4	Apply techniques that enable applications to control the underlying network using SDN.
		23ECE115.5	Evaluate Network Functions Virtualization components and their roles in SDN.
28	I/I	**23MEM103 - RESEARCH METHODOLOGY AND IPR**	
		23MEM103.1	Define research problem, review and assess the

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			quality of literature from various sources.
		23MEM103.2	Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs.
		23MEM103.3	Collect the data by various methods: observation, interview, questionnaires.
		23MEM103.4	Analyze problem by statistical techniques: ANOVA, F-test, and Chi-square.
		23MEM103.5	Understand apply for patent and copyrights.
29		**23CEA101 - DISASTER MITIGATION AND MANAGEMENT**	
		23CEA101.1	Ability to analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels.
		23CEA101.2	Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
		23CEA101.3	Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management.
		23CEA101.4	Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same.
		23CEA101.5	Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management.
30		**23EGA101 - ENGLISH FOR RESEARCH PAPER WRITING**	
		23EGA101.1	Improve work performance and efficiency Illustrate the nuances of research paper writing and draw conclusions on professional usefulness.
		23EGA101.2	Classify different types of research papers and organize the format and citation of sources.
		23EGA101.3	Explore various formats of APA, MLA and IEEE and set up for writing a research paper.
		23EGA101.4	Draft paragraphs and write theme-based thesis statements in a scientific manner.
		23EGA101.5	Develop an original research paper while acquiring the knowledge of how and where to publish their papers.
31		**23EGA102 - CONSTITUTION OF INDIA**	
		23EGA102.1	Understand the making of the Indian Constitution and its features.
		23EGA102.2	Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.

		23EGA102.3	Have an insight into various Organs of Governance - composition and functions.
		23EGA102.4	Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
		23EGA102.5	Understand Electoral Process, special provisions.
32		**23ADA101 - PEDAGOGY STUDIES (Audit Course)**	
		23ADA101.1	Illustrate the pedagogical practices followed by teachers in developing countries.
		23ADA101.2	Examine the effectiveness of pedagogical practices.
		23ADA101.3	Understand educational research methodologies.
		23ADA101.4	Describe classroom practices, curriculum, and barriers to learning.
		23ADA101.5	Understand research gaps and learn future directions in pedagogy.
33		**23EGA104 - PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS (Audit Course)**	
		23EGA104.1	Develop personality and achieve life goals.
		23EGA104.2	Lead to peace and prosperity.
		23EGA104.3	Practice emotional self-regulation.
		23EGA104.4	Develop a positive approach to work.
		23EGA104.5	Develop a versatile personality for personal and professional success.
34		**23EEA101 - SANSKRIT FOR TECHNICAL KNOWLEDGE (Audit Course)**	
		23EEA101.1	Develop passion for learning Sanskrit.
		23EEA101.2	Decipher engineering principles through Sanskrit texts.
		23EEA101.3	Correlate technological concepts with ancient Sanskrit literature.
		23EEA101.4	Develop knowledge for technological progress rooted in Sanskrit.
		23EEA101.5	Explore new research avenues using Sanskrit for technology-based studies.
35		**23EGA103 - STRESS MANAGEMENT BY YOGA (Audit Course)**	
		23EGA103.1	: Understand yoga and its benefits for stress management.
		23EGA103.2	Enhance physical strength, flexibility, and overall health.
		23EGA103.3	Learn effective relaxation techniques through yoga practices.
		23EGA103.4	Relieve physical and mental tension through specific asanas.
		23EGA103.5	Improve work performance, efficiency, and mental clarity.
36		**23ECA101 - VALUE EDUCATION (Audit Course)**	
		23ECA101.1	Summarize the classification of values for self-development.

		23ECA101.2	Identify the importance of values in personal and professional life.
		23ECA101.3	Apply social values for better career and interpersonal relationships.
		23ECA101.4	Compile values from sacred texts and their relevance today.
		23ECA101.5	Discuss philosophical concepts like soul, reincarnation, Dharma, Karma, and Guna.
37	II/III	**23CSO101 - Business Analytics**	
		23CSO101.1	Identify and describe complex business problems in terms of analytical models.
		23CSO101.2	Apply appropriate analytical methods to find solutions to business problems that achieve stated objectives.
		23CSO101.3	Interpret various metrics, descriptive, predictive, and prescriptive measures used in business analytics.
		23CSO101.4	Model the business data using various business analytical methods and techniques.
		23CSO101.5	Create viable solutions to decision-making problems.
38	II/III	**23MEO103 - Composite Materials**	
		23MEO103.1	Classify and characterize the composite materials.
		23MEO103.2	Describe types of reinforcements and their properties.
		23MEO103.3	Understand different fabrication methods of metal matrix composites.
		23MEO103.4	Understand different fabrication methods of polymer matrix composites.
		23MEO103.5	Decide the failure of composite materials.
39	II/III	**23CEO101 - Cost Management of Engineering Projects**	
		23CEO101.1	Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.
		23CEO101.2	Determine the critical path of a typical project using CPM and PERT techniques.
		23CEO101.3	Prepare a work breakdown plan and perform linear scheduling using various methods.
		23CEO101.4	Solve problems of resource scheduling and levelling using network diagrams.
		23CEO101.5	Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.
40	II/III	**23MEO101 - Industrial Safety**	
		23MEO101.1	Identify the causes for industrial accidents and suggest preventive measures.
		23MEO101.2	Identify the basic tools and requirements of different maintenance procedures.

		23MEO101.3	Apply different techniques to reduce and prevent wear and corrosion in industry.
		23MEO101.4	Identify different types of faults present in various equipment like machine tools, IC engines, boilers, etc.
		23MEO101.5	Apply periodic and preventive maintenance techniques as required for industrial equipment like motors, pumps, air compressors, and machine tools.
41	II/III	**23MEO102 - Introduction to Optimization Techniques**	
		23MEO102.1	Formulate a linear programming problem (LPP).
		23MEO102.2	Build and solve transportation models and assignment models.
		23MEO102.3	Apply project management techniques like CPM and PERT to plan and execute projects successfully.
		23MEO102.4	Apply queuing and inventory concepts in industrial applications.
		23MEO102.5	Apply sequencing models in industries.
42	II/III	**23EEO101 - Waste to Energy**	
		23EEO101.1	Understand the concept of waste to energy.
		23EEO101.2	Explore the various energy extraction options.
		23EEO101.3	Describe the energy production methodology.
		23EEO101.4	Explicate the environmental implications.

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