CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
DEPARTMENT OF ECE

ME – EMBEDDED SYSTEMS & VLSI DESIGN

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 apply engineering expertise to solve real world problems in the areas of Embedded Systems and VLSI Design.
PEO2	Graduates will have the ability to adopt latest technologies.
PEO3	Graduates will be able to carry out research in the fields of Micro Electronics and Embedded Systems.
PEO4	Graduates will develop professional ethics, effective communication skills, self-confidence and societal responsibilities.

PROGRAM SPECIFIC OUTCOMES

The Graduates of this program will:

PSO1	An ability to independently carry out research /investigation and development work to solve practical problems.
PSO2	An ability to write and present a substantial technical report/document.
PSO3	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.
PSO4	Students will be able to use modern engineering tools/software to design and develop Embedded and VLSI Systems as per the needs of the Industry.
PSO5	Students will be able to develop self-confidence, team work, skills for lifelong learning and committed to social responsibilities.

COURSE OUTCOMES

S.No	Year / Sem	Name of the course	
1	I / I	**23ECC201 – ANALOG AND DIGITAL CMOS VLSI DESIGN**	
		23ECC201.1	Choose and apply appropriate MOS model for analytical modelling/analysis of the circuits.
		23ECC201.2	Choose appropriate amplifier or current mirror circuit for a given application or specification.
		23ECC201.3	Design various types of amplifiers, Op-Amps and current sources as per the required specifications.
		23ECC201.4	Design and analyze any combinational circuits for a given application.
		23ECC201.5	Design and analyze sequential circuits for any given application.
2	I / I	**23ECC202 – MICROCONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSORS**	
		23ECC202.1	Compare and select ARM processor core based on requirements of embedded application.
		23ECC202.2	Analyze various features of ARM Cortex-M4 Series processor.
		23ECC202.3	Develop the skills to program ARM CortexM4 processors.
		23ECC202.4	Design interfacing applications on ARM Cortex M4 based microcontroller.
		23ECC202.5	Apply various signal processing applications on DSP processor-based platforms.
		23MEM103 - BASIC ELECTRICAL ENGINEERING	
		23MEM103.1	Define research problem, review and asses the quality of literature from various sources.
		23MEM103.2	Improve the style and format of writing a report for

3	I / I		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.
4	I / I	**23ECE201 – LOW POWER VLSI**	
		23ECE201.1	Identify and Understand leakage sources and reduction techniques.
		23ECE201.2	Understand the impact of power on system performance and reliability.
		23ECE201.3	Analyze and apply various low power circuit techniques for combinational and sequential circuits.
		23ECE201.4	Explain power minimization techniques for Clock distribution, arithmetic, and memory subsystem.
		23ECE201.5	Characterize and model power consumption & understand the basic analysis methods for Microprocessor Design System
5	I / I	**23ECE202 – MEMS AND APPLICATIONS**	
		23ECE202.1	Understand the fundamental concepts of MEMS and Microsystems.
		23ECE202.2	Classify and discuss various possible materials for MEMS based devices.
		23ECE202.3	Illustrate various process steps involved in fabrication of MEMS devices.
		23ECE202.4	Apply knowledge to design micro sensors and micro actuators.
		23ECE202.5	Apply knowledge to design RF MEMS devices.
6	I / I	**23ECE203 – PROGRAMMING LANGUAGES FOR EMBEDDED SOFTWARE**	
		23ECE203.1	Develop embedded C application of moderate complexity.
		23ECE203.2	Summaries the object-oriented programming concepts.
		23ECE203.3	Build the Object-Oriented approach to software that models application and Develop algorithms in C++.
		23ECE203.4	Understand the overloading and Inheritance concepts of programming.
		23ECE203.5	Differentiate interpreted languages from compiled languages.
		23ECE204 – ADVANCED COMPUTER ORGANIZATION	
		23ECE204.1	Analyze the computer arithmetic operations.

7	I / I	23ECE204.2	Design of control unit of the computer.
		23ECE204.3	Understand the memory organization of the computer.
		23ECE204.4	Interface various I/O modules and various buses to the computer system.
		23ECE204.5	Analyze the multiprocessor environment for the computer system.
8	I / I	**23ECE205 – ALGORITHMS FOR VLSI DESIGN**	
		23ECE205.1	Describe and formulate the flow of VLSI Design for any application.
		23ECE205.2	Explain the algorithms for floor planning, placement and routing the digital designs at frontend level & at backend VLSI Design level.
		23ECE205.3	Compare the various global routing algorithms, ILP approaches.
		23ECE205.4	Analyze single layer and three-layer detailed routing algorithms.
		23ECE205.5	Apply cell routing and minimization techniques, 1D and 2D compactions.
9	I / I	**23ECE206 – SYSTEM DESIGN WITH EMBEDDED LINUX**	
		23ECE206.1	Understand the importance of Embedded Linux in system design.
		23ECE206.2	Analyze the architecture of embedded Linux in detail.
		23ECE206.3	Explain the Linux BSP for a hardware platform.
		23ECE206.4	Develop and Debug the drivers in Embedded Linux.
		23ECE206.5	Apply the concepts of µC Linux to system design.
10	I / I	**23MEM103 – RESEARCH METHODOLOGY AND IPR**	
		23MEM103.1	Define research problem, review and asses the 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.
11	I / I	**23ECC203 – ANALOG AND DIGITAL CMOS VLSI DESIGN LAB**	
		23ECC203.1	Characterize MOSFET by simulation and extract design parameters.
		23ECC203.2	Design and simulate basic digital circuits.
		23ECC203.3	Design, simulate and compare single stage amplifiers.
		23ECC203.4	Design, simulate and compare differential amplifiers &

			op-amps
		23ECC203.5	Develop layout of any given circuit.
12	I / I	**23ECC204 - MICROCONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSORS LAB**	
		23ECC204.1	Install, configure, and utilize tool sets for developing applications based on ARM processor core.
		23ECC204.2	Design and develop the ARM Cortex M4 based embedded systems for various applications.
		23ECC204.3	Develop application programs on ARM and DSP development boards both in assembly and C.
		23ECC204.4	Design and implement the digital filters on DSP 67XX processor.
		23ECC204.5	Analyse the hardware and software interaction and integration.
13	I / I	**23CEA101 – DISASTOR MITIGATION AND MANAGEMENT**	
		23CEA101.1	Equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
		23CEA101.2	Impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters.
		23CEA101.3	Enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters.
		23CEA101.4	Enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
		23CEA101.5	Equip the students with the knowledge of the chronological phases in a disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions.
14	I / I	**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.
15	I / I	**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.
16	I / I	**23ADA101 – PEDAGOGY STUDIES**	
		23ADA101.1	Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
		23ADA101.2	Examine the effectiveness of pedagogical practices.
		23ADA101.3	Understand the concept, characteristics and types of educational research and perspectives of research.
		23ADA101.4	Describe the role of classroom practices, curriculum and barriers to learning.
		23ADA101.5	Understand Research gaps and learn the future directions.
17	I / III	**23EGA104 - PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS**	
		23EGA104.1	Develop their personality and achieve their highest goal of life.
		23EGA104.2	Lead the nation and mankind to peace and prosperity.
		23EGA104.3	Practice emotional self-regulation.
		23EGA104.4	Develop a positive approach to work and duties.
		23EGA104.5	Develop a versatile personality.
18	II / III	**23EEA101 - SANSKRIT FOR TECHNICAL KNOWLEDGE**	
		23EEA101.1	Develop passion towards Sanskrit language.
		23EEA101.2	Decipher the latent engineering principles from Sanskrit literature.
		23EEA101.3	Correlates the technological concepts with the ancient Sanskrit history.
		23EEA101.4	Develop knowledge for the technological progress.
		23EEA101.5	Explore the avenue for research in engineering with aid of Sanskrit.
		23EGA103 - STRESS MANAGEMENT BY YOGA	

19	II / III	23EGA103.1	Understand yoga and its benefits.
		23EGA103.2	Enhance Physical strength and flexibility.
		23EGA103.3	Learn to relax and focus.
		23EGA103.4	Relieve physical and mental tension through asanas.
		23EGA103.5	Improve work performance and efficiency.
20	II / III	**23ECA101 - VALUE EDUCATION**	
		23ECA101.1	Summarize classification of values and values for self-development.
		23ECA101.2	Identify the importance of values in personal and professional life.
		23ECA101.3	Apply the importance of social values for better career and relationships.
		23ECA101.4	Compile the values from holy books for personal and social responsibility.
		23ECA101.5	Discuss concept of soul and reincarnation, values Dharma, Karma and Guna.
21	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, measures used in business analytics.
		23CSO101.4	Illustrate various descriptive, predictive and prescriptive methods and techniques.
		23CSO101.5	Model the business data using various business analytical methods and techniques.
		23CSO101.6	Create viable solutions to decision making problems.
22	II / III	**23MEO103 – COMPOSITE MATERIALS**	
		23MEO103.1	Composite materials and their constituents.
		23MEO103.2	Classification of the reinforcements and evaluate the behaviour of composites.
		23MEO103.3	Fabrication methods of metal matrix composites.
		23MEO103.4	Manufacturing of Polymer matrix composites.
		23MEO103.5	Failure mechanisms in composite materials.
23	II / III	**23CEO101 – COST MANAGEMENT OF ENGINEERING PRODUCTS**	
		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 break down 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.
24	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 equipments like machine tools, IC Engines, boilers etc.
		23MEO101.5	Apply periodic and preventive maintenance techniques as required for industrial equipment like motors, pumps and air compressors and machine tools etc.
25	II / III	**23MEO102 – INTRODUCTION TO OPTIMIZATION TECHNIQUES**	
		23MEO102.1	Formulate a linear programming problems (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 project successfully.
		23MEO102.4	Apply queing and inventory concepts in industrial applications.
		23MEO102.5	Apply sequencing models in industries.
26	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.
		23EEO101.5	Compare and contrast waste to energy productions by case studies.
27	II / III	**23ECE213 – NANOMATERIALS AND NANOTECHNOLOGY**	
		23ECE213.1	Understand the basic electrical and optical, magnetic, mechanical properties of nano materials.
		23ECE213.2	Construct devices based on nano-materials.
		23ECE213.3	Explain nano fabrication steps, fabrication and applications of MEMS.
		23ECE213.4	Construct Nano structures like Carbon nano tubes and MEM actuators.
		23ECE213.5	Discuss various procedures of nano composites and applications of nano biomaterials.

28	II / III	**23ECE214 – RECONFIGURABLE COMPUTING SYSTEMS**	
		23ECE214.1	Describe the concepts of Reconfigurable computing systems and able to implement logic functions using them.
		23ECE214.2	Analyze the various architectures of CPLD and FPGA.
		23ECE214.3	Summarize the various features of advanced FPGAs.
		23ECE214.4	Understand the concepts of placement and routing algorithms.
		23ECE214.5	Demonstrate VLSI tool flow for FPGA and ASICs and relate the testing concepts.
29	II / III	**23ECE215 – UNIX & SCRIPTING LANGUAGES**	
		23ECE215.1	Understand Unix operating system.
		23ECE215.2	Analyze the organization of files and file system in UNIX.
		23ECE215.3	Analyze and access UNIX files, processes, etc.
		23ECE215.4	Develop simple Unix shell scripts.
		23ECE215.5	Develop PERL scripts.
30	II / III	**23ECC211 – INDUSTRIAL PROJECT / DISSERTATION PHASE I**	
		23ECC211.1	Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
		23ECC211.2	Learn the required software/ computational/analytical tools for implementations.
		23ECC211.3	Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
		23ECC211.4	Ability to present the findings of their technical solution in a written report.
		23ECC211.5	Presenting the work in International/ National conference or reputed journals.
31	II / IV	**23ECC212 – INDUSTRIAL PROJECT / DISSERTATION PHASE II**	
		23ECC212.1	Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
		23ECC212.2	Learn the required software/ computational/analytical tools for implementations.
		23ECC212.3	Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
		23ECC212.4	Ability to present the findings of their technical solution in a written report.
		23ECC212.5	Presenting the work in International/ National conference or reputed journals.

32	I / II	**23ECC205 – IoT AND RTOS BASED EMBEDDED SYSTEM DESIGN**	
		23ECC205.1	Understand the terminology, enabling technologies and tools of IoT.
		23ECC205.2	Develop the building blocks of IoT physical devices and end points using Raspberry Pi and data analytics.
		23ECC205.3	Design methodology and case study illustration of different application domains.
		23ECC205.4	Analyze various scheduling algorithms and application to real time systems.
		23ECC205.5	Illustrate the concepts of real time operating system and VxWorks.
33	I / II	**23ECC206 – VLSI DESIGN, VERIFICATION AND TESTING**	
		23ECC206.1	Familiarity of front-end design and verification and testing and create reusable test environments.
		23ECC206.2	Understanding various data types used in System Verilog.
		23ECC206.3	Demonstrating OOPs concepts.
		23ECC206.4	Make use of Randomization in System Verilog.
		23ECC206.5	Verify increasingly complex designs more efficiently and effectively.
34	I / II	**23ECC207 – MIXED SIGNAL AND RF IC DESIGN**	
		23ECC207.1	Measure the performance metric of a given RF systems.
		23ECC207.2	Understand the design of High bandwidth and LNA circuits.
		23ECC207.3	Apply techniques for designing amplifiers for high frequencies.
		23ECC207.4	Design and Analyze Nyquist Data converter.
		23ECC207.5	Design and Analyze of over-sample Data converter.
35	I / II	**23ECE207 – INDUSTRIAL INTERNET OF THINGS**	
		23ECE207.1	Understand the Industrial Internet of Things and Cyber Physical manufacturing.
		23ECE207.2	Analyze the Cyber Physical and Cyber Manufacturing systems.
		23ECE207.3	Evaluate the Architectural design patterns for industrial Internet of Things.
		23ECE207.4	Apply the AI and data Analytics for Industrial Internet of Things.
		23ECE207.5	Evaluation of Workforce and Human Machine Interaction and Application of Industrial Internet of Things.
		23ECE208 – SEMICONDUCTOR DEVICE MODELLING	
		23ECE208.1	Acquire knowledge about physics involved in modelling of semiconductor device.

36	I / II	23ECE208.2	Explore the properties of PN Junction Diodes.
		23ECE208.3	Discuss the device level characteristics of BJT transistors.
		23ECE208.4	Modelling of MOSFET devices using MATLAB, SPICE and ATLAS / SYNOPSYS.
		23ECE208.5	Summaries various ultra-deep submicron transistor design issues.
37	I / II	**23ECE209 – VLSI SIGNAL PROCESSING**	
		23ECE209.1	Understand the concepts of various DSP algorithms, its DFG representation, pipelining and parallel processing approaches.
		23ECE209.2	Demonstrate retiming techniques and systolic architecture design concepts.
		23ECE209.3	Develop various convolution algorithms for programmable hardware.
		23ECE209.4	Evaluate pipelining and parallel processing techniques in the design of recursive digital filters.
		23ECE209.5	Discuss algorithmic strength reduction techniques and evolution of DSP processors.
38	I / II	**23ECE210 – MEMORY TECHNOLOGIES**	
		23ECE210.1	Summarize Static Random Access Memory Technologies.
		23ECE210.2	Outline the concepts of dynamic random access memory technologies.
		23ECE210.3	Demonstrate various nonvolatile memories.
		23ECE210.4	Illustrate Memory Reliability and Radiation Effects.
		23ECE210.5	Describe advanced memory technologies.
39	I / II	**23ECE211 – PHYSICAL DESIGN AUTOMATION**	
		23ECE211.1	Study automation process for VLSI system design.
		23ECE211.2	Understand the fundamentals for VLSI system design.
		23ECE211.3	Develop and enhance the existing computational techniques for physical design process of VLSI Circuits.
		23ECE211.4	Study automation process for VLSI System design.
		23ECE211.5	Understanding fundamentals for various physical design CAD tools.
40	I / II	**23ECE212 – SoC DESIGN**	
		23ECE212.1	Utilize appropriate core from CISC, RISC, NISC, ASIP, etc. for the design of given SoC.
		23ECE212.2	Able to judge and select appropriate ADL for the design exploration of SoC.
		23ECE212.3	Choose appropriate interconnect for the SoC with proper justification.
		23ECE212.4	Understand the importance of simulation and validation

			of the SoC.
		23ECE212.5	Understand the process of synthesis of SoC.
41	I / II	**23ECC208 – IoT AND RTOS BASED EMBEDDED SYSTEM DESIGN LAB**	
		23ECC208.1	Analyze various software and hardware components required for IoT technology.
		23ECC208.2	Interface analog and digital sensing & actuating equipment using Raspberry Pi.
		23ECC208.3	Apply knowledge of IoT to solve engineering problems.
		23ECC208.4	Understand the programming concepts of RTOS.
		23ECC208.5	Analyze Multitasking, IPC and scheduling concepts.
42	I / II	**23ECC209 – RTL SYNTHESIS, SIMULATION AND VERIFICATION LAB**	
		23ECC209.1	Demonstrate the process steps required for simulation /synthesis.
		23ECC209.2	Design and simulate various combinational and sequential circuits using HDL.
		23ECC209.3	Develop an RTL code for various real time applications.
		23ECC209.4	Synthesize / Simulate an RTL code for several digital designs.
		23ECC209.5	Build and verify various digital circuits.
43	I / II	**23ECC210 – MINI PROJECT**	
		23ECC210.1	Formulate a specific problem and give a solution.
		23ECC210.2	Develop model/models theoretical/practical/numerical form.
		23ECC210.3	Solve, interpret/correlate the results and discussions.
		23ECC210.4	Conclude the results obtained.
		23ECC210.5	Write the documentation in standard format.