M. Tech. I Year I Semester   R22-Regulation

Code	Course Name	CO No.	CO Description
22ES101	**EMBEDDED SYSTEMS PROGRAMMING** (Professional Core - I)	CO 1	Choose the required ARM processor for Embedded Systems
		CO 2	Understand fundamental concepts of ARM Processor
		CO 3	Apply Embedded C programming knowledge to develop Embedded Applications
		CO 4	Understand the basics of MSP430 Processor
		CO 5	Explain different communication interfaces of MSP430 Processor
22EC101	**HDL MODELING AND PLD DESIGN** (Professional Core - II)	CO 1	Develop the Verilog HDL for digital designs
		CO 2	Design and analyze of finite state machines
		CO 3	Understand the architectures of various PLDs
		CO 4	Differentiate various types of FPGA architectures
		CO 5	Adopt tools and methodologies for FPGA-Based Design
22ES102	**SOC and NOC ARCHITECTURES** (Professional Elective - I) (Common to VLSI and ES)	CO 1	Describe the system architecture for the given performance indicators
		CO 2	Understand Co-design concepts and validation of system design
		CO 3	Differentiate and explain the principles of SoC and NoC designs
		CO 4	Analyze NoC Topology and Protocol design
		CO 5	Explore low-power requirements for NoC implementations
22ES103	**MEMORY TECHNOLOGIES** (Professional Elective - I)	CO 1	Explore the various static RAM technologies
		CO 2	Identify various dynamic random-access memories
		CO 3	Describe different types of non-volatile memories
		CO 4	Learn about the advanced and high-density memory technologies
		CO 5	Analyze hybrid memory and reliability issues in memory testing
22ES104	**WIRELESS SENSOR NETWORKS** (Professional Elective - I)	CO 1	Analyze various architectures of Wireless Sensor Networks
		CO 2	Understand the design issues and challenges in wireless sensor networks Design, simulate and compare the performance of various MAC protocols
		CO 3	Compare various data gathering and data dissemination methods. Also, design,
		CO 4	Understand the operating systems of wireless sensor networks and the traffic management issues
		CO 5	Select the various critical parameters in deploying a WSN of real time scenarios
22ES105	**MICROCONTROLLERS FOR EMBEDDED SYSTEMS** (Professional Elective - II)	CO 1	Identify and understand the basics of different microcontrollers
		CO 2	Examine the architecture and registers of AVR microcontrollers
		CO 3	Identify and understand the function of different blocks of PIC microcontroller
		CO 4	Develop programs for PIC microcontroller using Assembly language
		CO 5	Interface peripherals with PIC microcontroller
22VL105	**HARDWARE SOFTWARE CO-DESIGN** (Professional Elective - II) (Common to VLSI and ES)	CO 1	Understand need of different target architectures and co-design to solve engineering, communication and other problems
		CO 2	Analyze the extension of existing compilers and languages to system level codesign models for creation and using of modern tools
		CO 3	Design mixed hardware-software systems and the design of hardware-software interfaces
		CO 4	Understand the common underlying modeling concepts and the trade-offs between hardware and software components
		CO 5	Learn about System level specification, design representation for system level synthesis, system level specification languages
22ES106	**NETWORK SECURITY AND CRYPTOGRAPHY** (Professional Elective – II)	CO 1	Identify various security attacks, mechanisms, classical cryptography techniques
		CO 2	Analyze different private and public key techniques
		CO 3	Distinguish hash functions, key distribution and authentication algorithms
		CO 4	Categorize transport layer and wireless LAN security
		CO 5	Understand current security protocols implementation in Internet
22HS105	**RESEARCH METHODOLOGY AND IPR** (Common to All Branches)	CO 1	Understand research problem formulation and analyze research related information
		CO 2	Follow research ethics
		CO 3	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
		CO 4	Understanding importance of intellectual property rights
		CO 5	Understand the importance of patent rights and developments in IPR

22ES131	**EMBEDDED SYSTEMS PROGRAMMING LAB**	**CO 1**	Develop programming skills in embedded systems for various applications
		CO 2	Install, configure, and utilize tools for developing ARM based application
		CO 3	Examine the prototype codes using commonly available on and off chip peripherals on the ARM boards
		CO 4	Identify and understand the basic programming of MSP430 Processor
		CO 5	Implement a wireless communication model for Embedded Systems
22EC131	**PLD DESIGN LAB**	**CO 1**	Simulate and synthesize combinational circuits using FPGA
		CO 2	Implement the Sequential circuits using FPGA
		CO 3	Identify, formulate, solve and implement problems in signal processing,

<p align="center">Audit Course I</p>

22HS106	**ENGLISH FOR RESEARCH PAPER WRITING** (Audit Course - Common to All Branches)	**CO 1**	Write coherent and concise sentences.
		CO 2	Produce good research papers with ethical practices.
		CO 3	Develop an error-free research paper in proper framework.
		CO 4	Use language techniques appropriately.
		CO 5	Fulfil the requirement of a good research paper.
22HS107	**DISASTER MANAGEMENT** (Audit Course - Common to All Branches)	**CO 1**	CO1: Understand the factors that contribute to natural and man-made disasters and distinguish between them.
		CO 2	Identify the disaster-prone areas in India.
		CO 3	Assess the disaster and analyze it by collecting data from different sources
		CO 4	Know the concept of risk reduction and risk assessment and evolve strategies for disaster mitigation.
22HS108	**SANSKRIT FOR TECHNICAL KNOWLEDGE** (Audit Course - Common to All Branches)	**CO 1**	Understanding basic Sanskrit language
		CO 2	Ancient Sanskrit literature about science & technology can be understood
		CO 3	Being a logical language will help to develop logic in students
22HS109	**VALUE EDUCATION** (Audit Course - Common to All Branches)	**CO 1**	Knowledge of self-development
		CO 2	Learn the importance of Human values
		CO 3	Developing the overall personality

<p align="center">M. Tech. I Year II Semester</p>

22ES151	**OPERATING SYSTEMS FOR EMBEDDED DESIGN** (Professional Core - III)	**CO 1**	Summarize the necessary modules of an Operating System and implement in the program
		CO 2	Understand concepts of Real-Time systems and modeling
		CO 3	Interpret the various real time scheduling algorithms
		CO 4	Learn the various methods of Inter-process communications
		CO 5	Differentiate architectures of different RTOS and apply the knowledge in designing an embedded system
22ES152	**MACHINE LEARNING** (Professional Core - IV)	**CO 1**	Understand the machine learning approaches and paradigms to get an insight of when to apply a particular ML approach
		CO 2	Implement a decision-tree as a hierarchical data structure
		CO 3	Learn different algorithms with different inductive biases for learning such linear discriminants from a given labeled training sample
		CO 4	Learn the backpropagation algorithm to train a multilayer perceptron for a variety of applications
		CO 5	Analyze the various clustering techniques
22ES153	**HUMAN COMPUTER INTERACTION** (Professional Elective - III)	**CO 1**	Understand the guidelines influencing human computer interaction
		CO 2	Describe typical human computer interaction models
		CO 3	Analyze and identify stakeholder requirements of HCI systems
		CO 4	Build a Mobile Ecosystem for HCI
		CO 5	Design an interactive web interface based on the model studied
22ES154	**ADVANCED COMPUTER ARCHITECTURE** (Professional Elective - III) (Common to VLSI and ES)	**CO 1**	Identify the advanced design issues in concepts of computer architecture
		CO 2	Distinguish between RISC and CISC characteristics and memory hierarchy
		CO 3	Design structures of pipelined and superscalar systems
		CO 4	Distinguish between parallel and scalable architectures
		CO 5	Understand the architectural details of recent computer systems
22ES155	**BUILDING INTERNET OF THINGS** (Professional Elective - III)	**CO 1**	Understand the fundamental concepts of IoT, its characteristic and application
		CO 2	Learn the IoT architectures and the operation of sensors
		CO 3	Summarize the various wireless communication protocols used for IoT
		CO 4	Apply concepts of big data analysis to IoT and use the cloud for data storage
		CO 5	Analyze applications of IoT in real time scenario through case studies

22ES156	**COMMUNICATION BUSES AND INTERFACES** (Professional Elective - IV) (Common to VLSI and ES)	CO 1	Select a particular serial bus suitable for a particular application
		CO 2	Develop APIs for configuration, reading and writing data onto serial bus
		CO 3	Design and develop peripherals that can be interfaced to desired serial bus
		CO 4	Understand the wired communication protocols, and its formats
		CO 5	Explore the protocols of USB and its interface with the microcontroller
22ES157	**COMPUTER VISION AND DEEP LEARNING** (Professional Elective - IV)	CO 1	Understand the computer vision and image formation models
		CO 2	Familiarize with the methods for description of image using linear filters
		CO 3	Gain Knowledge about local image features and texture
		CO 4	Explore the machine learning and deep learning concepts
		CO 5	Analyze the major concepts of image recognition, classification and segmentation
22ES158	**DIGITAL SIGNAL PROCESSORS AND ARCHITECTURES** (Professional Elective - IV)	CO 1	Design, using MATLAB-based filter design techniques, FIR and IIR digital filters
		CO 2	Program and debug real-time signal processing algorithms in assembly language on a digital signal processor
		CO 3	Multidisciplinary teams, identify an useful DSP application, and then plan, design, implement and verify for a digital signal processor
		CO 4	Give an overview of entire digital signal processing techniques i.e. convolution, DFT, FFT, IIRFIR filters. The fixed and floating-point representation, different types of errors introduced during A-D and D-A converter stage
		CO 5	Introduce the DSP computational building blocks and special types of addressing modes compared to normal microprocessor
22ES181	**OPERATING SYSTEMS LAB**	CO 1	Program with Linux editor and shell commands
		CO 2	Program for Process and File Management
		CO 3	Develop the applications of Inter Process Communications
		CO 4	Program for RTOS Kernel objects
		CO 5	Develop Module for real time tasks
22ES182	**MACHINE LEARNING LAB**	CO 1	Familiarize python commands
		CO 2	Generate, analyze and interpret data using Python
		CO 3	Use Python to design and implement regression for machine learning applications
		CO 4	Use Python to design and implement classifiers for machine learning applications
		CO 5	Implement Neural Networks for classification
22ES183	**Mini project with Seminar**	CO 1	Collection and review of research material form literature.
		CO 2	Analysis of concepts in multidisciplinary research areas.
		CO 3	Preparation and presentation of technical topics with good communication skills.
Audit Course – II			
22HS156	**PEDAGOGY STUDIES** (Audit Course - Common to All Branches)	CO 1	Know theories of pedagogy and conceptual framework.
		CO 2	Learn pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
		CO 3	Practical usage of teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?
		CO 4	Evaluate teaching practices for bridging the gap between academics and the professional world.
		CO 5	Carry out research in pedagogical practices.
22HS157	**CONSTITUTION OF INDIA** (Audit Course - Common to All Branches)	CO 1	Understand the history of making the Indian Constitution and how the drafting committee completed
		CO 2	Analyze the constitutional rights and duties.
		CO 3	Understand the organs of Indian Governance, composition, qualifications, powers and functions and
		CO 4	Analyze the hierarchy of local administration of Indian constitution.
		CO 5	Understand the role and functioning of Election Commission.
22HS158	**STRESS MANAGEMENT BY YOGA** (Audit Course - Common to All Branches)	CO 1	Develop healthy mind in a healthy body thus improving social health also
		CO 2	Improve efficiency
22HS159	**PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS** (Audit Course - Common to All Branches)	CO 1	Study of Shrimad Bhagwad Geeta which helps the student in developing his personality and achieve the highest goal in life
		CO 2	Improve efficiency
		CO 3	Study of Neetishatakam that help in developing versatile personality.

				M. Tech. II Year I Semester
22ES201	**SYSTEM DESIGN WITH EMBEDDED LINUX** (Professional Elective - V)	CO 1		Understand Embedded Linux and its toolchain
		CO 2		Learn about Architecture of Embedded Linux and Linux startup sequence
		CO 3		Learn about Board support package and Embedded storage, also understand Embedded device
		CO 4		Explore porting Application and able to learn Real time Linux
		CO 5		Learn Building of kernel and applications. Able to use Integrated development environment
22ES202	**SOFT COMPUTING TECHNIQUES** (Professional Elective - V)	CO 1		Understand Soft Computing Techniques such as Neural Networks and Rough Sets
		CO 2		Use Associative Memory and Adaptive Resonance Theory.
		CO 3		Illustrate Fuzzy Set Theory and develop Fuzzy systems and applications.
		CO 4		Apply Genetic Algorithms and Modeling for finding solutions real lifeproblems.
		CO 5		Learn Hybrid systems that use combination of soft computing techniques
22ES203	**ARTIFICIAL INTELLIGENCE** (Professional Elective - V)	CO 1		Understand the difference between optimal reasoning versus human like reasoning
		CO 2		Gain the in-depth knowledge of the notions of state space representation, exhaustive search, heuristic search along with the time and space complexities
		CO 3		Understand different knowledge representation techniques and fuzzy logic for artificial intelligence
		CO 4		Learn the applications of Al: namely Game Playing, Theorem Proving, Expert Systems, Machine Learning and Natural. Language Processing
		CO 5		Learn various natural language processing and connectionist models
22IT209	**BUSINESS ANALYTICS** (Open Elective) (Common to All Branches)	CO 1		Understand knowledge of data analytics.
		CO 2		Demonstrate the ability of thinking critically in making decisions based on data and deep analytics.
		CO 3		CO3 : Express the ability to use technical skills in business analytics and predictive analysis.
		CO 4		Understand various forecasting and simulation models.
		CO 5		Evident the ability to translate data into clear, actionable insights and learn decisions strategies.
22CE208	**COST MANAGEMENT OF ENGINEERING PROJECTS** (Open Elective) (Common to All Branches)	CO 1		Understand the parameters involved in the strategic cost management process.
		CO 2		Comprehend the technical and non-technical activities involved in the Project Management.
		CO 3		Know the relation between project planning and cost analysis.
		CO 4		Identify different types of budgets and application in Civil Engineering projects.
		CO 5		Compare different costing methods and valuation techniques for different projects.
22CE209	**ENERGY FROM WASTE** (Open Elective) (Common to All Branches)	CO 1		Analyze the types of various energy conversion units from waste
		CO 2		Gain the knowledge on the solid waste disposal techniques
		CO 3		Understand the biochemical conversion of various residues
		CO 4		Familiarize the step-by-step process of Biogas Conversion
		CO 5		Understand E-waste Management in India
22ES231	**Dissertation Work Review–II**	CO 1		Apply knowledge to propose solutions to the multi domain and real time systems
		CO 2		Perform data collection, review research literature and project management
		CO 3		Use modern EDA tools and research knowledge for developing cost effective systems
		CO 4		Develop presentation and communication skills
				M. Tech. II Year II Semester
22ES281	**Dissertation Work Review–III**	CO 1		Apply knowledge to propose solutions to the multi domain and real time systems
		CO 2		Perform data collection, review research literature and project management
		CO 3		Use modern EDA tools and research knowledge for developing cost effective systems
		CO 4		Develop presentation and communication skills
22ES282	**Dissertation Viva-Voce**	CO 1		Apply knowledge to propose solutions to the multi domain and real time systems
		CO 2		Perform data collection, review research literature and project management
		CO 3		Use modern EDA tools and research knowledge for developing cost effective systems
		CO 4		Develop presentation and communication skills