DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE (AUTONOMOUS)

DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS

REGULATION - 2023

VISION

To inculcate in our students, strong values, develop fully integrated personality to face the future with confidence and courage that will uphold through their lives, to be an Institution of excellence in technology education and Research, to provide competent and ethical professional with a concern for society.

MISSION

M1: To impart quality technical education imbibed with proficiency and human values.

M2: To provide right ambience and opportunities for the MCA students to make them more efficient, creative, talented and globally competent professionals.

M3: To promote research and development in Department of MCA for the benefit of the society.

Program Educational Objectives (PEOs)

PEO1	To prepare students to excel in the computing profession by providing solid technical foundations in the field of computer applications.
PEO2	To provide students various computing skills like the analysis, design and development of innovative software products to meet the industry needs.
PEO3	To motivate students to pursue lifelong learning and to do research as computing professionals and scientists.

Program Outcomes (POs):

PSO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 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 the public health and safety, and the cultural, societal, and environmental considerations.

PO 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.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the

limitations.

PO 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.

PO 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.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with 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.

PO 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.

PO 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.

Program Specific Outcomes (PSOs):

PSO 1: Enable the students to select the suitable data model, appropriate architecture and platform to implement a system with good performance.

PSO 2: Enable the students to design and integrate various system based components to provide user interactive solutions for various challenges.

Course Outcomes (COs) of All Courses.

Autonomous Regulation – R2023

S.NO	SUBJECT CODE	COURSE TITLE
1	P23MAT12	Applied Probability and Statistics For Computer Science Engineers
2	P23CAT12	Advanced Data Structures and Algorithms
3	P23CAT13	Object Oriented Software Engineering
4	P23CAT14	Python Programming
5	P23CAT15	Advanced Computer Networks
6	P23CAT17	Machine Learning
7	P23CAP11	Advanced Data Structures Laboratory Using C++
8	P23CAP12	Python programming Laboratory
9	P23CAP13	Technical Seminar & Report Writing
10	P23CAT21	Advanced Database Technology
12	P23CAT22	Full Stack Web Development
13	P23CAT23	Cyber Security
14	P23CAT24	Big Data Analytics
15	P23MAE11	Operations Research
16	P23CAE13	Software Testing
17	P23CAE16	Advanced Operating System
18	P23CAE17	E-Learning
19	P23CAE18	Business Data Analytics
20	P23MAE11	Operations Research

21	P23CAE21	Embedded Systems
22	P23CAE22	Artificial Intelligence
23	P23CAE23	Soft computing
24	P23CAE24	Social Network Analysis
25	P23CAP21	Advanced Database Technology Laboratory
26	P23CAP22	Full Stack Web Development Laboratory
27	P23CAT32	Industry 4.0
28	P23CAT33	Research Methodology and IPR
29	P23CAT34	Data Science & Analytics
30	P23CAE33	DevOps and Micro services
31	P23CAE34	Cyber Forensics
32	P23CAE35	Bio Inspired Learning
33	P23CAE36	Deep Learning
34	P23CAE37	Advances in Networking
35	P23CAE41	Information Retrieval Techniques
36	P23CAE42	Digital Marketing
37	P23CAE43	Data visualization and Techniques
38	P23CAE44	Bio-informatics
39	P23CAE45	Adhoc and Sensor Network
40	P23CAO1	Integrated Water Resources Management
41	P23CAO2	Water, Sanitation and Health
42	P23CAO3	Principles of Sustainable Development
43	P23CAO4	Environmental Impact Assessment in Domestic sectors

44	P23CAO5	Vibration and Noise Control Strategies
45	P23CAO6	Energy Conservation and Management in domestic sectors
46	P23CAO7	Additive Manufacturing
47	P23CAO8	Electric Vehicle Technology
48	P23CAO9	New Product Development
49	P23CAO10	Sustainable Management
50	P23CAO11	Micro and Small Business Management
51	P23CAO12	Intellectual Property Rights
52	P23CAO13	Ethical Management
53	P23CAO14	IOT for Smart Systems
54	P23CAO15	Machine Learning and Deep Learning
55	P23CAO16	Renewable Energy Technology
56	P23CAO17	Smart Grid
57	P23CAO18	Big Data Analytics
58	P23CAO19	Internet of Things and Cloud
59	P23CAO20	Medical Robotics
60	P23CAO21	Embedded Automation
61	P23CAO22	Environmental Sustainability
62	P23CAO23	Textile Reinforced Composites
63	P23CAO24	Nanocomposite Materials
64	P23CAO25	IPR, Biosafety and Entrepreneurship
65	P23CAO26	Block Chain Technologies
66	P23CAO27	Professional Ethics in IT

67	P23CAO1	Integrated Water Resources Management
68	P23CAO2	Water, Sanitation and Health
69	P23CAO3	Principles of Sustainable Development
70	P23CAO4	Environmental Impact Assessment in Domestic sectors
71	P23CAO5	Vibration and Noise Control Strategies
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79	P23CAO13	Ethical Management
80	P23CAO14	IOT for Smart Systems
81	P23CAO15	Machine Learning and Deep Learning
82	P23CAO16	Renewable Energy Technology
83	P23CAO17	Smart Grid
84	P23CAP28	Cloud computing Laboratory
85	P23CAP29	Data Science Laboratory
86	P23CAP31	Project work – Phase I
87	P23CAP32	Project Work – Phase II

SEMESTER-I

P23MAT12 APPLIED PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE ENGINEERS

COURSE OUTCOMES:

CO1:	Apply the concepts of Linear Algebra to solve practical problems.
CO2:	Use the ideas of probability and random variables in solving engineering problems.
CO3:	Be familiar with some of the commonly encountered two dimension random Variables and be equipped for a possible extension to multivariate analysis.
CO4:	Use statistical tests in testing hypothesis on data
CO5:	Develop critical thinking based on empirical evidence and the scientific approach to knowledge development.
CO6:	Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.

P23CAT12 ADVANCED DATA STRUCTURES AND ALGORITHMS

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Design object oriented software using appropriate process models.
CO2	Differentiate software processes under waterfall and agile methodology.
CO3	Design and Develop UML diagrams for software projects.
CO4	Apply Design Patterns for a software process.
CO5	Categorize testing methods and compare different testing tools for software processes.
CO6	Analyze object oriented metrics and quality for software engineering processes.

P23CAT14 PYTHON PROGRAMMING

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Develop algorithmic solutions to simple computational problems
CO2	Represent compound data using Python lists, tuples and dictionaries.
CO3	Read and write data from/to files in Python Programs
CO4	Structure simple Python programs using libraries, modules etc.
CO5	Structure a program by bundling related properties and behaviors into individual objects.
CO6	Apply Python Programming using Problem Solving Approach.

P23CAT15 ADVANCED COMPUTER NETWORKS

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Understand advanced concepts and next generation networks
CO2	Analyze TCP/IP variants, network Algorithm's, Protocols and their functionalities
CO3	Comprehend features of SDN and its application to next generation systems
CO4	Analyze the performance of various server implementation
CO5	Analyze the concepts involved in the application layer.
CO6	Analyze the connectionless versus connection oriented protocols.

P23CAT17 MACHINE LEARNING

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Explain the basic concepts of machine learning.
CO2	Construct supervised learning models.
CO3	Construct unsupervised learning algorithms.
CO4	Evaluate and compare different models
CO5	Use smart contract for real world application in a machine learning platforms.
CO6	Use prediction markets and real world data feeds.

P23CAP11 ADVANCED DATA STRUCTURES LABORATORY USING C++

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Design and implement basic and advanced data structures extensively
CO2	Design algorithms using graph structures
CO3	Design and develop efficient algorithms with minimum complexity using design techniques
CO4	Develop programs using various algorithms.
CO5	Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem
CO6	Implementation of iteration function for tree traversal and Fibonacci.

P23CAP12 PYTHON PROGRAMMING LABORATORY

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Design and implement basic and advanced data structures extensively
CO2	Design algorithms using graph structures
CO3	Design and develop efficient algorithms with minimum complexity using design techniques
CO4	Develop programs using various algorithms.
CO5	Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem
CO6	Implementing programs using Strings

P23CAP13 TECHNICAL SEMINAR AND REPORT WRITING

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Listen and comprehend lectures in English
CO2	Articulate well and give presentations clearly
CO3	Participate in Group Discussions successfully
CO4	Communicate effectively in formal and informal writing
CO5	Write proficient essays and emails
CO6	completing listening comprehension exercises Listening to TED Talks.

SEMESTER: II

P23CAT21 ADVANCED DATABASE TECHNOLOGY

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Design a distributed database system and execute distributed queries.
CO2	Manage Spatial and Temporal Database systems and implement it in corresponding applications.
CO3	Use NoSQL database systems and manipulate the data associated with it.
CO4	Design XML database systems and validate with XML schema.
CO5	Apply knowledge of information retrieval concepts on web databases.
CO6	Apply Database Operations, Partitioning.

P23CAT22 FULL STACK WEB DEVELOPMENT

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Write client side scripting HTML, CSS and JS.
CO2	Implement and architect the server side of the web application.
CO3	Implement Web Application using NodeJS.
CO4	Architect NoSQL databases with MongoDB.
CO5	Implement a full–stack Single Page Application using React, NodeJS and MongoDB and deploy on Cloud.
CO6	Implementing side rendering with Templating Engines.

P23CAT23 CYBER SECURITY

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Develop a set of risk and security requirements to ensure that there are no gaps in an organization's security practices.
CO2	Achieve management, operational and technical means for effective cyber security.
CO3	Audit and monitor the performance of cyber security controls.
CO4	Spot gaps in the system and devise improvements.

P23CAT24 BIGDATA ANALYTICS

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Understand what Big Data, importance and various sources of data.
CO2	Describe the elements of big data–volume, variety, velocity and veracity.
CO3	Define distributed and parallel computing for big data.
CO4	Understand Map Reduce and its qualities and retain advanced Map Reduce thoughts.
CO5	Design and implement different technologies for processing big data in pig and hive.
CO6	Use Built–in functions.

P23MAE11 OPERATIONS RESEARCH

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Dynamic programming approach for Priority
CO2	Management employment smoothening
CO3	the stepping stone method and MODI method.
CO4	unbalanced Transportation problem
CO5	cargo loading and Reliability problems.
CO6	degeneracy and unbound solutions.

P23CAE13 SOFTWARE TESTING

COURSE OUTCOMES:	
On the successful completion of the course, student will be able to:	
CO1	Understand the fundamentals of software testing
CO2	Gain software testing experience by applying software testing knowledge and methods to practice-oriented software testing projects.
CO3	Analyze path testing concept.
CO4	Analyze state testing concept.
CO5	Execute programs and test data in Client-Server Architecture.
CO6	Analyze The art of Debugging.

P23CAE16 ADVANCED OPERATION SYSTEM

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Identify the features of distributed operating systems.
CO2	Demonstrate the various protocols of distributed operating systems.
CO3	Identify the different features of real time operating systems.
CO4	Discuss the features of mobile operating systems.
CO5	Discuss the features of cloud operating systems.
CO6	Understand about the distributed OS.

P23CAE17 E-LEARNING

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Explain influence of software architecture on business and technical activities
CO2	Summarize quality attribute workshop
CO3	Identify key architectural structure
CO4	Use styles and views to specify architecture
CO5	Design document for a given architecture
CO6	Use Architectural Description Languages

P23CAE18 BUSINESS DATA ANALYTICS

COURSE OUTCOMES:	
On the successful completion of the course, student will be able to:	
CO1	Identify the real world business problems and model with analytical solutions.
CO2	Solve analytical problems with relevant mathematics background knowledge.
CO3	Convert any real world decision making problem to hypothesis and apply suitable statistical testing.
CO4	Write and Demonstrate simple applications involving analytics using Hadoop and MapReduce
CO5	Use open source frameworks for modeling and storing data
CO6	Overview of Application development Languages for Hadoop

P23CAE21 EMBEDDED SYSTEM

COURSE OUTCOMES:	
On the successful completion of the course, student will be able to:	
CO1	Understand embedded systems concepts
CO2	Understand RTOS concepts
CO3	Identify the devices and buses used in embedded networking
CO4	Analyze on software development process life cycle and its models
CO5	Analyze and design various real time embedded systems using RTOS
CO6	Analyze embedded system for a smart card.

P23CAE22 ARTIFICIAL INTELLEGIENCE

COURSE OUTCOMES:	
On the successful completion of the course, student will be able to:	
CO1	After successful completion of this course
CO2	the students should be able to Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations
CO3	Apply basic principles of AI in solutions that require problem solving
CO4	inference, perception
CO5	knowledge representation, and learning.
CO6	Definition of Classical Planning

P23CAE23 SOFT COMPUTING

COURSE OUTCOMES:	
On the successful completion of the course, student will be able to:	
CO1	Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.
CO2	Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic
CO3	To understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations
CO4	Understand appropriate learning rules for each of the architectures and learn several

	neural network paradigms and its applications
CO5	Reveal different applications of these models to solve engineering and other problems.
CO6	Soft Computing for Coloripe Prediction.

P23CAE24 SOCIAL NETWORK ANALYSIS

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	create entities and relationships of data as network and do analysis.
CO2	Model and represent knowledge for social semantic Web.
CO3	Use extraction and mining tools for analyzing Social networks.
CO4	Collect data from various social media resources and analyze.
CO5	Develop personalized visualization for Social networks.
CO6	Supporting technologies for community maintained resources.

P23CAE25 DIGITAL IMAGE PROCESSING

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Digitize the input image using appropriate sampling and quantizing techniques
CO2	Transform the input images to various domains and classify the images
CO3	Enhance the images using spatial domain and frequency domain for better visual representation
CO4	To extract the features of a image by applying Morphological Image Processing techniques.
CO5	Analyze the different image compression techniques and its significance
CO6	Analyze JPEG compression standard.

P23CAP21 ADVANCED DATABASE TECHNOLOGY LABORATORY

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Design and implement advanced databases.
CO2	Use big data frameworks and tools.
CO3	Formulate complex queries using SQL.
CO4	Create an XML document and perform XQuery.
CO5	Query processing in Mobile databases using open source tools.
CO6	Apply knowledge of information retrieval concepts on web databases.

P23CAP22 FULL STACK WEB DEVELOPMENT LABORATORY

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	To implement and deploy the client side of the web application.
CO2	To develop and deploy server side applications using NodeJS.
CO3	To use Express framework in web development.
CO4	To implement and architect database systems in both NoSQL and SQL environments.
CO5	To develop a full stack single page application using React, NodeJS, and a Database and deploy using containers.
CO6	Create a form and validate the contents of the form using JavaScript.

SEMESTER III

P23CAT32 INDUSTRY 4.0

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Understand the basic concepts of Industry 4.0 and the other related fields.
CO2	Understand cyber physical system and the emerging applications.
CO3	Analyze the communication between intelligent work piece and its environment.
CO4	Implement the industry 4.0 to solve IT security issues in cloud application.
CO5	Analyze the basics of service oriented architecture.

CO6	Analyze IT security for cloud applications.

P23CAT33 RESEARCH METHODOLOGY AND IPR

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Analyze the Registration of patent agents.
CO2	Understand the Functions of UNESCO in IPR maintenance.
CO3	Analyze Questionnaires and Instruments.
CO4	Use Types and Features of IPR Agreement.
CO5	Understand the Benefits of patent, Concept, features of patent.
CO6	Use Hypotheses testing and Measures of Association.

P23CAT34 DATA SCIENCE & ANALYTICS

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Explain the data analytics pipeline
CO2	Describe and visualize data
CO3	Perform statistical inferences from data
CO4	Analyze the variance in the data
CO5	Build models for predictive analytics
CO6	Using data tables library.

P23CAE33 DEVOPS AND MICROSERVICES

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Select the Microservices design and apply the principles..
CO2	Apply Microservices in DevOps
CO3	Understand about DevOps and the common tools use din DevOps.

CO4	Develop and integrate projects using DevOps
CO5	Develop and integrate projects using DevOps
CO6	Deploy and monitor projects using DevOps

P23CAE34 CYBER FORENSICS

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Understand the basics of computer forensics
CO2	Apply a number of different computer forensic tools to a given scenario
CO3	Analyze and validate forensics data
CO4	Identify the vulnerabilities in a given network infrastructure
CO5	Implement real-world hacking techniques to test system security
CO6	Identify the Cell Phone and Mobile Devices Forensics

P23CAE35 BIO-INSPIRED LEARNING

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Improved Weighted Thresholded Histogram Equalization Algorithm
CO2	Digital Image Contrast Enhancement Using Bat Algorithm
CO3	Ground Glass Opacity Nodules Detection and Segmentation using Snake Model
CO4	Ant colony optimization toward feature selection
CO5	Importance of randomization
CO6	Modality and intermittent search strategy

P23CAE36 DEEP LEARNING

COURSE OUTCOMES:

At the end of the course the students would be able to	
CO1	Demonstrate the mathematical foundation of neural network
CO2	Describe the machine learning basics
CO3	Compare the different architectures of deep neural network
CO4	Build a convolutional neural network
CO5	Build and train RNN and LSTMs
CO6	Term Dependencies, Auto encoders

P23CAE37 ADVANCES IN NETWORKING

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	DescribehowIPv6 interacts with data link layer with IPv6 Structure and addressing methods.
CO2	To develop the strategies for deploying IPv6 in the place of IPv4
CO3	Analyze the security issues for IPv6 in emerging applications
CO4	Analyze the need for separation of data and control plane in Networking
CO5	To use SDN to enable and enhance NFV
CO6	To Use Big Data and Network Function Virtualization.

P23CAE41 INFORMATION RETRIEVAL TECHNIQUES

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Build an Information Retrieval system using the available tools.
CO2	Identify and design the various components of an Information Retrieval system.

CO3	Model an information retrieval system

CO4	Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
CO5	Design an efficient search engine and analyze the Web content structure.
CO6	Indexing and Searching Parallel and Distributed IR.

P23CAE42 DIGITAL MARKETING

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	To gain in sight on the concept of digital marketing and the role of a digital manager.
CO2	To understand and administer the website and the search engines.
CO3	To understand how to use MISC and Google Webmaster tools.
CO4	To understand the concepts of lead management and digital marketing.
CO5	To gain knowledge on the latest digital marketing trends
CO6	To understand Affiliate Marketing.

P23CAE43 DATA VISUALIZATION AND TECHNIQUES

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Describe principles of visual perception
CO2	Apply visualization techniques for various data analysis tasks – numerical data
CO3	Apply visualization techniques for various data analysis tasks– Non numerical data
CO4	Design effective visualization techniques for different problems
CO5	Design information dashboard.

CO6	Apply visualization techniques find issue of Hardware.

P23CAE44 BIO INFORMATICS

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Analysis the Sequence alignment
CO2	Analysis the effect of scoring schemes
CO3	Understand the procedures to access these databases and to make use of the tools available
CO4	Analysis the scoring matrices for amino acid sequence alignment
CO5	Understand the Multiple sequence alignment
CO6	Understand the nucleic acid sequence databases

P23CAE45 ADHOC AND SENSOR NETWORK

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Identify different issues in wireless ad hoc and sensor networks
CO2	To analyze protocols developed for ad hoc and sensor networks
CO3	To identify and understand security issues in ad hoc and sensor networks.

CO4	To identify Key Distribution and Management
CO5	To identify Routing Protocols
CO6	To identify Network Layer QoS solutions

P23CAP28 CLOUD COMPUTING LABORATORY

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Show an ability to upload/download sensor data on cloud and server.
CO2	**Work with serverless architectures** and explore services like AWS Lambda, Azure Functions, or Google Cloud Functions..
CO3	use and investigate various cloud computing services
CO4	utilize productivity software, create and develop cloud apps.
CO5	install a program on cloud platform

P23CAP29 DATA SCIENCE LABORATORY

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	**Understand and apply R programming concepts** for data manipulation, analysis, and visualization.
CO2	**Import, clean, and preprocess datasets** using R and RStudio for efficient data analysis.
CO3	**Understand and apply R programming concepts** for data manipulation, analysis, and visualization.
CO4	Analyze the Correlation and Covariance.
CO5	Understand the Visualizations and formats
CO6	Understand the basic Statistical and Probability measures for data science.

LIST OF OPEN ELECTIVE FOR PG PROGRAMMES SEMESTER III

P23CAO1 INTEGRATED WATER RESOURCES MANAGEMENT

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Describe the context and principles of IWRM; Compare the conventional and integrated Ways of water management.
CO2	Select the best economic option among the alternatives; illustrate the pro sand cons of PPP Through case studies.
CO3	Apply law and governance in the context of IWRM.
CO4	Discuss the link ages between water–health; develop a HIA framework.
CO5	Analyze how the virtual water concept pave way to alternate policy options.
CO6	Analyze Health impact assessment of water resources development projects.

P23CAO2 WATER– SANITATION AND HEALTH

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Capture to fundamental concepts and terms which are to be applied and understood All through the study.
CO2	Comprehendthevariousfactorsaffectingwatersanitationandhealththroughthelens of third world scenario.
CO3	Critically analyse and articulate he underlying common challenges in water–sanitation and health.
CO4	Acquire knowledge on the attributes of governance and its say on water sanitation and

	health.
CO5	Gainanoverarchinginsightintotheaspectsofsustainableresourcemanagementin The absence of a clear level playing field in the developmental aspects.
CO6	Analyze the Capacity of Building.

P23CAO3 PRINCIPLESOFSUSTAINABLEDEVELOPMENT

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Explain and evaluate current challenges to sustainability– including modern world social– environmental– and economic structures and crises.
CO2	Identify and critically analyze the social environmental– and economic dimensions of sustainability in terms of UN Sustainable development goals
CO3	Develop a fair understanding of the social– economic and ecological linkage of Human well being– production and consumption
CO4	Evaluate sustainability issues and solutions using a holistic approach that focuses on connections between complex human and natural systems.
CO5	Integrate knowledge from multiple sources and perspectives to understand environmental limits governing human societies and economies and social justice dimensions of sustainability.
CO6	Science and Technology for sustainable development.

P23CAO4 ENVIRONMENTAL IMPACT ASSESSMENT

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Understand need for environmental clearance– its legal procedure– need of EIA–

	its types– stakeholders and their roles.
CO2	Understand various impact identification methodologies– prediction techniques and model of impacts on various environments.
CO3	Understand relationship between social impacts and change in community due to development activities and rehabilitation methods
CO4	Document the EIA findings and prepare environmental management and monitoring plan
CO5	Identify– predict and assess impacts of similar projects based on case studies
CO6	common hazardous waste facilities

P23CAO5 VIBRATION AND NOISE CONTROL STRATEGIES

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	apply the basic concepts of vibration in damped and un damped systems
CO2	apply the basic concepts of noise and to understand its effects on systems
CO3	select the instruments required for vibration measurement and its analysis
CO4	select the instruments required for noise measurement and its analysis.
CO5	recognize the noise sources and to control the vibration levels in a body and to control noise under different strategies
CO6	Apply Frequency Measuring Instruments

P23CAO6 ENERGY CONSERVATION AND MANAGEMENT IN DOMESTIC SECTORS

COURSE OUTCOMES:
At the end of the course the students would be able to

CO1	Understand technical aspects of energy conservation scenario.
CO2	Energy audit in any type for domestic buildings and suggest the conservation measures.
CO3	Perform building load estimates and design the energy efficient landscape system.
CO4	Gain knowledge to utilize an appliance/device sustainably.
CO5	Understand the status and current technological advancement in energy storage field.
CO6	Understand the Hydrogen energy storage & Super capacitors

P23CAO7 ADDITIVE MANUFACTURING

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Understand pattern and mould
CO2	Business Opportunities and Future Directions
CO3	Additive Manufacturing Computer Aided Tissue Engineering
CO4	Laminated Object Manufacturing
CO5	Part Orientation and Support Structure Generation
CO6	Advantages and Limitations.

P23CAO8 ELECTRIC VEHICLE TECHNOLOGY

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Dynamic equationof vehicle motion
CO2	Maximum tractive effort
CO3	hybrid electric vehicles and range extended hybrid electric vehicles
CO4	Concepts of hybrid electric drive train
CO5	Flywheel technology
CO6	Acceleration performance

P23CAO9 NEW PRODUCT DEVELOPMENT

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Apply the principles of generic development process; and understand the organization structure for new product design and development.
CO2	Identify opportunity and plan for new product design and development
CO3	Conduct customer need analysis; and set product specification for new product design and development.
CO4	Generate– select– and test the concepts for new product design and development.
CO5	Apply the principles of Industrial design and prototype for design and develop new products.
CO6	Apply Seven Step activities of concept testing.

P23CAO10 SUSTAINABLE MANAGEMENT

COURSE OUTCOMES:
At the end of the course the students would be able to

CO1	An understanding of sustainability management as an approach to aid in evaluating.
CO2	An understanding of corporate sustainability and responsible Business Practices
CO3	Knowledge and skills to understand– to measure and interpret sustainability performances.
CO4	Knowledge of innovative practices in sustainable business and community management
CO5	Deep understanding of sustainable management of resources and commodities
CO6	Emergingtrends in sustainable management

P23CAO11 MICRO AND SMALL BUSINESS MANAGEMENT

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Familiarize the students with the concept of small business
CO2	In depth knowledge on small business opportunities and challenges
CO3	Ability to devise plans for small business by building the right skills and marketing strategies
CO4	Identify the funding source for small start ups
CO5	Business evaluation for buying and selling of small firms
CO6	Advantages and disadvantages of buying an established small firm

P23CAO12 INTELLECTUAL PROPERTY RIGHTS

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Understanding of intellectual property and appreciation of the need to protect it

CO2	Awareness about the process of patenting
CO3	Understanding of the statutes related to IPR
CO4	Ability to apply strategies to protect intellectual property
CO5	Ability to apply models for making strategic decisions related to IPR
CO6	IP Valuation and IP Valuation Models

P23CAO13 ETHICAL MANAGEMENT

COURSE OUTCOMES	
CO1	Role modelling and influencing the ethical and cultural context.
CO2	Respond to ethical crises and proactively address potential crises situations.
CO3	Understand and implement stakeholder management decisions.
CO4	Develop the ability– knowledge– and skills for ethical management.
CO5	Develop practical skills to navigate– resolve and thrive in management situations
CO6	Resolving issues and preventing unethical management

P23CAO14 IOT FOR SMART SYSTEMS

COURSE OUTCOMES	
CO1	Analyze the concepts of IOT and it present developments.
CO2	Compare and contrast different platforms and infrastructures available for IOT
CO3	Explain different protocols and communication technologies used in IOT
CO4	Analyze the big data analytic and programming of IOT
CO5	Implement IOT solutions for smart applications

CO6	Productivity Applications

P23CAO15 MACHINE LEARNING AND DEEP LEARNING

COURSE OUTCOMES	
At the end of the course the student will be able to	
CO1	Illustrate the categorization of machine learning algorithms.
CO2	Compare and contrast the types of neural network architectures– activation functions
CO3	Acquaint with the pattern association using neural networks
CO4	Elaborate various terminologies related with pattern recognition and architectures of convolution neural networks.
CO5	Construct different feature selection and classification techniques and advanced neural network architectures such as RNN– Auto encoders– and GANs.
CO6	Time distributed layers

P23CAO16 RENEWABLE ENERGY TECHNOLOGY

COURSE OUTCOMES	
After completion of this course– the student will be able to:	
CO1	Demonstrate the need for renewable energy sources.
CO2	Develop a stand–alone photo voltaic system and implement a maximum power pointtracking in the PV system.
CO3	Design a stand–alone and Grid connected PV system.
CO4	Analyze the different configurations of the wind energy conversion systems.
CO5	Realize the basic of various available renewable energy sources
CO6	Classification of wind turbine

P23CAO17 SMART GRID

COURSE OUTCOME	
Students able to	
CO1	Relate with the smart resources– smart meters and other smart devices.
CO2	Explain the function of Smart Grid.
CO3	Experiment the issues of Power Quality in Smart Grid.
CO4	Analyze the performance of Smart Grid.
CO5	Recommend suitable communication networks for smart grid applications
CO6	Architecture and Standards

P23CAO18 BIG DATA ANALYTICS

COURSE OUTCOMES	
CO1	understand the basics of big data analytics
CO2	Ability to use Hadoop– Map Reduce Framework.
CO3	Ability to identify the areas for applying big data analytics for increasing the business outcome.
CO4	gain knowledge on R language
CO5	Contextually integrate and correlate large amounts of information to gain faster insights.
CO6	Overview of Programming structures

P23CAO19 INTERNET OF THINGS AND CLOUD

COURSE OUTCOMES:	
At the end of the course– the student will be able to	
CO1	Understand the various concept of the IOT and their technologies
CO2	Develop IOT application using different hardware platforms
CO3	Implement the various IOT Protocols
CO4	Understand the basic principles of cloud computing
CO5	Develop and deploy the IOT application into cloud environment
CO6	Role of Cloud Computing in IOT

P23CAO20 MEDICAL ROBOTICS

COURSE OUTCOMES	
CO1	Describe the configuration– applications of robots and the concept of grippers and actuators
CO2	Explain the functions of manipulators and basic kinematics
CO3	Describe the application of robots in various surgeries
CO4	Design and analyze the robotic systems for rehabilitation
CO5	Design the wearable robots
CO6	Based Gait Rehabilitation Robots

P23CAO21 EMBEDDED AUTOMATION

COURSE OUTCOMES:	
On successful completion of this course– students will be able to	
CO1	analyze the 8–bit series microcontroller architecture– features and pin details
CO2	write embedded C programs for embedded system application

CO3	Design and develop real time systems using AVR microcontrollers
CO4	Design and develop the systems based on vision mechanism
CO5	Design and develop a real time home automation system
CO6	Voice Controlled Home Automation

P23CAO22 ENVIRONMENTAL SUSTAINABILITY

COURSE OUTCOMES:	
On successful completion of this course– students will be able to	
CO1	Valuing the Environment: Concepts
CO2	The Population Problem
CO3	Acid Rain and Atmospheric Modification
CO4	Sustainable Development
CO5	Solid Waste and Recycling
CO6	Visions of the Future

P23CAO23 TEXTILE REINFORCED COMPOSITES

COURSE OUTCOMES:	
On successful completion of this course– students will be able to	
CO1	classification and application
CO2	fibers and its properties
CO3	Optimization of matrices

CO4	Methods of composites manufacturing for both thermos plastics and thermos sets
CO5	compression– inter laminar shear stress
CO6	Macro mechanics of laminate

P23CAO24 NANOCOMPOSITE MATERIALS

COURSE OUTCOMES:	
On successful completion of this course– students will be able to	
CO1	Structure and Physical properties
CO2	Nanotechnology in Textiles and Cosmetics–
CO3	Their final properties and functionality
CO4	techniques and their final properties and functionality
CO5	Nano–fillers embedded polypropylene fibers Soil repellence
CO6	UV protection using titanium oxide

P23CAO25 IPR– BIOSAFETY AND ENTREPRENEURSHIP

COURSE OUTCOMES:	
On successful completion of this course– students will be able to	
CO1	National Regulations and relevant International Agreements including Cartegana Protocol.
CO2	Characteristics of successful Entrepreneur
CO3	Searching International Databases
CO4	Entrepreneurship Development Programmes
CO5	Recommended Biosafety Levels for Infectious Agents and Infected Animals
CO6	Launching Of Small Enterprise

P23CAO26 BLOCKCHAIN TECHNOLOGIES

COURSE OUTCOMES:	
At the end of the course the students would be able to	
CO1	Identify Block Chain as Data structure and Distribution Data
CO2	Implement the transactions of Crypto currency
CO3	identify the different ways to achieve Block chain Technology
CO4	Design and build smart contracts
CO5	Use smart contract for real world application in a Blockchain Platform
CO6	Use Prediction Markets and Real World Data Feeds.

P23CAO27 PROFESSIONAL ETHICS IN IT

COURSE OUTCOMES:
At the end of the course the students would be able to

CO1	Examine situations and to internalize the need for applying ethical principles, values to tackle various situations.
CO2	Develop a responsible attitude towards the use of computers as well as the technology.
CO3	Envision the societal impact on the products/ projects they develop in their career.
CO4	Understand the code of ethics and standards of computer professionals.
CO5	Analyze professional responsibility and empower access to information in the workplace.
CO6	Understand about the Cybersquatting.