CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

VISION and MISSION of the INSTITUTE

Vision:

To be a center of excellence in technical education and research

Mission:

To address the emerging needs through quality technical education and advanced research

Program Educational Objectives (PEOs)

Post graduates of AI & DS will be able to

1. Undertake careers in industry involving innovation and problem solving using Artificial Intelligence and Data Science technologies
2. Possess research orientation and adopt lifelong learning.

Program Specific Outcomes (PSOs)

After successful completion of the program, students will be able to:

1. Develop solutions to real world problems in the emerging areas of Manufacturing, Agriculture, Health-care, Education and Cyber Security.
2. Systematically investigate and provide Artificial Intelligence and Data Science based solutions in multidisciplinary domains.

Program Outcomes:

At the end of the program, students will be able to:

PO1: Independently carry out research/investigation and development work to solve practical problems.

PO2: Write and present a substantial technical report/document.

PO3: 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

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Department of Artificial Intelligence and Data Science
Course Outcomes
Academic Year 2023-2024
M.Tech. (Artificial Intelligence and Data Science)

S. No.	Year / Sem	Name of the Course	
1.	I/I	**23MTC101 : Mathematical Foundations for Data Science**	
		23MTC101.1	Identify the Basis and Dimension of vector space.
		23MTC101.2	Calculate the Rank and Nullity of linear transformation.
		23MTC101.3	Determine the stochastic measures for the process
		23MTC101.4	Infer the estimation of the statistical Parameters.
		23MTC101.5	Apply the appropriate model for Regression diagnostic of the raw data.
2.	I/I	**23ADC101 : Artificial Intelligence**	
		23ADC101.1	Understand the basics of AI and concept of Intelligent Agent.
		23ADC101.2	Compare the advanced Searching techniques.
		23ADC101.3	Understand and apply the first-order and second-order predicate Logic to infer the knowledge
		23ADC101.4	Analyse classical and real-world planning approaches
		23ADC101.5	Understand the uncertainty and apply the probabilistic reasoning models
3.	I/I	**23ME M103 : RESEARCH METHODOLOGY AND IPR**	
		23MEM103.1	Define research problem, review and asses the quality of literature from various sources
		23ME M103.2	Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
		23ME M103.3	Collect the data by various methods: observation, interview, questionnaires for patent and copyrights
		23ME M103.4	Analyze problem by statistical techniques: ANOVA, F-test,

			Chi-square
		23ME M103.5	Understand apply for patent and copyrights
4.	I/I	**23ADE101 : Soft Computing**	
		23ADE101.1	Understand soft computing techniques and their role in building intelligent machines
		23ADE101.2	Demonstrate fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
		23ADE101.3	Apply genetic algorithms to provide optimized solutions.
		23ADE101.4	Explain rough set theory and swarm intelligence techniques to solve problems.
		23ADE101.5	Build real time applications using soft computing techniques
5.	I/I	**23ADE102 : Cloud Computing**	
		23ADE102.1	Understand different types of cloud computing concepts and the techniques..
		23ADE102.2	Determine the issues related to scaling, capacity planning and load balancing.
		23ADE102.3	Assess the cloud infrastructure, information security and compliance issues.
		23ADE102.4	Analyse the Portability and Interoperability issues of cloud virtualization
		23ADE102.5	Evaluate the importance of SOA and cloud database technology
6.	I/I	**23ADE103 Information Retrieval Systems**	
		23ADE103.1	Understand different Information Retrieval models.
		23ADE103.2	Evaluate the performance of queries for retrieval of data.
		23ADE103.3	Analyse the methods for efficient information retrieval.
		23ADE103.4	Perform text operations and build indices.
		23ADE103.5	Analyse searching techniques and understand Parallel and Distributed IR models.
7.	I/I	**23ADE104 Time Series Analysis & Forecasting**	

		23ADE104.1	Understand the time series and non-time series data and choose the right approach to solve a given problem.
		23ADE104.2	Apply advanced Pre-processing and visualization techniques on time series data.
		23ADE104.3	Analyze the various smoothing methods such as first, second and higher-ordered exponentials.
		23ADE104.4	Understand the auto-regressive models.
		23ADE104.5	Develop forecasting models for time series data using different RNNs such as Vanilla RNN, Gated Recurrent Units, and Long Short-Term Memory units.
8.	**I/I**	**23ADE105 Social Network Analytics**	
		23ADE105.1	Understand the basics of social network analysis.
		23ADE105.2	Analyze Ontology representation of social network data.
		23ADE105.3	Apply supervised and unsupervised algorithms on social networks
		23ADE105.4	Interpret the semantic content of social media data.
		23ADE105.5	Build social network model for real time applications.
9.	**I/I**	**23ADE106 Block Chain Technology**	
		23ADE106.1	Demonstrate the concepts of blockchain technology.
		23ADE106.2	Understand Bitcoin, working with consensus in Bitcoin.
		23ADE106.3	Design Permissioned Blockchains.
		23ADE106.4	Illustrate the concepts of Cryptocurrency, Ethereum virtual machine, and cryptocurrency regulations.
		23ADE106.5	Design smart contracts using Hyperledger Fabric frameworks.
10.	**I/I**	**23ADE107 Intelligent Bio Informatics**	
		23ADE107.1	Recognize the purpose of molecular biology and challenges in the Bioinformatics
		23ADE107.2	Analyse the importance of Artificial Intelligence and its techniques related to bioinformatics.
		23ADE107.3	Enumerate different techniques of classification and

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			clustering with respect to bioinformatics applications
		23ADE107.4	Comprehend the methods related to neural networks and genetic algorithms.
		23ADE107.5	Elaborate the concepts of Genetic Programming, Cellular Automata and Hybrid methods
11.	I/I	**23ADE108 Recommender Systems**	
		23ADE108.1	Understand the fundamentals of information retrieval and recommender systems.
		23ADE108.2	Analyse collaborative filtering and model-based recommenders.
		23ADE108.3	Examine the suitable content-based recommenders for real time applications.
		23ADE108.4	Design hybrid recommendation system for a particular application.
		23ADE108.5	Evaluate recommender systems by means of various measures in different application domains
12.	I/I	**23ADE109 Reinforcement Learning**	
		23ADE109.1	Understand the Reinforcement Learning, Multi Armed Bandits and Finite Markov Decision process.
		23ADE109.2	Apply Monte Carlo, Temporal Difference methods for policy evaluation and prediction.
		23ADE109.3	Analyse the Tabular Methods and On-policy Prediction with Approximation.
		23ADE109.4	Understand On-policy Control and Off-policy Methods with Approximation.
		23ADE109.5	Apply Eligibility Traces, Policy Gradient Methods to improve the performance of reinforcement learning.
13.	I/I	**23ADE110 GPU Computing**	
		23ADE110.1	Outline the developments in the evolution of multi-core architectures and parallel programming paradigms feature vectors for the Images.
		23ADE110.2	Comprehend the various programming languages and memory hierarchy for parallel computing platforms.
		23ADE110.3	Compare and contrast the features of parallel programming languages such as OpenMP and CUDA.

		23ADE110.4	Write parallel programs using OpenMP and CUDA
		23ADE110.5	Evaluate efficiency trade-offs among alternative parallel computing architectures for an efficient parallel Application design.
14.	**I/I**	**23ADE111 Scalable Algorithms and Systems for Data Analysis**	
		23ADE111.1	Outline the characteristics of massive data and primitives of scalable algorithms.
		23ADE111.2	Apply geometric and clustering techniques for local computation of data.
		23ADE111.3	Solve large scale data science problems related to link analysis and finding similar items.
		23ADE111.4	Examine the need of scalable systems for large scale data science such as web advertising and recommendation systems.
		23ADE111.5	Determine useful information to be gained by analyzing the large-scale data that is derived from social networks
14.	**I/I**	**23ADE112 Cyber Physical Systems**	
		23ADE112.1	Understand the basics of cyber-physical system and Industrial revolution 4.0 concepts
		23ADE112.2	Understand the Cyber Physical System Hardware Platform
		23ADE112.3	Analyse the working of Sensors, Actuators and Sensor Networks
		23ADE112.4	Analyse the concepts involved in Cyber Physical Systems Security
		23ADE112.5	Design CPS requirements based on operating system and hardware architecture constraints.
15.	**I/I**	**23ADE113 Explainable AI**	
		23ADE113.1	Describe the machine learning application's context and why explainability might help.
		23ADE113.2	Understand the concepts of model validation, evaluation, and performance visualization for both supervised and unsupervised learning.
		23ADE113.3	Demonstrate post hoc explainability techniques through a self-chosen set of programming platforms.

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		23ADE113.4	Illustrate the results from Explainable deep learning techniques and suggest how it helps the problem context.
		23ADE113.5	Describe the comprehension of challenges and future related to Explainable AI
16.	**I/I**	**23ADE114 Advanced Data Structures**	
		23ADE114.1	Analyze the time complexity and performance of different algorithms.
		23ADE114.2	Compare and contrast the different sorting algorithms based on time complexity
		23ADE114.3	Select suitable data structures and algorithms, and use it to design algorithms for a specific problem.
		23ADE114.4	Comprehend and analyze the different graph algorithms and apply graphs to model engineering problems.
		23ADE114.5	Apply suitable algorithm design techniques to solve real-world problems.
17.	**I/I**	**23ADE115 High Performance Computing**	
		23ADE115.1	Elucidate on advanced processors
		23ADE115.2	Analyze the working of cluster and sky computing
		23ADE115.3	Apply Parallel Algorithmic concepts to solve problems
		23ADE115.4	Develop applications using Open MP and MPI
		23ADE115.5	Develop applications using Open MP and MPI
18.	**I/I**	**23ADE116 Ethics in AIsss**	
		23ADE116.1	Learn about morality and ethics in AI
		23ADE116.2	Acquire the knowledge of real time application ethics, issues and its challenges.
		23ADE116.3	Understand the ethical harms and ethical initiatives in AI
		23ADE116.4	Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems
		23ADE116.5	Understand the concepts of Roboethics and Morality with professional responsibilities.
		23ADE116.6	Learn about the societal issues in AI with National and

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			International Strategies on AI
19.	I/I	**23ADE117 : Digital Image Processing and Analysis** **Program Elective-2 and Elective-4 Courses (with Lab)**	
		23ADE117.1	Explain the fundamentals of digital image processing, colour models and intensity transformations
		23ADE117.2	Demonstrate smoothing and sharpening in both spatial and frequency domains, image restoration and reconstruction
		23ADE117.3	Demonstrate the usage of wavelets and other image transforms
		23ADE117.4	Compare image compression methods, Huffman Coding, Arithmetic Coding, LZW Coding, Block Transform Coding
		23ADE117.5	Recommend proper use of morphological and segmentation algorithms and Build an image pattern classification system using feature extraction and image pattern classification techniques
20.	I/I	**23ADE118 : CYBER SECURITY** **Program Elective-2 and Elective-4 Courses (with Lab)**	
		23ADE118.1	Infer legal and global perspectives of Cybercrimes.
		23ADE118.2	Examine cybercrime methods, tools, attacks, and thefts.
		23ADE118.3	Explore the vulnerability mechanisms and Injection Tools.
		23ADE118.4	Demonstrate Network Défense tools used in investigations.
		23ADE118.5	Explore web security tools
21.	I/I	**23ADE119 : BIG DATA ANALYTICS** **Program Elective-2 and Elective-4 Courses (with Lab)**	
		23ADE119.1	Design of Hadoop Distributed Files system and build applications using MapReduce
		23ADE119.2	Perform analysis on large datasets using Pig and Hive
		23ADE119.3	Model the data using NoSQL and MongoDB
		23ADE119.4	Develop applications of Parallel programming with Spark and Spark SQL
		23ADE119.5	Develop machine learning solutions using Spark and Spark GraphX.

HEAD OF THE DEPARTMENT
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22.	I/I	**23ADE120 : AUGMENTED AND VIRTUAL REALITY** **Program Elective-2 and Elective-4 Courses (with Lab)**	
		23ADE120.1	Describe the basic concepts of Virtual Reality and 3D Computer Graphics.
		23ADE120.2	Apply 3D manipulation techniques in Virtual Reality.
		23ADE120.3	Analyse Development Tools and Frameworks in Virtual Reality
		23ADE120.4	Develop a Virtual Reality application.
		23ADE120.5	Evaluate Augmented Reality Systems
23.	I/I	**23ADE121 : PREDICTIVE ANALYTICS WITH 'R'** **Program Elective-2 and Elective-4 Courses (with Lab)**	
		23ADE121.1	Comprehend predictive modeling and assess the performance
		23ADE121.2	Apply regression techniques and analyse the performance
		23ADE121.3	Demonstrate Support Vector Machines and build an efficient networking model
		23ADE121.4	Analyse ensemble methods by choosing Tree based classifiers
		23ADE121.5	Select appropriate probabilistic Graphic models and identify topics through topic modelling
24.	I/I	**23ADE122 : NATURAL LANGUAGE PROCESSING** **Program Elective-2 and Elective-4 Courses (with Lab)**	
		23ADE122.1	Comprehend the concept of natural language processing, its challenges and applications
		23ADE122.2	Demonstrate skills in natural language processing using Natural Language Toolkit (NLTK).
		23ADE122.3	Build and evaluate classifiers for textual data.
		23ADE122.4	Analyse linguistic structure of text and build feature-based grammar.
		23ADE122.5	Determine the semantics of sentences using WordNet and Treebank.
25.	I/I	**23ADE123 : ROBOTIC PROCESS AUTOMATION** **Program Elective-2 and Elective-4 Courses (with Lab)**	
		23ADE123.1	Describe the Automation Anywhere Enterprise Platform, Architecture, Components and its features.

		23ADE123.2	Demonstrate various Basic Commands to build Bots for automating simple processes.
		23ADE123.3	Apply manipulation techniques for data extraction and integration.
		23ADE123.4	Select the appropriate Recorders for web scrapping and capturing objects.
		23ADE123.5	Analyse various aspects of Meta Bots in Visual captures.
26.	**I/I**	**23ADE124 : FEDERATED MACHINE LEARNING** **Program Elective-2 and Elective-4 Courses (with Lab)**	
		23ADE124.1	Knowledge of the basic concepts, architecture, and applications of FL.
		23ADE124.2	Understanding of new research and application trends in FL.
		23ADE124.3	Analyze distributed Machine Learning
		23ADE124.4	Analyze horizontal federated learning
		23ADE124.5	Understand the significance of Federated Learning for Vision, Language, and Recommendation
27.	**I/I**	**23ADE125 : Internet of Things** **Program Elective-2 and Elective-4 Courses (with Lab)**	
		23ADE125.1	Describe the terminology, protocols, Communication models and APIs of IoT.
		23ADE125.2	Analyse the various IoT enabling technologies, Levels, M2M and Domain specific Applications.
		23ADE125.3	Design IoT platform and interpret the Case Studies.
		23ADE125.4	Develop IoT applications using Raspberry Pi3.
		23ADE125.5	Create web applications using Django frame work.
28.	**I/I**	**23ADE126 : Advanced Algorithms** **Program Elective-2 and Elective-4 Courses (with Lab)**	
		23ADE126.1	Understand the basic data structures and analyse time and space complexities of algorithms.
		23ADE126.2	Identify appropriate algorithmic strategy for solving problems and understand basics of graphs.

		23ADE126.3	Analyse shortest path algorithms in weighted graphs and flow control techniques in Network flows.
		23ADE126.4	Understand text processing concepts and cryptographic algorithms.
		23ADE126.5	Formulate computational geometry solutions using Range Trees, Quad trees and Convex Hulls.
29.	**I/I**	**23ADE127 : Digital Image Processing and Analysis Lab (Laboratory-2 & 4 (Based on Elective-2 & 4 Courses)*)**	
		23ADE127.1	Demonstrate the smoothing and sharpening operations in both the spatial and frequency domains, image restoration and reconstruction
		23ADE127.2	Demonstrate the usage of wavelets and other image transforms
		23ADE127.3	Compare image compression methods Huffman Coding, Arithmetic Coding, LZW Coding, Block Transform Coding
		23ADE127.4	Evaluate the use of morphological and segmentation algorithms and Build an image pattern classification system
30.	**I/I**	**23ADE128 : CYBER SECURITY LAB (Laboratory-2 & 4 (Based on Elective-2 & 4 Courses)*)**	
		23ADE128.1	Examine Port scanning to determine the services are running on the systems.
		23ADE128.2	Illustrate the Netcat and Open VAS and uses such as simple sniffing abilities, and port redirection.
		23ADE128.3	Demonstrate SQL injection technique often used to attack data-driven applications.
		23ADE128.4	Experiment with Cross-site Scripting (XSS), a client-side attack that leverages the user's browser to execute malicious code.
		23ADE128.5	Design and develop an intrusion prevention system capable of real-time traffic analysis and packet logging.
31.	**I/I**	**23ADE129 : BIG DATA ANALYTICS LAB (Laboratory-2 & 4 (Based on Elective-2 & 4 Courses)*)**	
		23ADE129.1	Understand Hadoop working environment
		23ADE129.2	Work with big data applications in multi node clusters using MapReduce
		23ADE129.3	Write scripts using Pig to solve real world problems.

		23ADE129.4	Write queries using Hive to analyse the datasets
		23ADE129.5	Use Spark working environment to solve real world problems.
32.	**I/I**	**23ADE130 : AUGMENTED AND VIRTUAL REALITY LAB (Laboratory-2 & 4 (Based on Elective-2 & 4 Courses)*)**	
		23ADE130.1	Build AR and VR Apps with Unity
		23ADE130.2	Develop Mobile VR in Unity
		23ADE130.3	Demonstrate Augmented Reality SpacePose Tracking and Environment Detections
		23ADE130.4	Design the UX in Augmented Reality
		23ADE130.5	Create AR Content with Unity and Vuforia
33.	**I/I**	**23ADE131 : PREDICTIVE ANALYTICS WITH 'R' LAB (Laboratory-2 & 4 (Based on Elective-2 & 4 Courses)*)**	
		23ADE131.1	Demonstrate the basic functions and implement R packages and commands
		23ADE131.2	Apply regression analysis methods and infer the problems
		23ADE131.3	Develop applications of neural networks and evaluate the techniques
		23ADE131.4	Evaluation of ensemble methods
		23ADE131.5	Build a system to perform topic modeling on real time datasets
34.	**I/I**	**23ADE132 : NATURAL LANGUAGE PROCESSING LAB (Laboratory-2 & 4 (Based on Elective-2 & 4 Courses)*)**	
		23ADE132.1	Apply the concept of natural language processing (NLP) using Natural Language Toolkit (NLTK).
		23ADE132.2	Build text corpora with tokenization, Stemming, Lemmatization and apply visualization techniques.
		23ADE132.3	Evaluate the classifiers and choose the best classifier.
		23ADE132.4	Access WordNet and Treebank and apply regular expression pattern recognition methods.
		23ADE132.5	Create Artificial Intelligence applications for text data.

HEAD OF THE DEPARTMENT
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INSTITUTE OF TECHNOLOGY,
Hyderabad-500075, Telangana, India.

35.	I/I	**23ADE133 : ROBOTIC PROCESS AUTOMATION LAB (Laboratory-2 & 4 (Based on Elective-2 & 4 Courses)*)**	
		23ADE133.1	Demonstrate the process of writing, compiling and executing task bots.
		23ADE133.2	Implement task bots using various Basic Commands for automating simple processes.
		23ADE133.3	Develop task bots using manipulation commands for data extraction and integration.
		23ADE133.4	Solve real world problems using exceptional concepts.
		23ADE133.5	Construct MetaBots using API's and Visual captures.
36.	I/I	**23ADE134 : Federated Machine Learning Lab (Laboratory-2 & 4 (Based on Elective-2 & 4 Courses)*)**	
		23ADE134.1	Create federated learning environments using Python libraries like PySyft, TensorFlow Federated, or PyTorch, allowing for decentralized model training.
		23ADE134.2	Practical experience in integrating privacy preservation mechanisms like differential privacy and homomorphic encryption into federated learning, ensuring data privacy.
		23ADE134.3	Deep understanding of advanced federated learning algorithms (e.g., FedProx, FedAvg-M, FedAdapt) and their applications in solving complex machine learning problems.
		23ADE134.4	Apply federated learning to real-world datasets and use cases, demonstrating their ability to address practical challenges in various domains.
		23ADE134.5	Develop problem-solving skills and adaptability, enabling them to design fault-tolerant mechanisms, explore model compression techniques, and handle heterogeneity in federated learning scenarios.
37.	I/I	**23ADE135 : INTERNET OF THINGS LAB (Laboratory-2 & 4 (Based on Elective-2 & 4 Courses)*)**	
		23ADE135.1	Develop interfacing techniques with Raspberry Pi
		23ADE135.2	Implement Python scripts that run on Raspberry Pi/Arduino.
		23ADE135.3	Build IoT Applications using sensors.
		23ADE135.4	Demonstrate Read and write cloud data using Thing speak.

		23ADE135.5	Interpret the Case studies in different domains.
38.	**I/I**	**23ADE136 : ADVANCED ALGORITHMS LAB(Laboratory-2 & 4 (Based on Elective-2 & 4 Courses)*)**	
		23ADE136.1	Understand the implementation of basic data structures like stacks, queues, search trees and balanced trees.
		23ADE136.2	Identify appropriate algorithmic paradigm to find the optimal solution.
		23ADE136.3	Analyse the algorithms to find the shortest path in weighted graphs.
		23ADE136.4	Apply appropriate string pattern matching technique and flow control techniques.
		23ADE136.5	Implement Cryptographic techniques to ensure security
39.	**I/I**	**23MTC102 : MATHEMATICAL FOUNDATIONS FOR DATA SCIENCE LAB**	
		23MTC102.1	Construct Eigen vectors for the nth order transformation.
		23MTC102.2	Test the reliability for the probability function.
		23MTC102.3	Estimate the parameter using the LR test.
		23MTC102.4	Identify the significance level for the generalized linear model.
		23MTC102.5	Predict the values of generalized linear models using Analysis of Variance.
40.	**I/I**	**23ADC105 : ARTIFICIAL INTELLIGENCE LAB**	
		23ADC105.1	Solve AI problems through Python Programming
		23ADC105.2	Demonstrate an intelligent agent
		23ADC105.3	Evaluate Search algorithms
		23ADC105.4	Build knowledge representation system and infer knowledge from it
		23ADC105.5	Apply probabilistic reasoning on data.
41.	**I/II**	**23ADC102 : Introduction to Data Science**	

HEAD OF THE DEPARTMENT
Department of AI&DS,
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INSTITUTE OF TECHNOLOGY,
Hyderabad-500075, Telangana, India.

		23ADC102.1	Comprehend the process of Data Science and handle large unstructured data.
		23ADC102.2	Use the packages Numpy, Pandas and interact with Web API and databases.
		23ADC102.3	Choose suitable pre-processing techniques to process raw data.
		23ADC102.4	Interpret the data from visualisations.
		23ADC102.5	Apply appropriate group and aggregation operations.
42.	**I/II**	**23ADC103 : Machine Learning**	
		23ADC103.1	Understand the concepts of Machine learning and Concept learning
		23ADC103.2	Build classification algorithms and artificial neural networks and evaluate the accuracy.
		23ADC103.3	Examine the Bayesian classifier and its variants for predicting the probabilities.
		23ADC103.4	Design solutions based on optimization using genetic algorithms.
		23ADC103.5	Understand reinforcement learning and choose the best learning mechanism to the problem.
43.	**I/II**	**23ADC104 : Deep Learning**	
		23ADC104.1	Illustrate the working principle of neural networks, deep learning and their challenges.
		23ADC104.2	Understand training of deep feed forward network and Partially Observable Markov Decision Process.
		23ADC104.3	Identify the challenges in Neural Network optimization and apply Convolution Neural Network.
		23ADC104.4	Analyse the usage of Recurrent Neural Networks for sequential analysis
		23ADC104.5	Implement deep learning algorithms for real-world problems and evaluate their performance.
44.	**I/II**	**23ADC106 : Introduction to Data Science Lab**	
		23ADC106.1	Identify appropriate data structures for storing and processing the data.

		23ADC106.2	Choose suitable data type to handle real time data and explain file formats.
		23ADC106.3	Apply pre-processing techniques on raw data
		23ADC106.4	Interpret the data from visualisations.
		23ADC106.5	Build supervised and unsupervised models to solve real world problems.
44.	**I/II**	**23ADC107 : Machine Learning Lab**	
		23ADC107.1	Perform dimensionality reduction of a dataset.
		23ADC107.2	Build decision trees for classification.
		23ADC107.3	Design solutions using SVM, KNN, Regression algorithms.
		23ADC107.4	Perform clustering of data.
		23ADC107.5	Use principle Component Analysis for feature Extraction
45.	**I/II**	**23ADC109 Mini Project with Seminar**	
		23ADC109.1	Formulate a specific problem and give solution.
		23ADC109.2	Develop model/models either theoretical / practical / numerical form.
		23ADC109.3	Solve, interpret/correlate the results and discussions.
		23ADC109.4	Conclude the results obtained.
		23ADC109.5	Write the documentation in standard format.
46	**II/I**	**20ITE101 : Soft Computing**	
		20ITE101.1	Understand soft computing techniques and their role in building intelligent machines.
		20ITE101.2	Demonstrate fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
		20ITE101.3	Apply genetic algorithms to provide optimized solutions.
		20ITE101.4	Explain rough set theory and swarm intelligence techniques

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			to solve problems.
		20ITE101.5	Build real time applications using soft computing techniques
47	II/I	20ITE102 : CLOUD COMPUTING	
		20ITE102.1	Understand different types of cloud computing concepts and the techniques.
		20ITE102.2	Determine the issues related to scaling, capacity planning and load balancing.
		20ITE102.3	Assess the cloud infrastructure, information security and compliance issues.
		20ITE102.4	Analyse the Portability and Interoperability issues of cloud virtualization.
		20ITE102.5	Evaluate the importance of SOA and cloud database technology
48	II/I	20ITE103 : INFORMATION RETRIEVAL SYSTEMS	
		20ITE103.1	Understand different Information Retrieval models.
		20ITE103.2	Evaluate the performance of queries for retrieval of data.
		20ITE103.3	Analyze the methods for efficient information retrieval.
		20ITE103.4	Perform text operations and build indices.
		20ITE103.5	Analyze searching techniques and understand Parallel and Distributed IR models
49	II/I	20ITE104 : TIME SERIES ANALYSIS AND FORECASTING	
		20ITE104.1	Distinguish between time series and non-time series data and choose the right approach to solve a given problem
		20ITE104.2	Select the appropriate techniques for a time series problem based on the internal structures of the given data.
		20ITE104.3	Pre-process and visualize time series data through re sampling, group-by, and calculation of moving averages
		20ITE104.4	Extract estimated trend and noise based on the parameters related to time series signal composition such as the presence of trend, seasonality, and residual noise.
		20ITE104.5	Describe Autoregressive models which include moving average (MA), autoregressive (AR), Auto Regressive Moving Average (ARMA), and Auto Regressive Integrated Moving Average

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			(ARIMA) for predicting future trends.
		20ITE104.6	Develop forecasting models for time series data using different RNNs such as Vanilla RNN, Gated Recurrent Units, and Long Short-Term Memory units
50	II/I	20ITE105 : SOCIAL NETWORK ANALYSIS	
		20ITE105.1	Understand the basics of social network analysis.
		20ITE105.2	Analyze Ontology representation of social network data.
		20ITE105.3	Apply supervised and unsupervised algorithms on social networks.
		20ITE105.4	Interpret the semantic content of social media data.
		20ITE105.5	Build social network model for real time applications.
51	II/I	20ITE106 : BLOCK CHAIN TECHNOLOGY	
		20ITE106.1	Outline the concepts of block chain technology.
		20ITE106.2	Understand the bit coin, working with consensus in Bitcoin.
		20ITE106.3	Develop knowledge about designing and building Permissioned block chains.
		20ITE106.4	Describe the concepts of Cryptocurrency, Ethereum virtual machine, Crytpocurrency regulations.
		20ITE106.5	Design smart contract using Hyperledger Fabric frameworks.
52	II/I	20ITE107 : INTELLIGENT BIOINFORMATICS	
		20ITE107.1	Recognize the purpose of molecular biology and challenges in the Bioinformatics
		20ITE107.2	Analyse the importance of Artificial Intelligence and its techniques related to bioinformatics.
		20ITE107.3	Enumerate different techniques of classification and clustering with respect to bioinformatics applications
		20ITE107.4	Comprehend the methods related to neural network and genetic algorithms.
		20ITE107.5	Elaborate the concepts of Genetic Programming, Cellular Automata and Hybrid methods
53	II/I	20ITE108 : RECOMMENDER SYSTEMS	

		20ITE108.1	Understand the fundamentals of information retrieval and recommender systems
		20ITE108.2	Analyze collaborative filtering and model based recommenders.
		20ITE108.3	Identify suitable content based recommenders and understand the concept of user profiling.
		20ITE108.4	Design and apply hybrid recommendation system for a particular application.
		20ITE108.5	Evaluate recommender systems by means of various measures in different application domains.
54	**II/I**	**20ITE109: REINFORCEMENT LEARNING**	
		20ITE109.1	Understand the concepts of Reinforcement Learning, Multi Armed Bandits and Finite Markov Decision process.
		20ITE109.2	Apply Monte Carlo, Temporal Difference methods for policy evaluation and prediction.
		20ITE109.3	Analyze the Tabular Methods and On-policy Prediction with Approximation.
		20ITE109.4	Understand On-policy Control and Off-policy Methods with Approximation.
		20ITE109.5	Apply Eligibility Traces, Policy Gradient Methods to improve the performance of reinforcement learning.
55	**II/I**	**20ITE110: GPU COMPUTING**	
		20ITE110.1	Outline the developments in the evolution of multi-core architectures and parallel programming paradigms feature vectors for the Images.
		20ITE110.2	Comprehend the various programming languages and libraries for parallel computing platforms.
		20ITE110.3	Use of profiling tools to analyse the performance of applications by interpreting the given data
		20ITE110.4	Compare and contrast the features of parallel programming languages such as OpenMP and CUDA.
		20ITE110.5	Write parallel programs using OpenMP and CUDA. 6. Evaluate efficiency trade-offs among alternative parallel computing architectures for an efficient parallel Application design.
56	**II/I**	**20ITE111 : SCALABLE ALGORITHMS AND SYSTEMS FOR DATA ANALYSIS**	

		20ITE111.1	Outline the characteristics of massive data and primitives of scalable algorithms
		20ITE111.2	Apply geometric and clustering techniques for local computation of data.
		20ITE111.3	Solve large scale data science problems related to link analysis and finding similar items.
		20ITE111.4	Examine the need of scalable systems for large scaledata science such as web advertising and recommendation systems.
		20ITE111.5	Determine useful information to be gained by analyzing the large-scale data that is derived from social networks.
57	**II/I**	**20CSO101: Business Analytics (Open Elective)**	
		20CSO101.1	To understand the basic concepts of business analytics
		20CSO101.2	Identify the application of business analytics and use tools to analyze business data
		20CSO101.3	Become familiar with various metrics, measures used in business analytics
		20CSO101.4	Illustrate various descriptive, predictive and prescriptive methods and techniques
		20CSO101.5	Model the business data using various business analytical methods and techniques
58	**II/I**	**20MEO102 : INTRODUCTION TO OPTIMIZATION TECHNIQUES (Open Elective)**	
		20MEO102.1	Formulate a linear programming problems (LPP)
		20MEO102.2	Build and solve Transportation Models and Assignment Models.
		20MEO102.3	Apply project management techniques like CPM and PERT to plan and execute project successfully
		20MEO102.4	Apply queuing and inventory concepts in industrial applications
		20MEO102.5	Apply sequencing models in industries
59	**II/I**	**20MEO101: INDUSTRIAL SAFETY(OPEN ELECTIVE)**	
		20MEO101.1	Identify the causes for industrial accidents and suggest preventive measures.

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Department of AI&DS,
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Hyderabad-500075, Telangana, India.

		20MEO101.2	Identify the basic tools and requirements of different maintenance procedures.
		20MEO101.3	Apply different techniques to reduce and prevent Wear and corrosion in Industry.
		20MEO101.4	Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.
		20MEO101.5	Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc
60	**II/I**	**20MEO103 : COMPOSITE MATERIALS (OPEN ELECTIVE)**	
		20MEO103.1	Classify and characterize the composite materials.
		20MEO103.2	Describe types of reinforcements and their properties.
		20MEO103.3	Understand different fabrication methods of metal matrix composites.
		20MEO103.4	Understand different fabrication methods of polymer matrix composites.
		20MEO103.5	Decide the failure of composite materials
61	**II/I**	**20EE O101 : WASTE TO ENERGY (OPEN ELECTIVE)**	
		20EE O101.1	Understand the concept of conservation of waste
		20EE O101.2	Identify the different forms of wastage
		20EEO101.3	Chose the best way for conservation to produce energy from waste
		20EEO101.4	Explore the ways and means of combustion of biomass
		20EEO101.5	Develop a healthy environment for the mankind
62	**II/I**	**20ITC108 : DISSERTATION PHASE- I**	
		20ITC108.1	Students will be exposed to self-learning various topics.
		20ITC108.2	Students will learn to survey the literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.
		20ITC108.3	Students will learn to write technical reports.
		20ITC108.4	Students will develop oral and written communication skills

			to present.
		20ITC108.5	Student will defend their work in front of technically qualified audience.
63	**II/II**	**20ITC109 : Dissertation/Phase-II**	
		20ITC109.1	Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools.
		20ITC109.2	Students will be able to design and develop an experimental set up/ equipment/test rig.
		20ITC109.3	Students will be able to conduct tests on existing set ups / equipments and draw logical conclusions from the results after analyzing them.
		20ITC109.4	Students will be able to either work in a research environment or in an industrial environment.
		20ITC109.5	Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.

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