JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

B.Tech. – III Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Information Retrieval Systems	3	0	0	3
2	Professional Core	Computer Networks	3	0	0	3
3	Professional Core	Deep Learning with Applications	3	0	0	3
4	Professional Elective-I	1. Software Engineering 2. Digital Twin 3. Mobile Edge Computing 4. Optimization Techniques 5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
5	Open Elective- I	**Open elective offered by other department**	3	0	0	3
6	Professional Core	Information Retrieval &Deep Learning Lab	0	0	3	1.5
7	Professional Core	Computer Networks Lab	0	0	3	1.5
8	Skill Enhancement course	NodesJS	0	1	2	2
9	ES	Tinkering Lab	0	0	2	1
10	Evaluation of Community Service Internship		-	-	-	2
Total			14	1	10	23

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

B.Tech.– III Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Operating System	3	0	0	3
2	Professional Core	Automata Theory & Compiler Design	3	0	0	3
3	Professional Core	Computer Vision	3	0	0	3
4	Professional Elective-II	1. Software Testing Methodology 2. Cryptography & Network Security 3. Internet of Things 4. Recommender Systems 5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
5	Professional Elective-III	1. Software Project Management 2. Ethical AI 3. Data Visualization 4. Soft computing 5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
6	Open Elective – III	**Open elective offered by other department**	3	0	0	3
7	Professional Core	Computer Vision Lab	0	0	3	1.5
8	Professional Core	Operating System lab	0	0	3	1.5
9	Skill Enhancement course	Soft skills	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	-
Total			**20**	**1**	**8**	**23**
Mandatory Industry Internship of 08 weeks duration during summer vacation						

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

B.Tech. – IV Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Natural Language Programming	3	0	0	3
2	Management Course- II	Management Science Human resource Management Entrepreneurship &Incubation	2	0	0	2
3	Professional Elective-IV	1. Federated Learning 2. NoSQL databases 3. Quantum Computing 4. Computational Neuroscience 5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
4	Professional Elective-V	1. Agile methodologies 2. Big Data Analytics 3. Reinforcement Learning 4. High-performance Computing (HPC) 5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
5	Open Elective-III	**Open elective offered by other department**	3	0	0	3
6	Open Elective-IV	**Open elective offered by other department**	3	0	0	3
7	Skill Enhancement Course	Prompt Engineering	0	1	2	2
8	Audit Course	Gender Sensitization	2	0	0	-
9	Internship	Evaluation of Industry Internship	-	-	-	2
Total			**19**	**1**	**02**	**21**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

B.Tech.– IV Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Internship & Project Work	Full semester Internship & Project Work	0	0	24	12

OPEN ELECTIVES OFFERED BY CSE (AI &ML) TO OTHER BRANCHES:

OPEN ELECTIVE –I	OPEN ELECTIVE -II
1. Introduction to Artificial Intelligence 2. Exploratory Data Analysis with Python 3. Web Technologies	1. Fundamentals of Data Base Management System 2. JAVA Programming 3. Social Media Analytics
OPEN ELECTIVE –III	**OPEN ELECTIVE -IV**
1. Introduction to Machine Learning 2. Data Wrangling and Pre-processing 3. Block Chain Technologies	1. Internet of Things 2. Fundamentals of Cloud Computing 3. Cyber Security

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year I Semester	INFORMATION RETRIEVAL SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

1. Implement text indexing and retrieval systems for efficient information access.
2. Evaluate the performance of information retrieval systems using key metrics.
3. Analyse and preprocess textual and semi-structured datasets for meaningful insights.
4. Apply text similarity measures for effective comparison and clustering of documents.
5. Understand the principles of search engines and implement text classification models.

SYLLABUS:

Unit- I

Overview of text retrieval systems, Boolean retrieval, the term vocabulary and postings list,

Dictionaries and tolerant retrieval, Index construction and compression

Unit-II

Retrieval models and implementation: Vector Space Models, Vector Space Model,

TF-IDF Weight, Evaluation in information retrieval

Unit-III

Query expansion and feedback, Relevance feedback, pseudo relevance feedback, Query

Reformulation

Unit-IV

Probabilistic models; statistical language models, Okapi/BM25; Language models,

KL-divergence, Smoothing.

Unit-V

Text classification & Text clustering, The text classification problem, Naive Bayes text classification,k- nearest neighbors , Support vector Machine ,Feature Selection , Vector-space clustering; K-meansalgorithm , Hierarchical clustering , DBSCAN algorithm ,PAM and PAMK EM algorithm

Course Outcomes:

1. Understand the fundamentals of text retrieval systems, including Boolean retrieval and index construction.
2. Gain knowledge of retrieval models like Vector Space Model, TF-IDF, and the evaluation metrics in information retrieval.

3. Learn techniques for query expansion, feedback, and reformulation in information retrieval systems.
4. Understand probabilistic models, including statistical language models and Okapi/BM25, for efficient text retrieval.
5. Apply text classification and clustering algorithms, such as Naive Bayes, K-means, and DBSCAN, for text analysis tasks.

Text Books:

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, Introduction to Information Retrieval, Cambridge University Press. 2008. http://nlp.stanford.edu/IR-book/informationretrieval-book.html

2. ChengXiang Zhai, Statistical Language Models for Information Retrieval (Synthesis Lectures Series on Human Language Technologies), Morgan & Claypool Publishers, 2008.

IT R20 Course Structure & Syllabus

E-Link:

1. http://www.morganclaypool.com/doi/abs/10.2200/S00158ED1V01Y200811HLT001

Reference Books:

1.Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theory and Implementation, Springer, 2004.

2. SoumenChakrabarti, Mining the Web : Discovering Knowledge from Hypertext Data, Morgan – Kaufmann Publishers, 2002.

3. Christopher D Manning, PrabhakarRaghavan, HinrichSchutze, An Introduction to Information Retrieval By Cambridge University Press, England, 2009

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year I Semester	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

1. To educate basic knowledge of networking technologies and network management concepts
2. To interpret the layering concepts in computer networks.
3. To analyze the functions of each layer and gain knowledge in different applications that use computer networks.
4. To emphasize the hand-on experience of network topology in a laboratory environment
5. To be familiar with contemporary issues in networking technologies

UNIT – I: Introduction: Network Topologies WAN, LAN, MAN. Reference models-The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models Examples of Networks: Novell Networks, Arpanet, Internet.

UNIT – II: Physical Layer and overview of Physical Layer Switching:
Transmission Modes-Transmission media (Guided and Unguided Media). Multiplexing: frequency division multiplexing, wave length division multiplexing, synchronous time division multiplexing, statistical time division multiplexing, introduction to switching: Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks

UNIT-III: Data link layer: Design issues: Framing, Flow control, Error control, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, Elementary Data Link Layer protocols: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel. Sliding window protocol: One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC: configuration and transfer modes, frames, control field.

UNIT-IV: Random Access: ALOHA, MAC addresses, Carrier sense multiple access (CSMA), CSMA /CD, CSMA/CA, Controlled Access: Reservation, Polling, Token Passing, Channelization: frequency division multiple access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA).
Network Layer: IP Addresses – Ipv4&IPv6 – Internetworking, Routing algorithm shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing. IEEE Standards: – Standard Ethernet: MAC sub layer, physical layer, Fast Ethernet: MAC sub layer, physical layer, IEEE-802.11: Architecture, MAC sub layer, addressing mechanism, frame structure.

UNIT-V: Transport Layer & Application Layer: Process to Process Delivery -User Datagram - Protocol (UDP) - Transmission Control Protocol (TCP) -
Congestion Control- Quality of services (QOS) - Integrated Services - Domain Name Space (DNS) - FTP – HTTP- WWW & HTTP.

TEXT BOOKS:

1. Tanenbaum and David J Wetherall, Computer Networks, 5th Edition, Pearson Edu, 2010
2. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw Hill Education

REFERENCE BOOKS:

1. Larry L. Peterson and Bruce S. Davie, "Computer Networks - A Systems Approach" (5th edition)
2.Computer Networks, Mayank Dave, CENGAGE Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

COURSE OUTCOMES:

1. Understand various network topologies and compare OSI and TCP/IP reference models.
2. Learn about physical layer transmission media, multiplexing techniques, and switching methods.
3. Master data link layer protocols, including error control, flow control, and HDLC.
4. Understand random and controlled access techniques, including CSMA, FDMA, TDMA, and CDMA.
5. Explore transport and application layer protocols such as TCP/UDP, congestion control, and HTTP.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year I Semester	Deep Learning with Applications	L	T	P	C
		3	0	0	3

Course Objectives:

1. To acquire knowledge on the basics of neural networks.
2. To implement neural networks using computational tools for variety of problems.
3. To explore various deep learning algorithms.

Unit1: Introduction to Deep Learning, Bayesian Learning, Decision Surfaces Linear Classifiers, Linear Machines with Hinge Loss, Optimization Techniques, Gradient Descent, Batch Optimization

Unit2: Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning

Unit 3: Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization

Unit 4: Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN etc. Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection etc.

Unit 5: LSTM Networks, Generative Modelling with DL, Variational Autoencoder, Generative Adversarial Network Revisiting Gradient Descent

Course Outcomes:

Students will be able to:

1. Develop algorithms simulating human brain.
2. Implement Neural Networks in Tensor Flow for solving problems.
3. Explore the essentials of Deep Learning and Deep Network architectures.
4. Define, train and use a Deep Neural Network for solving real world problems that require artificial Intelligence based solutions.

Text Books:

1. ”Deep Learning (Adaptive Computation and Machine Learning series”, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2017.
2. Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.
3. “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, Nikhil Buduma, Nicholas Locascio, O'Reilly Media, 2017.

Reference Books:

1. Deep learning from first principle,2nd edition, tinniam v Ganesh,2018
2. Introduction to Deep Learning ,1st edition, by Eugene charniak, The MIT Press,2019

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year I Semester	Professional Elective-I 1. Software Engineering	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on the

1. To understand the software life cycle models.
2. To understand the software requirements and SRS document.
3. To understand the importance of modeling and modelling languages.
4. To design and develop correct and robust software products.

UNIT – I:

Software and Software Engineering: The Nature of Software, The Unique Nature of Web Apps, Software Engineering, Software Process, Software Engineering Practice, Software Myths.

Process Models: A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Terminology, Product and Process.

UNIT - II:

Requirements Analysis And Specification: Requirements Gathering and Analysis, Software Requirement Specification (SRS), Formal System Specification.

Software Design: Overview of the Design Process, How to Characterize of a Design, Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design

UNIT – III:

Function-Oriented Software Design: Overview of SA/SD Methodology, Structured Analysis, Developing the DFD Model of a System, Structured Design, Detailed Design, Design Review, over view of Object Oriented design.

User Interface Design: Characteristics of Good User Interface, Basic Concepts, Types of User Interfaces, Fundamentals of Component-based GUI Development, A User Interface Design Methodology.

UNIT - IV:

Coding And Testing: Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tool, Integration Testing, Testing Object-Oriented Programs, System Testing, Some General Issues Associated with Testing

UNIT - V:

Software Reliability And Quality Management: Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model.

Software Maintenance: Software maintenance, Maintenance Process Models, Maintenance Cost, Software Configuration Management.

Software Reuse: what can be reused? Why almost No Reuse So Far? Basic Issues in Reuse Approach, Reuse at Organization Level

Course Outcomes:

1. Define and develop a software project from requirement gathering to implementation.
2. Obtain knowledge about principles and practices of software engineering.
3. Focus on the fundamentals of modelling a software project.
4. Obtain basic knowledge of coding
5. Obtain knowledge about estimation maintenance and reuse of software systems.

Text Books:

1. Software engineering A practitioner's Approach, Roger S. Pressman, Seventh Edition McGrawHillInternationalEdition.
2. Fundamentals of Software Engineering, Rajib Mall, Third Edition,PHI.
3. Software Engineering, Ian Sommerville, Ninth edition, Pearsoneducation

References:

1. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill,2008
2. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
3. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
4. Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition,2006.

Web References:

https://nptel.ac.in/courses/106/105/106105182/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year I Semester	Professional Elective-I 2. Digital Twin	L	T	P	C
		3	0	0	3

Course Objectives

1. To introduce the concept of Digital Twin and its significance in modern engineering and technology.
2. To understand the architecture and components of Digital Twin systems.
3. To explore the role of sensors, IoT, AI, and data analytics in enabling Digital Twins.
4. To examine real-world applications of Digital Twins across industries such as manufacturing, healthcare, and smart cities.
5. To develop skills in designing and implementing basic Digital Twin models using simulation tools and platforms.

UNIT I:

Introduction to Digital Twin: Introduction to the concept of Digital Twin – Evolution, definitions, and relevance in the context of Industry 4.0. Types of Digital Twins – Product Twin, Process Twin, and System Twin. Overview of components: physical entity, digital representation, and data connection. Role of sensors, data acquisition, and IoT in enabling Digital Twins. Benefits and challenges in Digital Twin implementation.

UNIT II:

Digital Twin Architecture and Technologies: Core architecture of Digital Twin systems. Enabling technologies – Internet of Things (IoT), Cloud Computing, Edge Computing, Artificial Intelligence (AI), and Machine Learning (ML). Communication protocols and middleware platforms. Data integration from heterogeneous sources. Synchronization between physical and virtual entities.

UNIT III:

Modeling and Simulation in Digital Twin: System modeling techniques – CAD models, physics-based models, and data-driven models. Simulation frameworks and tools. Real-time monitoring and predictive analytics. Feedback loops and control systems. Integration with simulation software (ANSYS, MATLAB/Simulink, etc.). Model calibration and validation.

UNIT IV:

Data Analytics and Visualization: Role of Big Data and real-time data analytics in Digital Twins. Data storage, preprocessing, and analysis techniques. Application of machine learning algorithms for fault prediction, anomaly detection, and optimization. Visualization tools and dashboards. Augmented Reality (AR) and Virtual Reality (VR) integration.

UNIT V:

Applications and Case Studies: Application of Digital Twin in manufacturing, predictive maintenance, healthcare systems, energy sector, automotive, aerospace, and smart cities. Case studies on Siemens, GE Digital, and Microsoft Azure Digital Twins. Emerging trends, standards, and future directions. Ethical considerations and cybersecurity in Digital Twin environments.

COURSE OUTCOMES:

1. Understand the fundamental principles and architecture of Digital Twin systems.
2. Apply enabling technologies like IoT, AI, and cloud computing in developing Digital Twin models.
3. Design and simulate real-world systems using Digital Twin modeling techniques.
4. Analyze and visualize real-time data for decision-making using machine learning and visualization tools.
5. Evaluate and apply Digital Twin technologies across various industrial domains through case studies.

TEXT BOOKS:

1. Grieves, M., & Vickers, J. (2017). Digital Twin: Mitigating Unpredictable, Undesirable Emergent Behavior in Complex Systems. Springer.
2. Rajiv Pandey, et al. (2021). Digital Twin Technology: Concepts and Applications. CRC Press.
3. Manoj Kumar Tiwari & Nilesh N. (2020). Digital Twin Development and Deployment on the Cloud: Developing Cloud-Friendly Dynamic Models using Simulink/Simscape. Academic Press.

REFERENCE BOOKS:

1. Parlikad, A.K., et al. (2022). Digital Twins for Smart Cities. Institution of Engineering and Technology.
2. Peters, S. (2021). The Digital Twin: Bringing Industry 4.0 to Life. McGraw Hill.
3. Boschert, S., & Rosen, R. (2021). Digital Twin – Fundamental Concepts to Applications. Springer.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year I Semester	**Professional Elective-I** **3. Mobile Edge Computing**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives (COs)

1. Understand the evolution and fundamentals of Mobile Edge Computing (MEC).
2. Explore the architecture, components, and deployment models of MEC systems.
3. Analyze the integration of AI/ML techniques within edge environments.
4. Examine real-world applications of MEC across various domains like IoT, AR/VR, and smart cities.
5. Identify security, privacy, and performance challenges in MEC systems and explore emerging trends.

UNIT I – Introduction to Mobile Edge Computing

Evolution from Cloud Computing to Edge Computing,Definition and Architecture of MEC,Characteristics and Benefits of MEC,MEC vs Mobile Cloud Computing,Role of 5G in MEC,MEC Use Cases Overview,Edge Nodes, Edge Data Centers, and Deployment Models

UNIT II – MEC Architecture and Components

MEC Reference Architecture (ETSI),Components: Edge Server, Orchestrator, User Equipment,Communication Protocols (REST, MQTT, CoAP),Integration with IoT, Cloud, and 5G,Virtualization and Containerization at the Edge (Docker, Kubernetes)

UNIT III – AI/ML in Mobile Edge Computing

Role of AI/ML at the Edge,Inference vs Training in Edge Environments,Use of TinyML, ONNX, TensorFlow Lite, Edge TPU

Case Studies:Real-time object detection at the edge,Predictive maintenance in smart factories,Personalized content delivery using edge AI

UNIT IV – Applications and Use Cases

Smart Cities and Edge Analytics,Augmented/Virtual Reality (AR/VR) over MEC,Edge-based Autonomous Vehicles,Industrial IoT (IIoT) with MEC,Healthcare and Remote Patient Monitoring,MEC for Video Analytics and Surveillance

UNIT V – Security, Challenges, and Future Trends

Security & Privacy Challenges in MEC,Trust Models and Data Protection at the Edge,Network Slicing & QoS in 5G Edge Networks,Standardization (ETSI, 3GPP),Emerging Trends: Edge Federations, Serverless Edge, AI Ops at Edge,Research Directions & Career Opportunities.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

Course Outcomes

After completing this course, students will be able to:

1. Explain the key concepts and architecture of Mobile Edge Computing.
2. Design and evaluate MEC systems and their integration with AI/ML technologies.
3. Implement edge-based AI models for real-time data processing.
4. Analyze and propose MEC solutions for domain-specific problems (e.g., healthcare, autonomous systems).
5. Assess security, scalability, and future directions of MEC in AI-driven ecosystems.

TEXTBOOKS BOOKS:

1. **"Mobile Edge Computing: Principles and Applications"**Yan Zhang, Mehdi Bennis, Mário Costa Springer.
2. **"Edge Computing: A Primer",** Jie Cao, Quan Zhang, Weisong Shi, SpringerBriefs in Computer Science
3. **"Multi-Access Edge Computing in Action"**,ETSI (European Telecommunications Standards Institute)

REFRENCE BOOKS:

1. **"Edge AI: Convergence of Edge Computing and Artificial Intelligence"**,Xiaofei Wang, Yi Pan,Springer
   - Focuses on deploying AI models at the edge—ideal for AI & ML integration in MEC.
2. **"Architecting the Internet of Things"**,Dieter Uckelmann, Mark Harrison, Florian Michahelles,Springer

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year I Semester	Professional Elective-I 4. Optimization Techniques	L	T	P	C
		3	0	0	3

Course Objectives:

1. To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
2. To state single variable and multi variable optimization problems, without and with constraints.
3. To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
4. To state transportation and assignment problem as a linear programming problem to determine Simplex method.
5. To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.

UNIT I:

Introduction and Classical Optimization Techniques: Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems.

Classical Optimization Techniques: Single variable Optimization, multi variable Optimization without constraints, necessary and sufficient conditions for minimum/maximum, multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers, multivariable Optimization with inequality constraints, Kuhn – Tucker conditions

UNIT II: Linear Programming: Standard form of a linear programming problem, geometry of linear programming problems, definitions and theorems, solution of a system of linear simultaneous equations, pivotal reduction of a general system of equations, motivation to the simplex method, simplex algorithm, Duality in Linear Programming, Dual Simplex method.

UNIT III: Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method, testing for optimality of balanced transportation problems, Special cases in transportation problem.

UNIT IV: Nonlinear Programming: Unconstrained cases, One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method, Univariate method, Powell's method and steepest descent method.
Constrained cases– Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods, Introduction to convex Programming Problem.

UNIT V: Dynamic Programming: Dynamic programming multistage decision processes, types, concept of sub optimization and the principle of optimality, computational procedure in dynamic programming, examples illustrating the calculus method of solution, examples illustrating the tabular method of solution.

TEXT BOOKS:

1. "Engineering optimization: Theory and practice", S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. "Introductory Operations Research", H.S. Kasene & K.D. Kumar, Springer (India), Pvt. LTd.

REFERENCE BOOKS:

1. "Optimization Methods in Operations Research and systems Analysis",by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Operations Research, Dr. S.D.Sharma, Kedarnath, Ramnath & Co

COURSE OUTCOMES:

At the end of the course, student will be able to

1. State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.
2. Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.
3. Apply and Solve transportation and assignment problem by using Linear programming Simplex method.
4. Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions
5. Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year I Semester	**Information Retrieval & Deep Learning Lab (Open Elective- I)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Software Required:

Python 3.7+, Jupyter Notebook, TensorFlow, Keras, PyTorch, Scikit-learn, NLTK, NumPy, Pandas, Matplotlib, Seaborn, Google Colab (optional), Anaconda (optional).

LIST OF EXPERIMENTS:

1. Implement a simple document retrieval system using Boolean retrieval. Pre-process documents to create a term vocabulary and postings list.
2. Implement an inverted index with basic compression techniques (e.g., delta encoding, variable byte encoding).
3. Apply smoothing techniques like Laplace or Jelinek-Mercer smoothing to improve the performance of language models.
4. Implement a Naive Bayes classifier to classify documents into predefined categories.
5. Implement K-Nearest Neighbors (KNN) for document classification based on feature vectors.
6. Implement K-Means clustering to group similar documents into clusters based on their feature vectors.
7. Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.
8. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset
9. Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset.
10. Design a neural network for predicting house prices using Boston Housing Price dataset.
11. Build a Convolution Neural Network for MNIST Hand written Digit Classification.
12. Build a Convolution Neural Network for simple image (dogs and Cats) Classification
13. Implement a Recurrent Neural Network for IMDB movie review classification problem.

TEXT BOOKS:

a. "Introduction to Information Retrieval" by Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, Cambridge University Press, 2008.

b. "Statistical Language Models for Information Retrieval" by ChengXiang Zhai, Morgan & Claypool Publishers, 2008.

c. Reza Zadeh and BharathRamsundar, “Tensorflow for Deep Learning”, O’Reilly publishers, 2018

REFERENCE BOOKS:

1. "Information Storage and Retrieval Systems: Theory and Implementation" by Gerald J. Kowalski, Mark T. Maybury, Springer, 2004.
2. "Mining the Web: Discovering Knowledge from Hypertext Data" by Soumen Chakrabarti, Morgan Kaufmann Publishers, 2002.
3. "An Introduction to Information Retrieval" by Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, Cambridge University Press, 2009.

LINK:

https://github.com/fchollet/deep-learning-with-python-notebooks

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year I Semester	**COMPUTER NETWORKS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

COURSE OBJECTIVES:

1. Understand and implement data link layer framing techniques, including character and bit stuffing.
2. Develop client-server applications and protocols using C programming for network communication.
3. Explore error-detection methods by implementing CRC (Cyclic Redundancy Check) polynomials.
4. Apply and implement graph algorithms such as Dijkstra's algorithm for routing and pathfinding.
5. Simulate and understand routing protocols such as Distance Vector Routing and OSPF in network systems.

LIST OF EXPERIMENTS:

1) Implement the data link layer framing methods such as character stuffing and bit

stuffing.

2) Write a program to develop a DNS client server to resolve the given hostname.

3) Implement on a data set of characters the three CRC polynomials – CRC-12, CRC-16

and CRC-CCIP.

4) Implement Dijkstra’s algorithm to compute the Shortest path in a graph.

5) Take an example subnet graph with weights indicating delay between nodes. Now

obtain Routing table art each node using distance vector routing algorithm

6) Take an example subnet of hosts. Obtain broadcast tree for it.

7) Write a client-server application for chat using UDP

8) Implement programs using raw sockets (like packet capturing and filtering)

9) Write a program to perform sliding window protocol.

10) Get the MAC or Physical address of the system using Address Resolution Protocol.

11) Simulate the Implementing Routing Protocols using border gateway protocol(BGP)

12) Simulate the OPEN SHORTEST PATH FIRST routing protocol based on the cost assigned to the path.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

COURSE OUTCOMES:

1. Apply data link layer framing methods like character and bit stuffing to handle data transmission efficiently.
2. Develop and test a DNS client-server application to resolve domain names using C programming.
3. Implement and evaluate CRC-12, CRC-16, and CRC-CCIP for error detection on datasets of characters.
4. Implement Dijkstra's algorithm to compute the shortest path in a graph and understand routing protocols.
5. Simulate and calculate routing tables using distance vector routing and broadcast tree creation for network subnets.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year I Semester	NodesJS (Skill Enhancement Course)	L	T	P	C
		0	1	2	2

Course Objectives:

- To understand the Node's Web Server Development.
- To understand npm and NodeJS Modules.
- To create NodeJS applications using Express.JS.
- To deploy NodeJS applications..

Unit I

Node JS – Introduction, What is Node JS? Advantages of Node JS, Traditional Web Server Model, Node. Js Process Model. **Setup Dev Environment:** Install Node.json Windows/Linux, Working in REPL, Node JS Console.

Unit II

Node JS Modules: Functions, Buffer, Module, Module Types, Core Modules, Local Modules, Module. Exports, **Node Package Manager:** What is NPM? Installing Packages Locally. Adding the dependency in package.json, installing packages globally, Updating packages. **Web server:** Creating web server, Handling HTTP requests, Sending requests

Unit III

File System: Synchronous vs Asynchronous, Open a File, Get File Information, Writing a File, Reading a File, Closing a File, Delete a File, Other IO Operations. **Callbacks:** What is Callback? Blocking Code Example, Non-Blocking Code. **Events:** Event Emitter Class, Methods, Events, Returning event emitter, Inhering events.

Unit IV

Express.JS: Configuring routes, Working with express, **Serving Static Resources:** Serving static files, Working with middleware. **Debugging Node JS Application:** Core Node JS debugger. Debugging with Visual Studio.

Unit V

Database Connectivity: Introduction to MongoDb, Connecting Node.Js to Database, Connection string, Configuring, working with the select command, updating records, deleting records, Creating Rest APIs.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

Course Outcomes:

- Understand the Node's unique approach to asynchronous development.
- Understand the Node Package Manager (npm) and Modules.
- Implement NodeJS applications with the Express frame work and Connect Middleware.
- Learning-depth practices for debugging and testing NodeJS applications.
- Deploy NodeJS applications in the cloud or on your own system

TEXT BOOKS:

1. NodeJS Book: Learning Node by Shelley Powers, O'Reilly, second edition, May 2016.
2. Learning Node.js Development: Learn the fundamentals of Node.js, and deploy and test Node.js applications on the web By Andrew Mead, Packet, first edition, January 2018.

REFERENCE BOOKS:

Mastering Node.js: Build robust ands callable real-time server-side web applications efficiently, Second Edition, Packet

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year I Semester	Tinkering Lab Engineering Sciences	L	T	P	C
		0	0	2	1

Course Objective

A small unique idea can be become big changer when it gets the suitable platform and transformed into a product or re-define existing products with better enhancement.

This lab provides a platform to seed, fertilizer and encourage the spirit of curiosity and innovation among young minds. It is a work place where students can give shape to their ideas.

Course Outcome:

In the tinkering lab, students able to

1. Apply prior knowledge to develop and conceptualize scientific methods and engineering techniques.
2. Analyze real-world problems through self-directed exploration and iterative experimentation.
3. Design and develop technical experiments or prototypes with available financial and mentoring support.
4. *Evaluate and refine self-initiated projects by learning from failures, feedback, and performance metrics.*
5. Create innovative, application-oriented solutions by integrating technical skills, creativity, and exploratory learning.

List of Sample Projects:

- Face Recognition Door lock System
- Hand gesture recognition
- Text to speech
- Smart City
- Private chat room
- Android app controlled roboticarm
- Smart Traffic System
- Vehicle Accident Alam System
- Smart dustbin
- Surveillance BOT
- Automatic Water Gardening System
- e-Mirror
- Smart Parking System
- Service Bot
- Drone Surveillance

- Wallpaintingrobot
- Home automation
- Automated wheelchair
- AnyInnovativeIdea–RealTime application

Expectations from the Lab:

- Workshop on empathy, ideation, and identifying real-world problems.
- Understanding the basic logics with interaction as teams.
- Working Hand-on using present tools available
- Students form teams, plan their mini project and starts working with the help of the mentor
- Students do Hands-on building, troubleshooting, testing
- Finalize, document, and prepare for demonstration

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Understand the fundamental principles of the operating system, its services and functionalities.
2. Illustrate the concepts of processes, inter-process communication, synchronization and scheduling.
3. Understand different types of memory management viz. virtual memory, paging and segmentation.
4. Identify the reasons for deadlock and understand the techniques for deadlock detection, prevention and recovery.
5. Understand the need of protection and security mechanisms in computer systems.

UNIT I:

OPERATING SYSTEMS OBJECTIVES AND FUNCTIONS:

Computer system architecture, operating systems structure, operating systems operations; Evolution of operating systems: Simple batch, multi programmed, time shared, personal computer, parallel distributed systems, real time systems, special purpose systems, operating system services, user operating systems interface; Systems calls: Types of systems calls, system programs, protection and security, operating system design and implementation.

UNIT II:

PROCESS CONCEPTS:

The process, process state, process control block, threads; Process scheduling: Scheduling queues, schedulers, context switch, pre-emptive scheduling, dispatcher, scheduling criteria, scheduling algorithms, multiple processor scheduling; Real time scheduling; Thread scheduling; Case studies Linux windows; Process synchronization, the critical section problem; Peterson‘s solution, synchronization hardware, semaphores and classic problems of synchronization, monitors.

UNIT III:

SYSTEM MODEL:

Deadlock characterization, methods of handling deadlocks, deadlock prevention, dead lock avoidance, dead lock detection and recovery form deadlock system protection, goals of protection.

UNIT IV:

LOGICAL AND PHYSICAL ADDRESS SPACE:

Swapping, contiguous memory allocation, paging, structure of page table. Segmentation: Segmentation with paging, virtual memory, demand paging; Performance of demand paging: Page replacement, page replacement algorithms, allocation of frames, thrashing.

UNIT V:

FILE SYSTEM IMPLEMENTATION AND DISK SCHEDULING:

The concept of a file, access methods, directory structure, file system mounting, file sharing, protection, file system structure, file system implementation, allocation methods, free space management, directory implementation, efficiency and performance; Overview of mass storage structure: Disk structure, disk attachment, disk scheduling, disk management, swap space management; Dynamic memory allocation: Basic concepts.

COURSE OUTCOMES:

1. Describe the structure of operating system and basic architectural components involved in operating system design.
2. Understand the objectives and functions of modern operating systems.
3. Analyze and design the applications to run in parallel either using process or thread models of different operating system.
4. Understand and analyze implementation of virtual memory.
5. Describe the mutual exclusion, deadlock detection in operating system.

TEXT BOOK:

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 9th Edition, John Wiley and Sons Inc., 2012.

2.William Stallings, Operating Systems: Internals and Design Principles, 8th edition Pearson

Education Limited, 2014 ISBN: 1292061944, 9781292061948

3. Operating Systems-S Halder, Alex A Aravind Pearson Education Second Edition 2016 .

REFERENCE BOOKS:

1. D.M Dhamdhere: Operating systems –A concept-based Approach, 3rd Edition, Tata McGrawHill,2012.

2. P.C.P. Bhatt: Introduction to Operating Systems Concepts and Practice, 3rd Edition, PHI, 2010.

3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 2011.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	Automata Theory & Compiler Design	L	T	P	C
		3	0	0	3

COURSE Objectives:

- Automata and compiler Design mainly deal with the languages which are formal and regular and also deals with grammar present in the machine.
- A compiler is a program that accepts a program in source language and converts into a machine understandable format.
- The push down automata is the major one it's a five-tuple set containing states, alphabets, transition function and accept states.

UNIT - I:

Formal Language and Regular Expressions: Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, Lex tools.

Context Free grammars and parsing: Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL (1) parsing

UNIT - II:

Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification. **Semantics:** Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements.

UNIT - III:

Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.

UNIT - IV:

Run time storage: Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation.

Code optimization: Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.

UNIT - V:

Code generation: Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.

TEXT BOOKS:

1. Introduction to Theory of computation.Sipser, 2nd Edition, Thomson.
2. Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.

REFERENCES:

1. Modern Compiler Construction in C, Andrew W.Appel Cambridge University Press.
2. Compiler Construction, LOUDEN, Thomson.
3. Elements of Compiler Design, A. Meduna, Auerbach Publications, Taylor and Francis Group.
4. Principles of Compiler Design, V. Raghavan, TMH.
5. Engineering a Compiler, K. D. Cooper, L. Torczon, ELSEVIER.

COURSE Outcomes:

1. Graduate should be able to understand the concept of abstract machines and their power to recognize the languages.
2. Attainsthe knowledge of language classes & grammars relationship among them with the help of chomsky hierarchy.
3. Ability to understand the design of a compiler given features of the languages.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	COMPUTER VISION	L	T	P	C
		3	0	0	3

Course Objective:

To Recognize and describe both the theoretical and practical aspects of computing with images and to Connect issues from Computer Vision to Human Vision

UNIT-I

Introduction: What is computer vision, A brief history, Image Formation, Geometric primitives and transformations, Photometric image formation, The digital camera.

UNIT-II

Feature detection and matching: Points and patches, Feature detectors, Feature descriptors, Feature matching, Feature tracking, Application: Performance-driven animation, Edges, Application: Edge editing and enhancement, Lines, Application: Rectangle detection.

UNIT-III

Segmentation: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods, Application: Medical image segmentation.

UNIT-IV

Feature-based alignment: 2D and 3D feature-based alignment, Pose estimation, Geometric intrinsic calibration, Calibration patterns, Vanishing points, Application: Single view metrology, Rotational motion, Radial distortion.

UNIT-V

Recognition: Object detection, Face detection, Pedestrian detection, Face recognition, Eigenfaces, Active appearance and 3D shape models, Application: Personal photo collections, Instance recognition, Category recognition, Context and scene understanding.

Course Outcomes:

1. Provide an introduction to computer vision including fundamentals of image formation
2. Enumerate the concepts of Feature detection and Matching
3. Discuss about Image Segmentation Techniques
4. Discuss applications of Feature based alignment like pose estimation
5. Discuss different recognition techniques.

Text Books:

1. Richard Szeliski,"Computer Vision: Algorithms and Applications", Springer, 2010.
2. Rafael C. Gonzalez "Digital Image Processing", Pearson Education; Fourth edition (2018)

Reference Books:

1. Forsyth /Ponce, "Computer Vision: A Modern Approach", Pearson Education India; 2nd edition (2015)
2. S.Nagabhushana, "Computer Vision and Image Processing", New Age International Pvt Ltd; First edition (2005)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	Professional Elective-II 1. Software Testing Methodology	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on the

1. Describe the principles and procedures for designing testcases.
2. Provide supports to debugging methods.
3. Acts as the reference for software testing techniques and strategies.

UNIT-I:

Introduction: Purpose of Testing, Dichotomies, Model for Testing, Consequences of Bugs, Taxonomy of Bugs. FLOW GRAPHS AND PATH TESTING: Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing.

UNIT-II:

Transaction Flows Testing: Transaction Flows, Transaction Flow Testing Techniques. Dataflow Testing: Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing. Domain Testing: Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interfaces Testing, Domain and Interface Testing, Domains andTestability.

UNIT-III:

Paths, Path Products and Regular Expressions:

Path Products &PathExpression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection.

Syntax Testing: Why, What and How, A Grammar for formats, Test Case Generation, Implementation and Application and Testability Tips.

Based Testing: Overview,Decision Tables, Path Expressions, KV Charts, and Specifications.

UNIT-IV:

State, State Graphs And Transition Testing: State Graphs, Good & Bad State Graphs, State Testing, and Testability Tips.

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm.

UNIT-V:

Software Testing Tools: Introduction to Testing, Automated Testing, Concepts of Test Automation, Introduction to list of tools like Win Runner, Load Runner, Jmeter, Selenium. About Win Runner, Using Win runner, Mapping the GUI,

Recording Test, Working with Test, Enhancing Test, Checkpoints, Test Script Language, putting it all together, Running and Debugging Tests, Analyzing Results, Batch Tests, Rapid Test Script Wizard.

Course Outcomes:

The students should be able to:

1. Define Software testing terminology and methodology
2. Discuss and classify various testing techniques for conducting different types of software testing
3. Apply different software testing techniques.
4. Construct test cases by understanding test suite management and software quality management.
5. Demonstrate modern software testing tools and testing of Object-Oriented Software and Webbased software

TEXT BOOKS:

1. Software testing techniques – Boris Beizer, Dreamtech, secondedition.

2. Software Testing- Yogesh Singh,Cambridge

REFERENCES:

1. The Craft of software testing - Brian Marick, PearsonEducation.

2. Software Testing, 3rd edition, P.C. Jorgensen, Aurbach Publications (Dist.bySPD).

3. Software Testing, N.Chauhan, Oxford UniversityPress.

4. Introduction to Software Testing, P.Ammann&J.Offutt, CambridgeUniv.Press.

5. Effective methods of Software Testing, Perry, John Wiley, 2nd Edition,1999.

6. Software Testing Concepts and Tools, P.NageswaraRao, dreamtechPress 7. Win Runner in simple steps by Hakeem Shittu, Genixpress,2007.

8. Foundations of Software Testing, D.Graham& Others, Cengage Learning.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	Professional Elective-II 2. Cryptography & Network Security	L	T	P	C
		3	0	0	3

Course Objectives

In this course, the following principles and practice of cryptography and network security are covered:

1. Classical systems, symmetric block ciphers (DES, AES, other contemporary symmetricciphers)
2. Public-key cryptosystems (RSA, El Gamal, and ECC),
3. Algorithms for factoring and discrete logarithms, cryptographic protocols, hash functions, authentication, keymanagement, key exchange, signature schemes.
4. The fundamental aspects of Email and web security ,viruses, firewalls, cyberlaws, and other topics are discussed.

UNIT-I: Introduction and Mathematical Background

Security Goals, Attacks, Services and Mechanisms, Model for Network Security, Cryptography and Cryptanalysis, Symmetric vs. Asymmetric Ciphers, Substitution vs. Transposition Ciphers, Stream vs. Block ciphers. Number Theory: Primes, Coprimes, Primality Test, GCD (Euclid's algorithm), Groups and Fields, Discrete Logarithmic Problem .Modular Arithmetic: Basics, Congruence, Fermat's little theorem, Euler's theorem, Computing Inverse, Chinese Remainder Theorem

UNIT-II: Symmetric Ciphers

Classic Ciphers, Confusion, and Diffusion, Feistel Structure, DES, Modes of operation, Triple DES, IDEA, Blowfish, AES

UNIT-III: Public Key Cryptography

RSA(algorithm, performance, and attacks), Diffie Hellman Key Exchange, El Gamal (encryption and signatures), Elliptic Curve Cryptography (Elliptic Curves, encryption, key exchange, and signatures)

UNIT-IV: Key Management and Authentication

Cryptographic Hash, Message Authentication Codes, Digital Signatures, X.509 certificates, PKI, One Way Authentication, Mutual Authentication, Centralised Authentication, Kerberos

UNIT-V: Network Security and Malware

IPsec (Transport vs. Tunnel, AH, ESP, Security Associations, IKE), SSL, Firewalls and Intrusion Detection Systems, DoS and DDoS, Buffer Overflow, Format Sting Vulnerabilities, The IT Act 2000: Aim and Objectives, Scope, Offences and Punishments

Course Outcomes

1. To be familiar with information security awareness and a clear understanding of its importance.
2. To master fundamentals of secret-key and public-key cryptographic systems.
3. To master protocols that provide security and authentication services.
4. To be familiar with network security threats and countermeasures.
5. To be familiar with different types of cyber-crimes and cyberlaws.

TEXTBOOKS:

1. Cryptography and Network Security: Principles and Practice, Sixth Edition, William Stallings, Pearson,7th edition.
2. Cryptography and Network Security, Third Edition, Behrouz A Forouzan, Debdeep Mukhopadhyay, Mc Graw Hill.
3. Cryptography, Network Security and Cyber Laws, Bernard L. Menezes, Ravinder Kumar,Cengage.

REFERENCES BOOKS:

1. Introduction to Computer Networks & Cyber Security, Chwan Hwa Wu, J.DavidIrwin, CRCpress.
2. Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, WileyDreamtech.
3. Everyday Cryptography, Fundamental Principles & Applications, Keith Martin, Oxford.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	Professional Elective-II 3. Internet of Things	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Learns about various types of sensors, actuators and different network protocols.
- Construction of wireless sensor networks and communication using different connectivity technologies
- To Know about how m2M communication performs and communication
- between user and the device
- Learns about how data is handled generated by IOT application how IoT is used for industrial purpose , able to builds viors IoT applications

UNIT- I: Introduction to IOT: Sensing: Sensors, Transducers, Sensor Classes and sensor types. Actuation: Actuator, Actuator Types: Hydraulic Actuators, Pneumatic Actuators, Electric Actuators, Thermal or Magnetic Actuators, Mechanical Actuators, Soft Actuators.
Basic of Networking: IoT Components, IoT Categories, N/w Protocols: MQTT(Message Queue Telemetry Transport), CoAP(Constrained Application Protocol), XMPP(Exte nsible Messaging and Presence Protocol), AMQP(Advanced Message Queuing Protocol).

UNIT- II: Communication protocols: Zigbee, 6LoWPAN, Z-Wave, NFC,RFID, IEEE 802.15.4.
Sensor Networks: Wireless Sensor Networks (WSNs), Sensor Nodes, Basic Components Sensor Node, Challanges, Node Behavior in WSNs, Applications of WSNs, Types of sensor networks: Static WSN's and Dynmaic WSN's.

UNIT- III: Machine to Machine communication: Introduction, M2M Overview, M2M Applications, M2M Features, M2M Node Types
Interoperability in IOT: Definition, Types of Interoperability: UserInteroperability, Device Interoperability
IoT Platforms: Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

UNIT- IV:
Introduction to Python programming, Introduction to Raspberry Pi:
Specifications, Basic Architecture, Raspberry Pi OS Setup,
Implementation of IoT with Raspberry Pi.
Software-Defined Networking: Overview of Current Network, Current Network to SDN, SD Architecture, Basic Concepts of SDN, Components/Attributes of SDN, Challenges

Platforms for data collection and storage:
Cloud Computing: Characteristics, Components of Cloud Computing, Service Models, Deployment Models and sensor clouds: Introduction, Actors in Sensor-cloud, Architecture, and Work Flow of Sensor-Cloud. Introduction to fog computing.

UNIT- V:
Introduction to IOE: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II, Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories.

COURSE OUTCOMES:

TEXT BOOKS:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
3. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015

REFERENCE BOOKS:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
2. Getting Started with the Internet of Things CunoPfister , Oreilly
3. Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress)
4. "Industrial Internet of Things: Cybermanufacturing Systems "by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	Professional Elective-II 4. Recommender Systems	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

1. To learn techniques for making recommendations, including non-personalized, content-based, and collaborative filtering
2. To automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations

Unit 1:

Introduction: Overview of Information Retrieval, Retrieval Models, Search and Filtering Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

Unit 2:

Content-based Filtering: High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, pre-processing and feature extraction, Obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Unit 3:

Collaborative Filtering: User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems.

Unit 4:

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies

Unit 5:

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations.Types of Recommender Systems: Recommender systems in personalized web search, knowledge-based recommender system, Social tagging recommender systems, Trust-centric recommendations, Group recommender systems.

COURSE OUTCOMES

After completion of course, students would be able to:

1. Design recommendation system for a particular application domain.
2. Evaluate recommender systems on the basis of metrics such as accuracy, rank accuracy, diversity, product coverage, and serendipity

TEXT BOOKS:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: AnIntroduction, Cambridge University Press (2011), 1sted.
2. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer (2016), 1sted.

REFERENCES:

1. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender SystemsHandbook, Springer (2011), 1sted.
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	Professional Elective-III 1. Software Project Management	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on the

1. To study how to plan and manage projects at each stage of the software development life cycle(SDLC)
2. To train software project managers and other individuals involved in software project planning and tracking and oversight in the implementation of the software project management process.
3. To understand successful software projects that support organization's strategic goals.

UNIT-I:

Conventional Software Management: The Waterfall Model, Conventional Software Management Performance.

Evolution Of Software Economics: Software Economics, Pragmatic Software CostEstimation.

Improving Software Economics: Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation through Software Economics.

UNIT-II:

The Old Way and the New: The Principles of Conventional Software Engineering, The Principles of Modern Software Management, Transitioning to an Iterative Process.

Life Cycle Phases: Engineering and Production Stages, Inception Phase, Elaboration Phase, Construction Phase, Transition Phase.

UNIT-III:

Model Based Software Architectures: A Management Perspective, A Technical Perspective.

Workflows of the Process: Software Process Workflows, Iteration Workflows.

Iterative Process Planning: Work Breakdown Structures, Planning Guidelines, The Cost and Schedule Estimating Process, The Iteration Planning Process.

UNIT-IV:

Project Organization and Responsibilities: Line-Of-Business Organizations, Project Organizations, Evolution of Organizations. **Project Control and Process Instrumentation:** The Seven Core Metrics, Management Indicators, Quality Indicators Modern Project Profiles. The COCOMO Cost Estimation Model: COCOMO.

UNIT-V:

Effort Estimation and Scheduling: Effort Estimation, Scheduling.

Quality Planning: Quality Concepts, Quantitative Quality Management Planning. RISK MANAGEMENT: Risk Assessment, Risk Control.

Course Outcomes: The students should be able to:

1. Estimate overall cost of a software project.
2. Explain software development process.
3. Distinguish workflows ofprocess.
4. Design project organization structure &analyzequality.
5. Estimate effort and schedule needed forproject.

Text Books:

1. 1.Walker Royce, “Software Project Management – A UnifiedFramework”, 1stEdition, Pearson Education,2002.
2. PankajJalote, “Software Project Management in Practice”, 1stEdition, Pearson Education, 2005.
3. Software Project Management, Bob Hughes & Mike Cotterell, TATAMcgraw-Hill.

References:

1. Bob Hughes, “Mike Cotterell, Rajib Mall, Software ProjectManagement”, 5thEdition, McGraw-Hill Higher Education,2011.
2. Joel Henry, “Software Project Management”, 1st Edition, Pearson Education,2006.
3. Norman E. Fenton,Shari Lawrence Pfleeger, “Software Metrics: A Rigorous and Practical Approach “, 1st Edition, PWS Publishing Company,1997

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM
VIZIANAGARAM – 535 003, Andhra Pradesh, India
B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)
CSE (AI & ML)

III Year II Semester	**Professional Elective-III** **2. Ethical AI**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

1. To introduce the core concepts of ethics and moral reasoning relevant to Artificial Intelligence.
2. To explore the ethical challenges in the design, development, and deployment of AI systems.
3. To familiarize students with fairness, accountability, transparency, and privacy issues in AI.
4. To study legal, societal, and philosophical implications of AI across different domains.
5. To enable students to critically assess AI systems using ethical frameworks and case studies.

UNIT I:
Introduction to Ethics and AI:

Overview of ethics – types of ethics: descriptive, normative, applied. Relevance of ethics in AI systems. Understanding moral agency in artificial systems. Foundations of machine ethics. Importance of responsible AI. Introduction to professional codes of conduct and IEEE/EU ethical AI guidelines.

UNIT II:
Fairness, Bias, and Discrimination:

Understanding algorithmic bias and its societal impact. Sources of bias – data, model, and usage. Fairness metrics and approaches. Case studies on biased AI systems (e.g., facial recognition, credit scoring). Strategies to mitigate discrimination in AI applications. Inclusive and equitable AI design.

UNIT III:
Transparency, Explainability, and Accountability:

Black-box nature of AI models. Importance of explainability in AI decisions. Techniques for interpretability (e.g., LIME, SHAP). Concepts of accountability and responsibility in AI errors. AI auditing frameworks. Legal accountability and liability of AI-driven decisions.

UNIT IV:
Privacy, Surveillance, and Consent:

Data privacy principles and AI implications. Informed consent in AI applications. Ethical concerns in surveillance systems, facial recognition, and biometric data use. Privacy-preserving AI – federated learning, differential privacy. General Data Protection Regulation (GDPR) and other global standards.

UNIT V:
Societal Impacts and Future of Ethical AI:

Autonomous systems – ethical issues in self-driving cars, military drones, and robotics. Employment and economic disruption due to AI. Misinformation and deepfakes. AI and human rights. Global perspectives on AI ethics. Future challenges – general AI and superintelligence. Designing for trust in AI systems.

COURSE OUTCOMES:

1. Understand key ethical theories and their application to artificial intelligence systems.
2. Identify and address bias, fairness, and discrimination in AI algorithms and datasets.
3. Analyze AI systems for transparency, explainability, and accountability.
4. Evaluate privacy concerns and regulatory frameworks relevant to AI deployment.
5. Critically assess the societal implications of AI and develop ethically responsible AI solutions.

TEXT BOOKS:

1. Markus D. Dubber, Frank Pasquale, Sunit Das (2020). *The Oxford Handbook of Ethics of AI*. Oxford University Press.
2. Virginia Dignum (2019). *Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way*. Springer.
3. Wendell Wallach and Colin Allen (2008). *Moral Machines: Teaching Robots Right from Wrong*. Oxford University Press.

REFERENCE BOOKS:

1. Cathy O'Neil (2016). *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy*. Crown Publishing.
2. Nick Bostrom and Eliezer Yudkowsky (2014). *The Ethics of Artificial Intelligence*. Cambridge Handbook of Artificial Intelligence.
3. Luciano Floridi (2013). *The Ethics of Information*. Oxford University Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	**Professional Elective-III** **3. Data Visualization**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

1. This course is all about data visualization, the art and science of turning data into readable graphics. Will explore how to design and create data visualizations based on data available and tasks to be achieved.
2. This process includes data modeling, data processing (such as aggregation and filtering), mapping data attributes to graphical attributes, and strategic visual encoding based on known properties of visual perception as well as the task(s) at hand.
3. Students will also learn to evaluate the effectiveness of visualization designs, and think critically about each design decision, such as choice of color and choice of visual encoding.
4. Students will create their own data visualizations, and learn to use Open Source data visualization tools, especially D3.js.
5. Students will also read papers from the current and past visualization literature and create video presentations of their findings.

Unit 1: INTRODUCTION TO VISUALIZATION

Visualizing Data-Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes- Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Color Scales-Color as a Tool to Distinguish, Color to Represent Data Values, Color as a Tool to Highlight, Directory of Visualizations- Amounts, Distributions, Proportions, x–y relationships, Geospatial Data

UNIT 2: VISUALIZING DISTRIBUTIONS

Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heatmaps, Visualizing Distributions: Histograms and Density Plots- Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots-Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile Quantile Plots, Visualizing Many Distributions at Once-Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis

UNIT 3: VISUALIZING ASSOCIATIONS & TIME SERIES

Visualizing Proportions-A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total, Visualizing Nested Proportions- Nested Proportions Gone Wrong, Mosaic Plots and Treemaps, Nested Pies, Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatterplots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an Independent Variable-Individual Time Series, Multiple Time Series and Dose-Response Curves, Time Series of Two or More Response Variable

UNIT 4: VISUALIZING UNCERTAINTY

Visualizing Trends-Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series Decomposition, Visualizing Geospatial Data-Projections, Layers, Choropleth Mapping, Cartograms, Visualizing Uncertainty-Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Visualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plots

UNIT 5: PRINCIPLE OF PROPORTIONAL INK

The Principle of Proportional Ink-Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations, Handling Overlapping Points-Partial Transparency and Jittering, 2D Histograms, Contour Lines, Common Pitfalls of Color Use- Encoding Too Much or Irrelevant Information, Using Nonmonotonic Color Scales to Encode Data Values, Not Designing for Color-Vision Deficiency

COURSE OUTCOMES

Upon completion of this course, the students will be able to

1. **Understand basics of Data Visualization**
2. Implement visualization of distributions
3. Write programs on visualization of time series, proportions & associations
4. Apply visualization on Trends and uncertainty
5. Explain principles of proportions

TEXTBOOKS

1. Claus Wilke, “Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures,” 1st edition, O’Reilly Media Inc, 2019.

REFERENCE BOOKS

1. Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization, O’Reilly,2016
2. Ossama Embarak, Data Analysis, and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems, Apress, 2018

EBOOKS

1. https://www.netquest.com/hubfs/docs/ebook-data-visualization-EN.pdf

MOOC

2. https://www.coursera.org/learn/data-visualization
3. https://www.coursera.org/learn/python-for-data-visualization#syllabus

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	Professional Elective-III 4. Soft Computing	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

This course will cover fundamental concepts used in Soft computing:

- The concepts of Fuzzy logic (FL) will be covered first, followed by Artificial Neural Networks (ANNs) and optimization techniques using Genetic Algorithm (GA).
- Applications of Soft Computing techniques to solve a number of real life problems will be covered to have hands on practices.
- The course will provide exposure to theory as well as practical systems and software used in soft computing.

SYLLABUS:

UNIT-I

Introduction to Soft Computing: Concept of computing systems."Soft" compiting versus "Hard" computing Characteristics of Soft computingSome applications of Soft computing techniques

UNIT-II

Fuzzy logic: Introduction to Fuzzy logic.Fuzzy sets and membership functions.Operations on Fuzzy sets.Fuzzy relations, rules, propositions, implications and inferences.Defuzzification techniques.Fuzzy logic controller design.Some applications of Fuzzy logic.

UNIT-III

Genetic Algorithms: Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures.GA operators: Encoding, Crossover, Selection, Mutation, etc. Solving single-objective optimization problems using GAs.

UNIT-IV

Multi-objective Optimization Problem Solving :Concept of multi-objective optimization problems (MOOPs) and issues of solving them.Multi-Objective Evolutionary Algorithm (MOEA).Non Pareto approaches to solve MOOPs,Pareto-based approaches to solve MOOPs,Some applications with MOEAs.

UNIT-V

Artificila Neural Networks: Biological neurons and its working.Simulation of biolgical neurons to problem soloving.Different ANNs architectures.Trainging techniques for ANNs.Applications of ANNs to solve some real life problems.

Course Outcomes:

After completing this course, you will be able to learn:

- Fuzzy logic and its applications.
- Artificial neural networks and its applications.
- Solving single-objective optimization problmes using GAs.

- Soloving multi-objectiove optimization problerms using Evolutionary algorithms (MOEAs).
- Applications of Soft computing to solve problmes in varieties of application domains.

Text Books:

1. Fuzzy Logic: A Pratical approach, F. Martin, Mc neill, and Ellen Thro, AP Professional, 2000.
2. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.

Reference Books:

1. Foundations of Neural Networks, Fuzzy Systems, and Knowldge Engineering, Nikola K. Kasabov, MIT Press, 1998.
2. Fuzzy Logic for Embedded Systems Applications, Ahmed M. Ibrahim, Elesvier Press, 2004.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	Open elective offered by other department	L	T	P	C
		3	0	0	3

III Year II Semester	COMPUTER VISION LAB	L	T	P	C
		0	**0**	**3**	**1.5**

Course Objectives

1. To introduce students to the foundational concepts and applications of computer vision.
2. To enable understanding of image formation, feature extraction, and transformation techniques.
3. To provide knowledge on segmentation, object recognition, and visual analysis methods.
4. To develop the ability to implement and evaluate computer vision algorithms for real-world tasks.
5. To expose students to cutting-edge research and industry applications in computer vision.

List of experments:

1. Implement image acquisition and display using OpenCV.
2. Detect and extract keypoints using Harris and SIFT.
3. Perform feature matching between two images using FLANN.
4. Apply Canny edge detection and visualize results.
5. Implement line detection using Hough Transform.
6. Segment an image using mean shift clustering.
7. Perform image segmentation using graph cuts.
8. Estimate homography and align images (image stitching).
9. Calibrate a camera using a chessboard pattern and OpenCV.
10. Implement face recognition using Eigenfaces.
11. Detect pedestrians in video using HOG + SVM.
12. Build a simple scene recognition model using a pre-trained CNN

Course Outcomes

1. Students will understand the theoretical foundation and workflow of computer vision systems.
2. Students will be able to implement and evaluate feature extraction and matching algorithms.
3. Students will apply image segmentation techniques for practical use cases.
4. Students will develop the ability to perform calibration and feature-based alignment.
5. Students will build systems capable of detecting and recognizing objects and people in images and video.

Textbooks

1. Richard Szeliski, *Computer Vision: Algorithms and Applications*, Springer.
2. E. R. Davies, *Computer Vision: Principles, Algorithms, Applications, Learning*, Academic Press.
3. Simon J. D. Prince, *Computer Vision: Models, Learning, and Inference*, Cambridge University Press.

Reference Books

1. Gary Bradski and Adrian Kaehler, *Learning OpenCV: Computer Vision with the OpenCV Library*, O'Reilly.
2. David A. Forsyth and Jean Ponce, *Computer Vision: A Modern Approach*, Pearson.
3. Mark Nixon and Alberto Aguado, *Feature Extraction and Image Processing for Computer Vision*, Academic Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	Operating System Lab	L	T	P	C
		0	0	3	1.5

Course objectives:

- To implement process scheduling algorithms to understand CPU management and process execution efficiency.
- To apply memory management techniques by simulating various allocation and deal location algorithms.
- To identify and implement solutions for critical section problems and virtual memory management using appropriate algorithms.
- To develop file allocation strategies by implementing common file organization algorithms.
- To understand and write shell scripts for automating basic tasks in a Unix/Linux environment.

.

List of Experiments:

1. Simulate the following CPU scheduling algorithms

a) Round Robin b) SJF c) FCFS d) Priority

2. Multiprogramming-Memory management-

Implementation of fork (), wait (), exec() and exit (), System calls

3. Simulate the following

a) Multiprogramming with a fixed number of tasks (MFT)

b) Multiprogramming with a variable number of tasks (MVT)

4. Simulate Bankers Algorithm for Dead Lock Avoidance

5. Simulate Bankers Algorithm for Dead Lock Detection.

6. Simulate the following page replacement algorithms.

a) FIFO b) LRU c) LFU

7. Simulate the following File allocation strategies

a) Sequenced b) Indexed c) Linked

8. Write a program to simulate producer and consumer problem using semaphores

9. Write program to create a thread using pthreads library and let it run its function.

10. Write a program to illustrate concurrent execution of threads using pitheads library.

Course Outcomes:

- Simulate various CPU process scheduling algorithms to analyze system performance.
- Implement system calls for process creation, management, and inter-process communication.
- Apply different memory management techniques including paging, segmentation, and allocation methods.
- Simulate page replacement, banker's algorithm, and file allocation strategies to evaluate their efficiency.
- Implement synchronization mechanisms in concurrent programming and demonstrate multithreading concepts for safe process execution

Text Books:

1. Operating System -Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley

2. The ultimate guide Unix, Sumiton das, McGraw-Hill Higher Education, 3rd Edition, January 21, 2012

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	Soft Skills (Skill Enhancement Course)	L	T	P	C
		0	1	2	2

Course Objectives

➢ Encourage use of a wide range of grammatical structures and vocabulary in speech and writing

➢ Demonstrate good writing skills for effective paraphrasing, argumentative essays, and formal correspondence

➢ Provide training and opportunities to develop fluency in English through participation informal group discussions and presentations using audio-visual aids

➢ Knowing the best practices at the workplace to perform well in the interview. ➢ Encouraging smart self-learning, communication skills that focus on employability.

Course Outcomes

➢ understand the grammatical forms of English and the use of these forms in specific communicative and career context

➢ use a wide range of reading comprehension strategies appropriate to texts, to retrieve information

➢ strengthen their ability to write paragraphs, essays, emails and summaries ➢ improve their speaking ability in English both in terms of fluency and comprehensibility by participating in Group discussion and oral assignments

➢ prepare their own resume and answer interview related questions unhesitatingly with acceptable soft skills

Unit 1 Preparing for Written Assessment [6 Hours] Grammar: Articles: Know how to use different types of Articles**,** use articles appropriately in context Identify errors in the use of articles, **Prepositions**: Learn to use prepositions in context, Identifying errors in the use of prepositions, Look at the different functions of Prepositions, **Tenses**: understand the different form of tense used in sentences, know the various purposes of using different Tense forms, Use appropriate tense forms of verbs in context, Identify the errors in the use of tense forms, **Concord**: Know how to identify Subject-Verb-Agreement in sentences, Use SVA appropriately in Context, identify the errors in the use of SVA, **Voices**:Know when to use Active or Passive Voice, Convert Active sentences to Passive ones,Relative Clause:

Know what relative pronouns are, know when to use relative clauses,know the functions of Relative Clauses.

Soft Skills: Leadership:Introduction to Leadership, Leadership Power, Leadership Styles, Leadership in Administration. **Interpersonal Relations**:Introduction to Interpersonal Relations, Analysis of different ego states, Analysis of Transactions, Analysis of Strokes, Analysis of Life position

Learning Outcomes

At the end of the module, the learners will be able to

➢ Comprehend the factors that influence use of grammar and vocabulary in speech and writing(L3)

➢ Produce a range of valid grammatical sentences in the real-world situations and professional environment. (L3)

➢ develop employability skills through Leadership skills and interpersonal skills (L3)

Unit 2 Reading Comprehension [6 Hours]

Purposes & Strategies of Reading:know the general purpose of Reading,assess your skills of reading ,develop reading Strategies **Skimming for details**:Skim through a variety of passages, understand how skimming will orient you to the text, **Identifying main Ideas**:Identify the main ideas in the give text,Look for supporting statements in a passage, understand how the writer supports main ideas with details **Scanning for information:**Scan passages for factual information, understand how scanning can help find certain answers quickly,know how to look for factual answers,**drawing inferences:**Understand how to draw inferences,infer meanings while reading passages, **vocabulary**:Learn strategies to understand difficult words used in the passage,Apply strategies of reading to understand a variety of passages,**practise tests**

Soft Skills:Communication: Introduction to Communication, Flow of Communication, Listening, Barriers of Communication, How to overcome barriers of communication. **Stress Management**:Introduction to Stress, Causes of Stress, Impact Stress, Managing Stress

Learning Outcomes

At the end of the module, the learners will be able to

➢ assess the reading skill by developing reading strategies (L3)

➢ Understand the skimming & scanning techniques orients to identify the theme,purpose and statements.(L2)

➢ develop employability skills through communication skills and stress management(L3)

Unit 3 Writing paragraphs & Essays [6 Hours]

Features of Good Writing:understand what makes a piece of writing good,Analyse & discuss some samples of good & bad writing, **Gathering Ideas**: Discuss various techniques for gathering ideas before you start writing, practice some of the techniques that can be used in the Prewriting stage ,**Purposes of Writing:**understand the importance of purpose of writing,explore various purpose of writing,choose content & language based on the purpose **Writing for Specific audience:**Study ways of tailoring content to suit a target audience,analyse text to deduce the target audience,discuss how language is used to suit the target audience **organizing ideas:**understand the importance of organising ideas in a text,Learn the different ways of organising ideas,practice organising ideas while writing **Writing an introduction:**Know the importance of a good introduction, understand the different ways in which writers catch the attention of readers, **Developing supporting ideas:**Learn how to develop your ideas in a paragraph, discuss a variety of supporting ideas ,**Writing a conclusion:**Learn the different parts of a conclusion, Practice writing an effective conclusion **Using linkers:**Learn the different types of Linkers or cohesive devices, Discuss why it is important to use connectors in writing,**Choosing the right words:**Discuss why writers make a careful choice of language,Learn how to select language to make the intended impact, **Writing film & book reviews:** Learn the different categories of books & films,Know the elements which go into analysing books & films,Write your own film & book reviews **Common errors in writing, editing & proofreading**.:Practice correcting errors in basic sentence structure,Learn to proof-read & edit your draft before writing the final version

Soft Skills:Group Dynamics and Team Building: Importance of groups in organization,Interactions in group, Group Decision Taking, Team Building, Interaction with the Team, How to build a good team?

Learning Outcomes

At the end of the module, the learners will be able to

➢ understand the use of passive voice in academic writing (L2)

➢ use appropriate vocabulary to express ideas and opinions (L2)

➢ develop employability skills through group dynamics and team building (L3) **Unit 4 Preparing for oral**

Assignment [6 Hours]

Group Discussion: Group Discussions as a tool for selection, skills for GD,Leadership & Problem-Solving Skills, Types of GD, Group Dynamics, Roles & Functions: Beginning, Presenting, Elaborating, Roles & Functions: Clarifying, Synthesising & Challenging, Roles & Functions: Agreeing, Disagreeing & Summarizing., Etiquette: Body Language & Time Management, GD Activities

Soft Skills: Conflict Management:Introduction to Conflict, Causes of Conflict, Managing Conflict **Time Management:** Time as a Resource, Identify Important Time Wasters, Individual Time Management Styles, Techniques for better Time Management.

Learning Outcomes

At the end of the module, the learners will be able to

➢ participate in group discussions using appropriate conventions and language strategies and develop advanced listening skills for in-depth understanding of academic text(L3) ➢ collaborate with a partner to make discussions (L2)

➢ develop employability skills through conflict management and time management(L3)

Unit 5 Interview Skills [6 Hours]

Purpose of interviews: Know what recruiters looking for during Interviews,Become familiar with the process of career search, understand your skills,interests,achievements and attitude better **Preparing a Resume:**Understand what a job application is,know the details to be included in a CV,Know how to lay out details of a CV & prepare CV on your own **Writing a Cover Letter:**Study the information which is included in a cover letter.Learn how to organise information in a cover letter ,**Before and at the interview:**Learn how to prepare for an interview,learn how to behave during the interview, discuss what the interviewer might assess you on **Answering FAQs about yourself & your families:**Learn how to answer questions about yourself & family, Learn how to identify & talk about your strengths and Weaknesses **Answering FAQs about Likes & Dislikes:**Learn to choose interests which will be relevant to your Interview.learn to speak about your likes & Dislikes **Answering FAQs about Justifying your candidature:**Know what you need to say to answer a question about yourself, Be able to answer questions about your suitability for a job **Answering FAQs about Priorities,Attitudes & Biases:**Understand what your priorities will be in a job & learn to talk about them,learn to correct understanding of your attitude, biases & prejudice, if any, towards others,know positive qualities that are valued at work **Answering FAQs about Professional goals:** Become aware of the things you need to keep in mind while choosing a job,Set goals for your professional growth & plan how to achieve them **Public Speaking: Planning, Practice & Delivery:**Plan one minute speeches on simple topics, understand how to capture the audience's attention, be able to create strong closing statements.

Soft Skills:Motivation: Introduction to Motivation, Relevance and types of Motivation, Motivating subordinates, Analysis of Motivation

Learning Outcomes

At the end of the module, the learners will be able to

➢ prepare a CV with a cover letter to seek internship/ job (L2)

➢ understand the structure of Interviews and familiar with frequently asked questions while interview and how to respond to it (L3)

➢ develop employability skills through motivation and analysis of motivation (L3)

The learners will demonstrate their knowledge and abilities through completion of the following required assessments while or at the end of this course. —1 Quiz, 1 GD, 2 Activities on Interview Readiness and Softskills, 1 Personal Interview

Quiz: (10M)

Quiz is conducted on Grammar, Vocabulary and Reading Comprehension. The Quiz consists of 50 questions and will be scaled down to 10 Marks. Duration of the quiz is 1hr 30 Min only and it is Computer Based Test (CBT)

Resume:(10 M)

Each student is required to submit 3 independently written Resumes during the course. Specific requirements for each one are accessed on the following

Link: https://docs.google.com/document/d/1W15961dOEnIxlnMm9BKyO8L9WIa7nPbEfg

R-9DT_m Rg/edit?usp=sharing

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

III Year II Semester	Technical Paper Writing & IPR	L	T	P	C
		2	0	0	-

COURSE OBJECTIVES:

1. To enable students to understand the process of writing quality technical papers and research articles.
2. To familiarize students with effective strategies for literature survey, organization, and scientific writing.
3. To introduce the basics of Intellectual Property Rights (IPR), including patents, copyrights, and trademarks.
4. To provide insights into patent filing procedures, laws, and the role of IPR in academia and industry.
5. To encourage ethical writing practices and awareness of plagiarism, authorship, and publication ethics.

UNIT I:

Introduction to Technical Writing:

Characteristics of technical writing – clarity, precision, formality, and structure. Types of technical documents – journal papers, conference papers, technical reports, theses. Components of a research paper – title, abstract, keywords, introduction, literature review, methodology, results, discussion, conclusion, and references. Importance of audience and purpose. Common errors in writing.

UNIT II:

Research Process and Writing Tools:

Understanding the research process – problem formulation, hypothesis, research design, and data interpretation. Conducting effective literature review using databases (IEEE Xplore, Scopus, Google Scholar). Citation and referencing styles – IEEE, APA, MLA. Use of tools such as LaTeX, Grammarly, Mendeley, and Zotero. Best practices in editing and proofreading.

UNIT III:

Publication Ethics and Plagiarism:

Ethics in research and authorship. Understanding plagiarism and how to avoid it. Tools for plagiarism detection. Roles of authors, co-authors, reviewers, and editors. Ethics in peer review. Predatory journals and conferences. Guidelines from COPE (Committee on Publication Ethics).

UNIT IV:

Introduction to Intellectual Property Rights (IPR):

Overview of IPR – need, scope, and types: patents, copyrights, trademarks, and trade secrets. Concept of novelty, utility, and non-obviousness in patents. Indian and international IPR frameworks (WIPO, TRIPS). Role of IPR in academia, startups, and innovation ecosystems.

UNIT V:

Patent Filing and Case Studies: Patent search and patentability criteria. Process of patent application – drafting, filing, prosecution, and grant. Role of patent attorneys and patent offices. Infringement and litigation. Case studies of IPR in technology and research. Role of IP in commercialization and technology transfer.

COURSE OUTCOMES:

1. Understand the components and structure of technical research papers.
2. Develop skills in literature review, referencing, and use of writing tools.
3. Apply ethical principles in academic writing and avoid plagiarism.
4. Gain knowledge of various types of intellectual property and related legal aspects.
5. Understand patent filing procedures and their importance in innovation and entrepreneurship.

TEXT BOOKS:

1. Ritu Arora (2020). Technical Writing and Professional Communication. McGraw-Hill Education.
2. Neeraj Pandey & Khushdeep Dharni (2014). Intellectual Property Rights. PHI Learning.
3. Gopalkrishnan, N. S. & Agitha, T. G. (2009). Principles of Intellectual Property. Eastern Book Company.

REFERENCE BOOKS:

1. WIPO (2016). Understanding Intellectual Property: A Guide for Beginners. World Intellectual Property Organization.
2. Day, R. A., & Gastel, B. (2012). How to Write and Publish a Scientific Paper. Cambridge University Press.
3. Deborah Bouchoux (2012). Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets. Cengage Learning.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

IV Year I Semester	Natural Language Programming	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Teach students the leading trends and systems in natural language processing.
2. Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate the above mentioned concepts.
3. Teach them to recognize the significance of pragmatics for natural language understanding.
4. Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

UNIT-I

Finding the Structure of Words: **Words and Their Components, Issues and Challenges, Morphological Models**

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

Unit-II

Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues

Unit-III

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

Unit-IV

Predicate-Argument Structure

Predicate-Argument Structure, Meaning Representation Systems, Software.

Unit-V

Discourse Processing: Cohension, Reference Resolution, Discourse Cohension and Structure

Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language Specific Modeling Problems, Multilingual and Crosslingual Language Modeling .

COURSE OUTCOMES:

1. Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
2. Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
3. Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.

4. Able to design, implement, and analyze NLP algorithms 5. Able to design different language modeling Techniques.

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel
2. M.Bikel and Imed Zitouni, Pearson Publication
3. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

REFERENCE BOOKS:

1.Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

IV Year I Semester	Management Course-II Human resource Management Entrepreneurship &Incubation	L	T	P	C
		2	0	0	2

Course Objectives:

- Outline an environment to inculcate entrepreneurial skills.(L2)
- Develop innovative products, services, processes and techniques.(L3)
- Planto prepare financial proposals and start-ups.(L3)
- Analyse the ideas to collaborate entrepreneur skills in establishment of start-ups.(L3)
- Explain the financial resource existing in government and private sectors.(L2)

Course outcomes:

- Explain the knowledge of Entrepreneurial behavior and skill development.(L2)
- Choose business ideas that have value in the end-market.(L2)
- Identify the validity of idea and it unique selling proportion.(L3)
- Comprehend opportunity and challenges of-startup(L2)
- Analyze various Government and non-Government financial resource.(L3)

Unit-I: Fundamentals of Entrepreneurship

Entrepreneurship- Concept, Importance, Characteristics –Myths of Entrepreneurship -Role of Entrepreneurs in Indian economy–Distinguish between professional entrepreneurs Vs Family entrepreneurs - Social and Ethical Perspectives of Entrepreneurship.

Application: Case lets: Business cases of young entrepreneurs.

Unit-II: Ideation and Evaluation of Business Ideas

Opportunity identification–Ideations process- Sources of business ideas –Role of creativity– Sources of Innovation – Technological Innovation and Entrepreneurship - Product/ Service design – Design Thinking.
Case lets: Business cases of OYO.
Activity: Collection of novel business ideas.

Unit-III: Feasibility Analysis and Business plan

Thrust areas of entrepreneurship- Techno-economic feasibility assessment- Financial feasibility – Market feasibility – Preparation of Business plan – Business canvas & Lean canvas.

Activity:

Unit-IV: Business Incubation and startups

Fundamentals of business incubation-Services of incubators -Start-ups-meaning, significance - start up strategy-Present scenario of startups.

Activity:

- Evaluating new start- ups in India
- Analysis on Shark Tank India program

Unit-V: Financial resources

Sources of finance–Bootstrapping-Government Support–MSMEs-Crowd Funding–Venture Capitalists & Angel Investors - Schemes for women entrepreneurs

Activity: Business plan final version

Contemporary Topics:

1. Green Business
2. Niche Markets
3. New perspectives in rural enterprises

Text Books:

a. T.V Rao, Donald F.Kuratko, Entrepreneurship, A South-Asian Perspective, Cengage Learning, 1st edition, 2012.
b. Datsy Davies, Indian Startups, Amazon Asia- Pacific Holdings Private Limited, 1st Edition, 2016

Reference Books:

1. P.N.Rath,Sarjue Pandita, Entrepreneurship :Startup India & Standup India, Lexicon Publishing House, 2018
2. MadhurimaLall, ShikhaSahai, Entrepreneurship, Excel Books(P)Ltd.2008
3. Rajeev Roy, Entrepreneurship, Oxford Higher Education.2011
4. H.Nandan, Fundamentals of Entrepreneurship, PHIL earning(P)Ltd,2013

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

IV Year I Semester	**Professional Elective - IV** **1.Federated Learning**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

1. To introduce the fundamentals of Federated Learning and its need in privacy-preserving machine learning.
2. To understand the architectures, protocols, and algorithms used in Federated Learning systems.
3. To study optimization and communication challenges associated with distributed learning.
4. To explore privacy, security, and trust mechanisms in Federated Learning environments.
5. To apply Federated Learning techniques in real-world applications such as mobile devices, healthcare, and finance.

UNIT I:

Introduction to Federated Learning: Fundamentals of distributed and decentralized learning. Evolution and definition of Federated Learning (FL). Motivation for FL – data privacy, regulatory constraints, and edge computing. Federated vs centralized learning. Components of FL – clients, server, and communication rounds. Real-world scenarios and case studies in Google Gboard and healthcare.

UNIT II:

Federated Learning Algorithms and Architectures: Basic algorithms – Federated Averaging (FedAvg), FedProx, and SCAFFOLD. Model update and aggregation mechanisms. System architecture – client-server model, cross-device and cross-silo FL. Client selection strategies. Asynchronous and synchronous learning in FL environments.

UNIT III:

Optimization and Communication Efficiency: Challenges in training models across heterogeneous clients. Techniques for reducing communication cost – model compression, quantization, sparsification. Handling non-IID (independent and identically distributed) data. Personalization strategies. Impact of client availability and system heterogeneity.

UNIT IV:

Privacy, Security, and Trust in FL: Threats in Federated Learning – inference attacks, data poisoning, and model poisoning. Secure aggregation and encryption techniques – homomorphic encryption, differential privacy, secure multiparty computation. Trust frameworks and incentive mechanisms. Blockchain-enabled Federated Learning.

UNIT V:

Applications and Future Directions: Applications in mobile computing, healthcare, banking, autonomous vehicles, and IoT. Case studies on real-world Federated Learning deployments. Frameworks and tools – TensorFlow Federated, PySyft, Flower. Current research trends and open challenges. Ethical considerations and regulatory compliance (GDPR, HIPAA).

COURSE OUTCOMES:

1. Understand the key principles, motivations, and applications of Federated Learning.
2. Apply suitable FL algorithms for different learning scenarios with privacy constraints.

3. Analyze and optimize Federated Learning systems under communication and data constraints.
4. Evaluate security and privacy-preserving techniques used in distributed ML.
5. Design Federated Learning models for real-world applications using appropriate tools and frameworks.

TEXT BOOKS:

1. Qiang Yang, Yang Liu, Tianjian Chen, Yongxin Tong (2019). Federated Machine Learning: Concept and Applications. Springer.
2. Jakub Konečný, Brendan McMahan et al. (2021). Advances and Open Problems in Federated Learning. NOW Publishers.
3. Rieke, Nicola, et al. (2020). The Future of Digital Health with Federated Learning. Springer.

REFERENCE BOOKS:

1. Peter Kairouz et al. (2021). Federated Learning: Strategies for Improving Communication Efficiency. arXiv preprint.
2. Mehdi Mohri, Gary Sivek, Ananda Theertha Suresh (2019). Agnostic Federated Learning. Proceedings of ICML.
3. Brendan McMahan et al. (2020). TensorFlow Federated: Machine Learning on Decentralized Data. Google AI Blog & Documentation.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

IV Year I Semester	**Professional Elective - IV** **2.NOSQL DATABES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

From the course the student will

1. To understand the basic concepts and the applications of database systems. To master the basics of SQL and construct queries using SQL.
2. To understand the relational database design principles.
3. To become familiar with the basic issues of transaction processing and concurrency control.
4. To become familiar with database storage structures and access techniques.

UNIT I

Introduction to NoSQL: Definition And Introduction, Sorted Ordered Column-Oriented Stores, Key/Value Stores, Document Databases, Graph Databases, Examining Two Simple Examples, Location Preferences Store,Car Make And Model Database, Working With Language Bindings.

UNIT II

Interacting with NoSQL: If NoSql Then What, Language Bindings ForNoSQL Data Stores, Performing Crud Operations, Creating Records, Accessing Data, Updating And Deleting Data

UNIT III

NoSQL Storage Architecture: Working With Column-Oriented Databases, Hbase Distributed Storage Architecture, Document Store Internals, Understanding Key/Value Stores In Memcached And Redis, Eventually Consistent Non-Relational Databases.

UNIT IV

NoSQL Stores: Similarities Between Sql And Mongodb Query Features, Accessing Data From Column-Oriented Databases Like Hbase, QueryingRedis Data Stores, Changing Document Databases, Schema Evolution In Column-Oriented Databases, Hbase Data Import And Export, Data Evolution In Key/Value Stores.

UNIT V

Indexing and Ordering Data Sets: Essential Concepts Behind A Database Index, Indexing And Ordering In Mongodb, Creating and UsingIndexes In Mongodb, Indexing And Ordering In Couchdb, Indexing In Apache Cassandra.

COURSE OUTCOMES:

After the completion of the course, student will be able to do the following.

1. Define, compare and use the four types of NoSQL Databases (Document-oriented, Key Value Pairs, Column oriented and Graph).
2. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
3. Explain the detailed architecture, define objects, load data, query data and performance tune.Document oriented NoSQL databases.
4. Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data

TEXT BOOKS:

1) Pramod Sadalage and Martin Fowler, NoSQL Distilled, Addison-Wesley Professional, 2012.

2) Dan McCreary and Ann Kelly, Making Sense of NoSQL, Manning Publications, 2013.

REFERENCE BOOKS:

1) Shashank Tiwari, Professional NoSQL, Wrox Press, Wiley, 2011, ISBN: 978-0-470-94224-6 Gaurav Vaish, Getting Started with NoSQL, Packt Publishing, 2013.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

IV Year I Semester	Professional Elective - IV 3.Quantum Computing	L	T	P	C
		3	0	0	3

Course Description:

The objective of this course is to impart necessary knowledge of Quantum Computing Technologies tothe learner, so that he/she can develop and implement algorithms and write programs using these algorithms to design and develop Quantum machines which is a cutting-edge technology. Students will solve quantum computing problems with the knowledge gain during this coursework

Course Educational Objectives:

- Introduce the working of a Quantum Computing program, its architecture and program model
- Teach universal gates circuits on available simulators
- Illustrate the advantage of super position and entanglement
- Create an understanding of quantum algorithms to solve real world quantum problems
- Demonstrate the applications of quantum computing

Course Outcomes:

1. Understand under lying principles of Quantum Computing (L2)
2. Analyse the matrix operators for universal quantum gate (L4)
3. Demonstrate quantum fouriert transformation(L1)
4. Analyse quantum algorithms for searching(L4)
5. Developaquantumcomputingapplicationformachinelearning/Keydistribution(L6)

Unit-I: INTRODUCTIONTO QUANTUM COMPUTING

Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.), Origin of Quantum Computing, Overview of major concepts in Quantum Computing: Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation(1.1., 1.2., 1.3.,)
Math Foundation for Quantum Computing (Matrix Algebra): basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors ,Dirac notation, Eigen values and Eigen vectors (2.1)

UNIT-II: QUANTUM CIRCUITS BUILDING BLOCKS FOR QUANTUMPROGRAM

Quantum Algorithms, Single Qubit operations, Controlled operations, Measurement, Universal quantum gates, Simulation of quantum systems (4.1 to 4.5, 4.7)

UNIT-III:TENSORPRODUCTS, TELEPORTATION AND SUPERDENSE CODING

Tensor Products, Multi Q-Bit system, Super Position, Entanglement, Decoherence, quantum teleportation, no-cloning theorem super dense coding(10thchapterofBook2),Quantum Fourier transformations and its applications (5.1., 5.2., 5.3.)

UNIT-IV:QUANTUM ALGORITHMS

Hadamard Gates, phase gate, Quantum interference, Quantum parallelism a function evaluation, Deutsch-Jozsa Algorithm, Phase Estimation, Shor's algorithm, Quantum Searching and Grover's Algorithm (9th chapter of Book 2)

UNIT-V: QUANTUM ERRORS & QUANTUM COMPUTING APPLICATIONS

Single- Qubit error, Quantum Operations and Krauss Operations. Quantum Machine Learning (SVM), Quantum Cryptography (QKD, Post-Quantum Cryptography (Chapter 8, 10, 12)

Textbook(s):

1. Michael A.Nielsen, Quantum Computation and Quantum Information,, Cambridge University Press, , 2013 ,ISBN:978-1107619197,10th edition.
2. David McMahon, Quantum Computing Explained, WileyPublisher,2008, ISBN:978-0470096994,1st edition.

Reference(s):

1. Introduction to Quantum Computing: Quantum Algorithms and Qiskit,
2. ,https://nptel.ac.in/courses/106106232
3. IBM Experience:, ,https://www.coursera.org/programs/gitam-open-learning-7qv77/learn/introduction-to-quantum-information?authProvider=gitam&sou
4. MicrosoftQuantumDevelopmentKit,,https://www.microsoft.com/en-us/quantum/development-kit
5. Forest SDKPyQuil,, https://pyquil.readthedocs.io/en/stable/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

IV Year I Semester	4.Computational Neuroscience Professional Elective-IV	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the interdisciplinary foundations of computational neuroscience combining biology, computer science, and mathematics.
2. To understand the structure and function of the brain from a computational modeling perspective.
3. To explore neural coding, neural networks, and mathematical modeling of brain activity.
4. To study various brain models from single neurons to large-scale neural circuits.
5. To apply computational methods to simulate and analyze neuronal dynamics and behavior.

UNIT I:

Introduction to Neuroscience and Neural Systems: Overview of neuroscience – neurons, synapses, and brain architecture. Neuron anatomy and electrophysiology. Communication between neurons – action potentials, ion channels, and neurotransmitters. Organization of the central and peripheral nervous systems. Introduction to brain regions and cognitive functions. Motivation for computational modeling of neural systems.

UNIT II:

Modeling Single Neurons: Mathematical models of neuron dynamics – Hodgkin-Huxley model, integrate-and-fire model. Ion channel dynamics and membrane potentials. Numerical simulation of neuron models. Comparison of biologically realistic vs. simplified neuron models. Synaptic integration and postsynaptic potentials.

UNIT III:

Neural Coding and Information Processing: Concepts of neural coding – rate coding, temporal coding, population coding. Encoding and decoding information in the brain. Signal representation in the nervous system. Information theory in neuroscience – entropy, mutual information, and efficient coding hypothesis. Role of noise and variability in neural responses.

UNIT IV:

Artificial and Biological Neural Networks: Network models of interconnected neurons. Recurrent neural networks, Hopfield networks, and attractor dynamics. Learning rules – Hebbian learning, STDP (Spike-Timing Dependent Plasticity). Computational modeling of memory, learning, and decision-making. Comparison with artificial neural networks and deep learning models.

UNIT V:

Cognitive and Behavioral Modeling: Computational approaches to perception, motor control, and attention. Large-scale brain modeling and simulation platforms (e.g., NEURON, NEST, Brian2). Brain-computer interfaces. Case studies of computational models in visual processing, auditory systems, and sensory-motor integration. Future directions in computational neuroscience and brain-inspired computing.

COURSE OUTCOMES:

1. Understand the biological basis of neural systems and how they are modeled computationally.
2. Simulate and analyze the behavior of single neurons using mathematical models.

3. Interpret neural codes and apply information theory to brain signal processing.
4. Construct and analyze simple neural networks based on biological principles.
5. Apply computational techniques to study cognition, perception, and motor functions in the brain.

TEXT BOOKS:

1. Peter Dayan & L.F. Abbott (2001). *Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems*. MIT Press.
2. Thomas Trappenberg (2010). *Fundamentals of Computational Neuroscience*. Oxford University Press.
3. Eugene M. Izhikevich (2007). *Dynamical Systems in Neuroscience: The Geometry of Excitability and Bursting*. MIT Press.

REFERENCE BOOKS:

1. Wulfram Gerstner & Werner M. Kistler (2002). *Spiking Neuron Models: Single Neurons, Populations, Plasticity*. Cambridge University Press.
2. Bard Ermentrout & David Terman (2010). *Mathematical Foundations of Neuroscience*. Springer.
3. Christof Koch (1999). *Biophysics of Computation: Information Processing in Single Neurons*. Oxford University Press.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

IV Year I Semester	1.Agile methodologies Professional Elective-V	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce students to various software development methodologies,
- To familiarize students with popular Agile frameworks
- To enable students to apply Agile planning and estimation techniques.
- To train students in modern Agile development practices
- To develop students' ability to analyze Agile project performance using metrics

Course Outcomes: Atthe end of the course the student should be able to:

- Understand various software development methodologies
- Explain and compare different Agile frameworks like Scrum, XP, and Kanban, and identify appropriate practices for different software project scenarios.
- Apply Agile planning techniques such as release planning, iteration planning, and user story mapping,
- Demonstrate Agile development practices including TDD, BDD, CI/CD, refactoring, and pair programming,
- Analyze Agile project management metrics, team dynamics

UNIT I

Introduction to Agile Development- Overview of Software Development Methodologies, Traditional vs Agile: Waterfall vs Iterative vs Agile, Agile Manifesto and Principles, Benefits and Challenges of Agile, Agile vs Lean vs DevOps

UNIT II

Agile Frameworks and Practices- Scrum: Roles as Scrum Master, Product Owner, Dev Team , Artifacts, Ceremonies, Extreme Programming (XP): Practices and Values, Kanban: Workflow Visualization and WIP Limits, Agile Modelling and Crystal Methods, Choosing the Right Framework

UNIT III

Agile Project Planning and Estimation- Release Planning, Iteration Planning, User Stories and Story Mapping, Product Backlog and Sprint Backlog, Estimation Techniques: Planning Poker, T-Shirt Sizing, Velocity, Burn-down and Burn-up Charts

UNIT IV

Agile Design, Development and Testing- Test-Driven Development (TDD), Behaviour Driven Development (BDD), Continuous Integration and Delivery (CI/CD), Refactoring and Pair Programming, Acceptance Testing and Agile Test Automation

UNIT V

Agile Project Management and Scaling-Agile Metrics and KPIs, Agile Team Dynamics and Roles, Scaling Agile: Safe, Less, Spotify Model, Agile in Distributed Teams, Agile Tools: JIRA, Trello, Azure DevOps.

TEXT BOOKS :

1. Robert C. Martin and Micah Martin, "Agile Software Development: Principles, Patterns, and Practices", Pearson Education, 1st edition, 2002.
2. Andrew Stellman, Jill Alison Hart, Learning Agile, O'Reilly, 1st edition, 2015.

REFERENCEBOOKS:

1. "Essential Scrum: A Practical Guide to the Most Popular Agile Process"
   Kenneth S. Rubin
2. "User Stories Applied: For Agile Software Development"
   Mike Cohn
3. "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation" Jez Humble & David Farley
4. "Large-Scale Scrum: More with Less" – Bas Vodde & Craig Larman

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

IV Year I Semester	2.Big Data Analytics Professional Elective-V	L	T	P	C
		3	0	0	3

Course Objectives

The objectives of this course is to acquire knowledge on the

1. Necessity of Big data analysis and challenges in Big data analysis
2. Descriptive, Predictive, Real-time analysts is of big data
3. Programming tools PIG & HIVE in Hadoop echo system

UNITI: Introduction: Introduction to big data: Introduction to Big Data platform, Challenges of conventional systems, intelligent data analysis, Nature of data, Analytic processes and tools, Analysis vs. Reporting.Role of Big Data in AI/ML & IoT and Introduction to Data Lakes vs Data Warehouses

UNITII: Stream Processing: Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies - Real Time Sentiment Analysis - Stock Market Predictions- Real-time Fraud Detection.

UNIT III: Introduction to Hadoop: Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analyzing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment.Introduction to YARN (Yet Another Resource Negotiator), Limitations of Hadoop vs Modern Frameworks like Spark

UNITIV: Frameworks and Applications: Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and Zoo Keeper.

UNIT V: Predictive Analytics and Visualizations: Predictive Analytics, Simple linear regression, Multiple linear Regressions, Interpretation of regression coefficients, Visualizations, Visual data analysis techniques, interaction techniques, Systems and application

Course Outcomes

The students should be able to:

1. Understand and Illustrate characteristics of big data and big data challenges in different domains including social media, transportation, finance and medicine
2. Demonstrate stream processing on real time applications
3. Do Big data processing using Map reduce on Hadoop
4. Do Big data processing using PIG scripts and Hive QLqueries
5. Understand Predictive analysis of big data.

Text Books

1. Tom White, "Hadoop:The Definitive Guide", Third Edition, O'reilly Media, Fourth Edition,2015.

2. ChrisEaton, DirkDeRoos, TomDeutsch, GeorgeLapis, PaulZikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw-Hill Publishing, first edition, 2011.

3. Anand Rajaraman and Jeffrey David Ullman, "MiningofMassive Datasets", CUP, first edition, 2011.

Reference Books

1. BillFranks,"TamingtheBigDataTidalWave:FindingOpportunitiesinHugeData Streams with Advanced Analytics", John Wiley& sons,2012.
2. . PaulZikopoulos, DirkdeRoos, KrishnanParasuraman, ThomasDeutsch, JamesGiles, David Corrigan, "Harness the Power of Big Data: The IBM Big Data Platform", Tata McGrawHillPublications, 2012.
3. ArshdeepBahgaandVijayMadisetti,"BigDataScience&Analytics:AHandsOn Approach ", VPT,2016.
4. BartBaesens,"AnalyticsinaBigDataWorld:TheEssentialGuidetoDataScienceand its Applications (WILEY Big Data Series)", John Wiley & Sons,2014.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM

VIZIANAGARAM – 535 003, Andhra Pradesh, India

B.Tech (R23-COURSE STRUCTURE & SYLLABUS)

(Applicable from the academic year 2023-24 and onwards)

CSE (AI & ML)

IV Year I Semester	3.Reinforcement Learning Professional Elective-V	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the fundamentals of Reinforcement Learning (RL) and its relevance in artificial intelligence.
2. To enable students to understand the mathematical foundations of Markov Decision Processes (MDPs) and Bellman Equations.
3. To explore key learning methods such as Q-learning, policy gradients, and actor-critic models.
4. To study model-based reinforcement learning and deep RL techniques.
5. To provide insight into real-world applications, ethics, and advanced topics like meta-learning and multi-agent environments.

1. .

UNIT-I:

Introduction and Basics of RL , Defining RL Framework and Markov Decision Process, Polices,ValueFunctionsandBellmanEquations,Explorationvs.Exploitation,CodeStandards and Libraries used in RL (Python/Keras/Tensor flow)

UNIT-II:

Tabular methods and Q-networks, Planning through the use of Dynamic Programming and Monte Carlo, Temporal-Difference learning methods (TD(0), SARSA, Q-Learning) ,Deep Q- networks (DQN, DDQN, Dueling DQN, Prioritised Experience Replay)

UNIT-III:

Introduction to policy- based methods: Vanilla Policy Gradient, REINFORCE algorithm and stochastic policy search, Actor-critic methods (A2C,A3C) ,Advanced policy gradient (PPO, TRPO, DDPG)

UNIT-IV:

Model-based RL approach: Analytic gradient computation, Sampling-based planning, Model-based data generation, Value-equivalence prediction, Model-based policy optimization. Model-based RL approach Recent Advances and Applications .

UNIT-V:

Meta-learning: Multi-AgentReinforcementLearning.PartiallyObservableMarkovDecision Process . Ethics in RL . Applying RL for real-world problem

Course Outcomes:

At the end of this course, the student will be able to

1. Understand the Basic concepts of Reinforcement learning.
2. Implement tabular methods to solve classical control problems.
3. Understand the policy gradient methods from vanillato more complex cases.
4. Apply various model based RL approaches to solve real world applications.
5. Recognize current advanced techniques and applications in RL

Text Books:

1. RichardS.SuttonandAndrewG.Barto,"Reinforcementlearning:Anintroduction", Second Edition, MIT Press, 2nd edition, 2018
2. Li,Yuxi."Deep rein for cement learning. "arXiv preprintarXiv:1810.06339 (2018).
3. Wiering, Marco, and MartijnVanOtterlo."Reinforcement learning."Adaptation, learning, and optimization 12 (2012):

Reference books:

1. Russell, StuartJ., and Peter Norvig. "Artificial intelligence: a modern approach ." Pearson Education Limited, 2016.
2. Good fellow, Ian,Yoshua Bengio, and Aaron Courville."Deep learning." MITpress, 2016.David Silver' s course on Reinforcement Learning(link)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURJADA VIZIANAGARAM
VIZIANAGARAM – 535 003, Andhra Pradesh, India
B.Tech (R23-COURSE STRUCTURE & SYLLABUS)
(Applicable from the academic year 2023-24 and onwards)
CSE (AI & ML)

IV Year I Semester	**Professional Elective - V** **4.High Performance Computing (HPC)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives

- This course covers the design of advanced modern computing systems. In particular, the design of modern microprocessors, characteristics of the memory hierarchy, and issues involved in multi-threading and multi-processing are discussed. The main objective of this course is to provide students with an understanding and appreciation of the fundamental issues and trade offs involved in the design and evaluation of modern computers

Course Outcomes

1. Understand the concepts and terminology of high-performance computing
2. Can write and analyze the behavior of high-performance parallel programs for distributed memory architectures (using MPI).
3. Canwriteandanalyzethebehaviorofhighperformanceparallelprogramsforshared memory architectures (using Pthreads and OpenMP).
4. Can writes imple programs for the GPU.
5. Can in dependently study, learn about, and present some aspect of high performance computing.

UNITI: Introduction to Parallel hard ware and software, need for high performance systems and Parallel Programming, SISD, SIMD, MISD, MIMD models, Performance issues.

UNIT II: Processors, PThreads, Thread Creation, Passing arguments to Thread function, Simple matrix multiplication using Pthreads, critical sections, mutexes, semaphores, barriers and conditional variables, locks, thread safety, simple programming assignments.

UNIT III: Open MP Programming: introduction, reduction clause, parallel for-loop scheduling, atomic directive, critical sections and locks ,private directive, Programming assignments, n body solvers using openMP.

UNIT IV: Introduction to MPI programming: MPI primitives such as MPI_ Send, MPI-Recv, MPI_ Init, MPI-Finalize, etc., Application of MPI to Trapezoidal rule, Collective Communication primitives in MPI, MPI derived data types, Performance evaluation of MPI programs, Parallel sorting algorithms, Tree search solved using MPI, Programming Assignments.

UNITV: Introduction to GPU computing, Graphics pipelines, GPGPU, Data Parallelism and CUDA C Programming, CUDA Threads Organization, Simple Matrix multiplication using CUDA, CUDA memories. Bench Marking and Tools for High Performance Computing Environments, Numerical Linear Algebra Routines BLAS for Parallel Systems evaluation.

Text Books

1. Michael J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill Education, 1st edition, 2003
2. Ananth Grama, An Introduction to Parallel Programming, 2nd Edition, Pearson Education, 2nd edition, 2003
3. David R. Butenhof , "Programming with POSIX Threads", Addison-Wesley,1st edition, 1997.

.

Reference Books

1. Programming Massively Parallel Processors, Kirk &Hwu,Elsevier,4th Edition, 2022.
2. Barbara Chapman "Using OpenMP: Portable Shared Memory Parallel Programming", MIT Press, ,21st edition ,2007

IV Year I Semester	Prompt Engineering (Skill oriented Course)	L	T	P	C
		0	1	2	2

Course Objectives:

Equip learners with the skills to design, optimize, and evaluate prompts for diverse tasks using LLMs in real-world applications.

Course Outcomes:

- Understand the Node's unique approach to asynchronous development.
- Understand the Node Package Manager (npm) and Modules.
- Implement NodeJS applications with the Express frame work and Connect Middleware.
- Learning-depth practices for debugging and testing NodeJS applications.
- Deploy NodeJS applications in the cloud or on your own system.

Week-1

Introduction to Prompt Engineering

What is a prompt?, Types of language models (ChatGPT, Claude, Gemini, etc.), Prompting paradigms: zero-shot, few-shot, chain-of-thought

Activity:

- Exploring ChatGPT or OpenAI Playground
- Basic prompt crafting and analysis

Week-2

Foundations of Prompt Crafting

Role of clarity, context, and constraints, Prompt templates and best practices, Role-playing and persona-based prompting

Activity:

- Rewrite/improve prompts for clarity and output quality
- Use templates for different tasks (e.g., summarize, explain, translate)

Week-3

Task-Specific Prompting

Categories-Text generation (creative writing, marketing), Classification and extraction (e.g., sentiment analysis, data extraction), Question answering and summarization

Activity:

- Design prompts for each category
- Evaluate and iterate based on outputs

Week-4 and 5

Advanced Prompting Techniques

Chain-of-thought reasoning, Step-by-step breakdowns, Self-consistency and verification,

System prompts and role instructions

Activity:

- Use multi-step prompts for logical reasoning or math
- Build a guided assistant with structured response flows

Week-6 and 7

Prompt Evaluation & Iteration

Evaluation metrics (fluency, relevance, coherence), A/B testing and prompt tuning, Limitations

of LLMs and prompt robustness

Activity:

- Compare prompt variants
- Analyze hallucinations and mitigate errors

Week-8 and 9

APIs and Automation

Using the OpenAI API (or other LLM APIs), Prompt injection defense basics, Automating tasks with prompts (scripts, tools)

Activity:

- Build a simple prompt-based app (e.g., email assistant or quiz generator)
- Use prompt chaining via API

Week-10

Capstone Project

Design a prompt-based solution for a real-world problem:

- Examples: résumé optimizer, content generator, legal contract explainer

TEXT BOOKS:

- You Look Like a Thing and I Love You by Janelle Shane – fun intro to how AI interprets prompts, Online Guide, 2019
- How to Talk to ChatGPT: The Art of Prompting by OpenAI , Online Guide, 2023
- The Art of Prompt Engineering with ChatGPT by Nathan Hunter, Online Guide, 2023
- **OpenAI Cookbook** – Prompt evaluation with GPT-4, Online, 2024

REFERENCE BOOKS:

- Designing Bots: Creating Conversational Experiences by Amir Shevat
- Building Intelligent Systems: A Guide to Machine Learning Engineering by Geoff Hulten

WEB REFERENCES

- Prompt Engineering Guide – https://www.promptingguide.ai/
- OpenAI Cookbook (Introduction to prompting) – https://github.com/openai/openai-cookbook
- Article: Anthropic's Claude Prompting Guide – https://docs.anthropic.com/claude/docs/prompting-best-practices
- Notion Prompt Library – https://www.notion.so/promptlibrary
- **AI Text Generation Handbook (online)** – https://textgeneration.com/
- **OpenAI Cookbook** (Prompt examples: summarization, extraction, classification)
- **Deep Learning Prompt Engineering Course** by Andrew Ng & OpenAI – https://learn.deeplearning.ai/chatgpt-prompt-eng/
- **OpenAI API Docs** – https://platform.openai.com/docs
- **LangChain Documentation** – https://docs.langchain.com
- **Prompt Injection Guide** – https://promptingguide.ai/risk/prompt-injection

WEB REFERENCES

- Prompt Engineering Guide – https://www.promptingguide.ai/
- OpenAI Cookbook (Introduction to prompting) – https://github.com/openai/openai-cookbook
- Article: Anthropic's Claude Prompting Guide – https://docs.anthropic.com/claude/docs/prompting-best-practices
- Notion Prompt Library – https://www.notion.so/promptlibrary
- **AI Text Generation Handbook (online)** – https://textgeneration.com/
- **OpenAI Cookbook** (Prompt examples: summarization, extraction, classification)
- **Deep Learning Prompt Engineering Course** by Andrew Ng & OpenAI – https://learn.deeplearning.ai/chatgpt-prompt-eng/
- **OpenAI API Docs** – https://platform.openai.com/docs
- **LangChain Documentation** – https://docs.langchain.com
- **Prompt Injection Guide** – https://promptingguide.ai/risk/prompt-injection

IV Year I Semester	Gender Sensitization Audit course	L	T	P	C
		0	1	2	2

Course: Objectives

1. To develop students' sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To introduce students to information about some key biological aspects of genders.
4. To expose the students to debates on the politics and economics of work.
5. To help students reflect critically on gender violence.
6. To expose students to more egalitarian interactions between men and women.

UNIT - I: UNDERSTANDING GENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men
- Preparing for Womanhood. Growing up Male. First lessons in Caste.

UNIT – II: GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences- Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary

UNIT – III: GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. - Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

UNIT – IV: GENDER - BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu".*

Domestic Violence: Speaking OutIs Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life…."

UNIT – V: GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature-Gender Development Issues-Gender Issues-Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks- The Brave Heart.

COURSE OUTCOMES:

1. Students will have developed a better understanding of important issues related to gender in contemporary India.
2. Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal

aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.

3. Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
4. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
5. Students will develop a sense of appreciation of women in all walks of life.