THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI301T	Applied Mathematics-III	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
The aim of this course is • To familiarize the students with concepts in linear algebra • To provide students standard concepts of statistics.	On completion of syllabus, students will be able to • Identify Engineering problems related to Matrices: Eigen value & Eigen vectors & Functions of Matrices. • Apply various concepts of vector spaces. • Apply the concepts of advanced linear algebra. • Use statistical methods and tools in engineering problems. • Recognize the optimization formulations.

Unit I	**[7Hrs]**
Linear dependence of vectors, Characteristics equation, Eigen values and Eigen vectors, Reduction to diagonal form, Sylvester's theorem.	
Unit II	**[8Hrs]**
Vector Space, Subspaces, Linear Dependence/Independence, Basis, dimension, Linear transformation, Range Space and Rank, Null Space and Nullity, Rank nullity theorem.	
Unit III	**[6Hrs]**
Inner Product Spaces, Norm, Orthonormal sets, Gram -Schmidt orthogonalization process, projections, positive definite matrices, and Singular Value Decomposition.	
Unit IV	**[7Hrs]**
Mean, Median, Mode, Mean deviation, Standard deviation, Hypothesis, Null hypothesis, Alternative hypothesis, Testing a hypothesis, t-test, F-test and Chi square test. One way and two-way analysis of variance (ANOVA).	
Unit V	**[7Hrs]**
Continuous optimization, Optimization using Gradient descent, Constrained optimization and Lagrange's multipliers, Convex optimization, Simplex method.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Higher Engineering Mathematics	B.S. Grewal	40th	Khanna Publication
2	Linear Algebra	Hoffman and Kunze	-	Prentice Hall of India, New Delhi
3	Convex optimization	Stephen Boyd and Lieven Vandenberghe	-	Cambridge University Press.

		July 2024	1.0	Applicable for 2024-25
Chairman - BoS	Dean – Academics	Date of Release	Version	

Reference Books

S.N	Title	Authors	Edition	Publisher
1	A Text Book of applied Mathematics-Volume II	P.N. Wartikar & J.N. Wartikar	2nd	Poona Vidyarthi Griha Prakashan
2	A text book of Engineering Mathematics	N. P. Bali & M. Goyal	-	Laxmi Publication.
3	Probability, Statistics with Reliability, Queuing and Computer Science Applications	K.S. Trivedi	-	-

ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2023-24

ARTIFICIAL INTELLIGENCE

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI302T	Data Structures	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
This course is intended to • Learn various static and dynamic representations of data structures • Design fundamental algorithmic problems of various nonlinear data structures. • Familiar with Graph representations and traversals. • Know the basic concepts of Hashing.	**Students will be able to** • Recognize different ADTs and their operations and specify their complexities. Examine Static and Dynamic data structures in implementing Stack applications • Design and realize linear data structures (stacks, queues, linked lists) and analyze their computation complexity. • Devise different sorting (comparison based, divide-and-conquer, distributive, and tree- based)and searching (linear, binary) methods and analyze their time and space requirements • Design traversal and path finding algorithms for Trees and Graphs • Analyze and Design Hash Functions

Unit I: Introduction	**[5Hrs]**
Basic terminologies, elementary data organizations, data structure operations; abstract data types (ADT) and their characteristics. Algorithms: definition, characteristics, analysis of an algorithm, asymptotic notations, time and space trade-offs. Array ADT: definition, operations and representations– row-major and column-major.**Stacks and Queues Stack ADT:** allowable operations, algorithms and their complexity analysis, applications of stacks –expression conversion and evaluation (algorithmic analysis), multiple stacks. **Queue ADT:** allowable operations, algorithms and their complexity analysis for simple queue and circular queue, introduction to double-ended queues and priority queues.	
Unit II: Linked Lists Singly Linked Lists	**[4Hrs]**
Representation in memory, algorithms of several operations: traversing, searching, insertion, deletion, reversal, ordering, etc. Doubly and Circular Linked Lists: operations and algorithmic analysis. Linked representation of stacks and queues, header node linked list.	
Unit III: Sorting and Searching Sorting	**[4Hrs]**
Algorithms (insertion, Shell, quick, merge, heap, counting), performance analysis and comparison. Searching: necessity of a robust search mechanism, searching linear lists (linear search, binary search) and complexity analysis of search methods	
Unit IV: Trees	**[5Hrs]**
Tree terminologies, binary tree and operations, binary search tree [BST] and operations with time analysis of algorithms, threaded binary trees. Self-balancing Search Trees: tree rotations, AVL tree and operations, B+-tree: definitions, characteristics, and operations (introductory).	
Unit V: Graphs and Hashing Graphs	**[5Hrs]**
Representation of graphs, traversals (DFS, BFS) with complexity analysis, path finding (Dijkstra'sSSSP, Floyd's APSP), and spanning tree (Prim's method) algorithms. **Hashing:** hash functions and hash tables, closed and open hashing, randomization methods (division method, mid-square method, folding), collision resolution techniques	

		July 2024	1.0	Applicable for 2024-25
Chairman - BoS	Dean – Academics	Date of Release	Version	

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Fundamentals of Data Structures in C	Horowitz and Sahani,	2nd	Galgotia Publications
2.	Data Structure with C	Seymour Lipschutz, Schaum's Outlines	2nd	Tata McGraw-Hill.
3.	Data structures and Algorithm Analysis in C	Mark Allen Weiss	2nd	Pearson

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Data Structures- A Pseudo code Approach with C	Richard F Gillberg & Behrouz A. Forouzan	2nd	Cengage Learning,
2.	Data Structures Using C and C++,	Aaron M. Tanenbaum, Yedidyah Langsam and Moshe J. Augenstein,	2nd	PHI Learning Private Limited, Delhi India.
3.	Data Structures & Algorithms using C	R.S. Salaria	5th	Khanna Publishing House.

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI302P	Data Structures Lab	-	-	4	2	25	25	50

Course Objectives	Course Outcomes
This course is intended to • Design and analyze simple linear and nonlinear data structures. • Design and implement various data structure algorithms • Identify and apply the suitable data structure for the given real world problem	**Students will be able to** • Develop the programs on stacks and its applications. • Demonstrate the implementation of various advanced trees. • Design and implementation of programs on BST and Graph Traversals. • Develop the programs on Hashing and Dictionaries

Sr. No.	List of Practicals
1	Write a program to compare the time complexity of different sorting algorithms (e.g., Bubble Sort vs. Insertion Sort) on datasets of varying sizes.
2	Implement the Stack ADT and develop an algorithm to convert infix expressions to postfix (Reverse Polish Notation) and evaluate the postfix expression using stacks.
3	Implement a Circular Queue using arrays. Write algorithms for enqueue and dequeue operations, and handle overflow and underflow conditions. Compare the space and time efficiency of the Circular Queue with a simple Queue.
4	Implement a Doubly Linked List and write algorithms for insertion, deletion, and traversal operations. Discuss the advantages of a Doubly Linked List over a Singly Linked List in terms of operation complexity.
5	Implement Merge Sort on datasets of different sizes. Perform a detailed analysis of the time complexity.
6	Develop a code for Binary Search and Linear Search algorithms. Compare their time complexities by searching for elements in large datasets of sorted and unsorted arrays. Analyze the conditions under which Binary Search is more efficient than Linear Search.
7	Design a Binary Search Tree (BST) and write algorithms for insertion, deletion, and searching operations. Perform a time complexity analysis of these operations and discuss the impact of tree height on performance.
8	Construct a graph using adjacency lists and adjacency matrices. Perform Depth-First Search (DFS) and Breadth-First Search (BFS) traversals on the graph. Additionally, implement Dijkstra's algorithm for finding the shortest path in a weighted.
	Open ended experiments
9	Create a hash table using various hash functions (e.g., division method, mid-square method) and apply both closed hashing (open addressing) and open hashing (chaining) techniques.
10	Micro-Project

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Data Structure with C	Seymour Lipschutz, Schaum's Outlines	2nd	Tata McGraw-Hill.
2.	Fundamentals of Data Structures	Horowitz and Sahani,	2nd	Galgotia Publications
3.	Data structures and Algorithm Analysis in C	Mark Allen Weiss	2nd	Pearson

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1.	Data Structures, A Pseudo code Approach with C,	Richard F Gillberg & Behrouz A. Forouzan	2nd	Cengage Learning,
2.	Data Structures Using C and C++,	Aaron M. Tanenbaum, Yedidyah Langsam and Moshe J. Augenstein,	2nd	PHI

3.	Data Structures & Algorithms using C	R.S. Salaria	5th	Khanna Publishing House.

ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

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B. Tech. Scheme of Examination & Syllabus 2023-24

ARTIFICIAL INTELLIGENCE

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI303T	Fundamentals of Artificial Intelligence	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
This course is intended to • Gain the basics of one of the most fascinating and fastest growing areas of Computer Science • Formulate artificial intelligence problems corresponding to different applications. • Apply artificial intelligence search strategies/ algorithms to solve the problems. • Learn the applications and existing systems of Artificial Intelligence in different areas.	**Students will be able to** • Learn the fundamentals of Artificial Intelligence domain. • Comprehend the basic AI problem solving strategies. • Analyze the applicability of various searching Techniques. • Distinguish between various search strategies. • Learn the various aspect of knowledge from AI point of view.

Unit I Introduction	**[5Hrs]**
Definition of AI, history & importance of AI, AI winter, current status, scope, agents, environments, Turing test concept, Task domain of AI, AI Characteristics, AI Problems and its state space search, Introduction to intelligent agents. Case study: MYCIN, Dendral	
Unit II AI Problems and its Formulations	**[10Hrs]**
Defining the problems as a state space search and representation, Introduction to Production system, it's type, Production system characteristics and Issues in the design of search problems, Additional problems. Specialized production system, Problem solving methods -Problem graphs, Matching.	
Unit III Uninformed Search Strategies	**[6Hrs]**
Search strategies, blind search, Breadth-first search, Depth-first search, Branch and bound algorithm, Comparing uniformed search techniques. Related Algorithms.	
Unit IV Informed search strategies	**[8Hrs]**
Indexing and Heuristic functions, Generate-and-test, Hill climbing, best-first search, problem reduction, constraint satisfaction, Mean-ends analysis. Search and optimization (gradient descent)	
Unit V Introduction Knowledge Representation	**[7Hrs]**
Knowledge Progression, Knowledge model, categories of various knowledge, knowledge type, KR system requirements, mapping between facts and representations, Brief about Issues in knowledge representation, Case study of AI Systems: Google Duplex (or latest one.) and others.	

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Artificial Intelligence	Elaine Rich, Kevin Knight, & Shivashankar B Nair	3rd	McGraw Hill
2	Artificial Intelligence: A Practical Approach	Rajiv Chopra	1st	S Chand & Co Ltd
3	Artificial Intelligence A modern approach	Stuart Russell, andPeter Norvig	2nd	Pearson

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Artificial Intelligence	Saroj Kaushik	1st	Cengage Learning India.
2	A First Course in Artificial Intelligence	Deepak Khemani	6th	McGraw Hill Education

		July 2024	1.0	Applicable for 2024-25
Chairman - BoS	Dean – Academics	Date of Release	Version	

ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2023-24

ARTIFICIAL INTELLIGENCE

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI303P	Fundamentals of Artificial Intelligence Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended • To implement the theoretical concepts of Artificial intelligence • To compare the efficiency of various AI search algorithms.	**Students will be able to** • Comprehend and explore Python programming language. • Demonstrate basic AI problem solving strategies. • Implement the applicability of various searching Techniques. • Evaluate and implement various knowledge representation techniques. • Implement real time AI based applications.

Sr. No.	List of the Practicals
1	Implementation of various AI Problems.
2	Production systems.
3	Uninformed search.
4	Informed search.
5	Constraint satisfaction.
6	Heuristic search procedure.
7	Knowledge representation
8	Course syllabus based Micro Project.
	Open ended practicals
9	Set up a simulated environment where a robot needs to navigate to different locations while avoiding obstacles. Implement the Simulated Annealing algorithm to optimize the robot's path planning considering factors like distance to goal, energy consumption, and obstacle avoidance.
10	Design a maze-solving task where students implement these algorithms and analyze their effectiveness in Finding the optimal path and the computational resources they consume.

Text Books

S. N	Title	Authors	Edition	Publisher
1	Artificial Intelligence	Elaine Rich, Kevin Knight, & Shivashankar B Nair	3rd	McGraw Hill
2	Artificial Intelligence: A Practical Approach	Rajiv Chopra	1st	S Chand & Co Ltd
3	A First Course in Artificial Intelligence	Deepak Khemani	6th	McGraw Hill Education
4	Artificial Intelligence A modern approach	Stuart Russell, and Peter Norvig	2nd	Pearson

Reference Books

S. N	Title	Authors	Edition	Publisher
1	A Classical Approach to Artificial Intelligence	Munesh Chandra Trivedi	2nd	Khanna Publishing House Delhi.
2	Artificial Intelligence	Saroj Kaushik	1st	Cengage Learning India.
3	Artificial Intelligence: Foundations for Computational Agents	David Poole and Alan Mackworth	2nd	Cambridge University Press.

		July 2024	1.0	Applicable for 2024-25
Chairman - BoS	Dean – Academics	Date of Release	Version	

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI304T	Computer Networking	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
This course is intended to • Deliver the fundamentals of computer network • Discuss and focuses on network architectures, protocols and applications, techniques for encoding and modulation.	**Students will be able to** • Describe the components and infrastructure that form the basis for most computer networks. Outline the various real-world networks. • Apply the knowledge of different techniques of flow control and error control during data transmission and illustrate various protocols of data link layer. • Illustrate the protocols of mac sub layer with IEEE 802.11 wireless lan. • Illustrate the different techniques for digital data transmissions and routing at network layer. • Analyze the functioning of transport layer and application layer.

Unit I Introduction to Computer Networking Concepts	**[5Hrs]**
Layered Network Protocol Architectures; Personal, Local, Metropolitan and Wide Area Networks; Telecommunications and Cellular Networks overview. **Physical Layer:** Basics of communications; Physical media types and their important bandwidth and bit-error-rate characteristics; Wired and Wireless media including copper cables, optical fiber and wireless.	
Unit II Data Link Layer and Logical Link Control (LLC) sub-layer	**[4Hrs]**
Framing; Error control including Bit-parity, CRC and Hamming Codes; Reliable transmission and Automatic Repeat Request (ARQ) protocols including Stop-and-Wait, Go-back-N, Selective Repeat. Performance analysis of ARQ protocols. Example protocols such as HDLC and PPP	
Unit III Medium Access Control (MAC) sub-layer	**[4Hrs]**
Shared media systems; Bus, Star and Ring topologies; TDMA, FDMA, CSMA, CSMA/CD, Ethernet and IEEE 802.3; IEEE 802.11 including CSMA/CA protocols; Performance analysis; Shared and Switched Ethernet; Related protocols such as ICMP, NAT, ARP and RARP.	
Unit IV Network Layer	**[5Hrs]**
Internet Protocol (IP) suite; Hierarchical network architectures; IPv4 and IPv6 addressing and headers; Routing protocols including distance-vector and link-state approaches; Interior and Exterior Gateway Protocol concepts; Routing Algorithms including Dijkstra's algorithm and distributed Bellman-Ford algorithm; Example protocols: OSPF, RIP, BGP.	
Unit V Transport Layer	**[5Hrs]**
Reliable end-to-end transmission protocols; UDP header; Details of TCP header and operation including options headers and congestion control; TCP variants such as Reno, Tahoe, Vegas, Compound and CUBIC. **Application Layer:** Socket Interface and Socket programming; Example protocols such as DNS, SMTP, FTP, and HTTP.	

Text Books

Sr. No.	Title	Authors	Edition	Publisher
1	Computer Networking - A top- down approach	Kurose and Ross,	7th	Pearson.
2	Computer Networks	Andrew S. Tanenbaum	5th	Pearson Education India.
3	Computer Networks, A Systems Approach	Peterson and Davie	5th	Elsevier.
4	Computer Networks, A Top-Down Approach	Behrouz A. Forouzan, Firouz Mosharraf	Standard	McGraw-Hill.

Reference Books

Sr. No.	Title	Authors	Edition	Publisher
1	Computer Networks: An Open-Source Approach	Ying-Dar Liu, Ren-Hung Hwang, Fred Baker	2nd	McGraw-Hill.
2	Unix Network Programming	W.Richard Stevens, Bill Fenner and Andrew R	3rd	Addison-Wesley Professional.

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI305T	Modern Computer Architecture	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
This course is intended • Understand the fundamental principles and components of modern computer architecture. • Analyze the performance and efficiency of computer systems using quantitative metrics and benchmarks. • Evaluate the design trade-offs in processor architecture, memory systems, and input/output interfaces. • Apply advanced concepts in parallel computing and multiprocessing to accelerate AI algorithms. • Design and optimize computer architectures for specific AI and machine learning tasks.	**Students will be able to** • Learn the historical development and key concepts of computer architecture. • Analyze organization and operation of central processing units (CPUs) and memory systems. • Apply the concepts of pipelining, superscalar execution, and out-of-order execution for various application. • Discuss parallel computing architectures, including SIMD, MIMD, and GPU-based systems. • Demonstrates hands-on experience with simulation tools and performance analysis techniques.

Unit I - Introduction to Computer Architecture	**[6Hrs]**
Overview of computer architecture principles and design methodologies, Historical perspective and evolution of computer systems, Instruction set architectures (ISAs) and assembly language programming	
Unit II - CPU Design and Performance	**[6Hrs]**
Basic CPU organization and operation, Pipelining and instruction-level parallelism, Branch prediction and speculative execution techniques	
Unit III - Memory Hierarchy and Cache Systems	**[8Hrs]**
Memory technologies and hierarchies, Cache organization, replacement policies, and coherence protocols, Virtual memory systems and address translation techniques.	
Unit IV - Multiprocessor and Multicore Architectures	**[8Hrs]**
Symmetric multiprocessing (SMP) and cache coherence protocols, Multicore processors and thread-level parallelism, Parallel computing architectures and programming models	
Unit V - GPU Architecture and Accelerators	**[10Hrs]**
Introduction to graphics processing units (GPUs), GPU architecture and parallel computing principles, Accelerators for AI and machine learning workloads. Emerging Trends in Computer Architecture: - Trends in power efficiency, reliability, and security, Neuromorphic computing and quantum computing architectures.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Computer Organization and Design: The Hardware/Software Interface	David A. Patterson and John L. Hennessy	1st	Wiley-IEEE Press
2	Modern Processor Design: Fundamentals of Superscalar Processors	John Paul Shen and Mikko H. Lipasti	1st	Pearson
3.	High-Performance Computer Architecture	Harold S Stone	1st	Pearson

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Computer Architecture: Concepts and Evolution	Gerritt A. Blaauw and Frederick P. Brooks Jr.	1st	Morgan Kaufmann
2	Parallel Computer Architecture: A Hardware/Software Approach	David Culler, Jaswinder Pal Singh, and Anoop Gupta	2nd	Morgan Kaufmann
3	Computer Architecture: A Quantitative Approach	John L. Hennessy and David A. Patterson	1st	Wiley-Blackwell

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI306P	Object Oriented Programming Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended • To introduce students to the fundamental concepts of Object-Oriented Programming (OOP). • To enable students to understand and implement various data structures and algorithms using OOP principles. • To develop students' proficiency in using C++ as an object-oriented programming language. • To familiarize students with key features of C++ such as classes, constructors, overloading, and inheritance. • To teach students how to effectively manage memory dynamically in C++ programs.	**Students will be able to** • Implement basic algorithms for number systems and manipulate arrays and lists efficiently. • Develop sorting algorithms and apply them to various data structures. • Design and implement class structures with constructors for creating objects in C++ programs. • Utilize friend functions and classes to access private and protected members of a class in C++ programs, proficiency in using pointers for dynamic memory allocation and memory management. • Apply exception handling mechanisms to gracefully handle runtime errors and exceptions in C++ programs.

Sr. No.	List of the Practicals
1	Implementation of Number system and array of list.
2	Implementation of sorting and dynamic memory allocation
3	Implementation of class structure and constructor
4	Implementation of overloading in C++.
5	Implementation of Friend function and class in C++.
6	Implementation of Friend function and class in C++.
7	Implementation of Inheritance in C++
8	Implementation of Exception Handling
9	Micro based Project based on studied syllabus.
Open ended practical	
10	Write a program showing implementation of stack class having the functionality of Push and Pop operations.
11	Write a program to implement a queue class with required operations/ functions.

Text Books

S.N	Title	Authors	Edition	Publisher
1	The C++ Programming Language	Bjarne Stroustrup	4th	Addison - Wesley
2	A Complete Guide to Programming in C++	Ulla Kirch-Prinz, Peter Prinz	3rd	Jones & Bartlett Learning
3.	Let Us C / C++	Yashwantrao Kanetkar	4th	BPB

Reference Books

S.N	Title	Authors	Edition	Publisher
1	C Pocket Reference C Syntax and Fundamentals	Peter Prinz, Ulla Kirch-Prinz	1st	O'Reilly Media
2	C++ Black Book	Steven Holzner	2nd	Paperback

		July 2024	1.0	Applicable for 2024-25
Chairman - BoS	Dean – Academics	Date of Release	Version	

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23AI331M	MDM – I(Responsible AI)	2	-	-	2	15	35	50

Course Objectives	Course Outcomes
This course is intended • Understand the Fundamentals of AI • Apply Ethical Principles in AI	**Students will be able to** • Explain AI Concepts and History • Analyze Intelligent Agents • Apply Ethical Reasoning • Design Ethical AI Systems • Implement Responsible AI Practices

Unit I - Introduction to AI	**[4Hrs]**
Introduction to AI, History of AI, Applications of Artificial Intelligence, How Does AI Works, Intelligent agents: Agents and Environments, The Concept of Rationality, The Nature of Environments, Properties of task environments, the Structure of Agents, Agent programs: Simple reflex agents, Model-based reflex agents, Goal-based agents, Utility-based agents, Learning agents.	
Unit II - Ethical Decision-Making	**[5Hrs]**
Introduction, Ethical Theories, Values, Ethics in Practice, Implementing Ethical Reasoning. Taking Responsibility: Introduction, Responsible Research and Innovation, The ART of AI- Accountability, Responsibility & Transparency, Design for Values.	
Unit III – Ethical AI	**[5Hrs]**
Ethical Action, Approaches to Ethical Reasoning by AI,Designing Artificial Moral Agents, Implementing Ethical Deliberation, The Levels of Ethical Behaviour, Ethical Status of AI Systems.	
Unit IV – Responsible AI in Practice:	**[5Hrs]**
Introduction, Governance for Responsible AI, Codes of Conduct, Inclusion & Diversity, The AI Narrative. AI and society, Super-intelligence, Responsible AI.	
Unit V - Case Study	**[5Hrs]**
Recommendation System, Medical Diagnosis, eduction, Computer Visssion, Natural Language Processing.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Responsible Artificial Intelligence	Virginia Dignum	1st	Springer
2	AI Ethics	Mark Coeckelbergh	1st	Addison-Wesley Professional

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Responsible AI: Best Practices for Creating Trustworthy AI Systems	Dr. Qinghua Lu ,Dr./Prof. Liming Zhu, Prof. Jon Whittle, Dr. Xiwei Xu	1st	Addison-Wesley Professiona