Zeal Education Society's

ZEAL COLLEGE OF ENGINEERING & RESEARCH, PUNE – 41

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

*NAAC Accredited with **A+** Grade / ISO 21001:2018*

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Curriculum Structure and Syllabus of

S.Y. B. Tech. – Artificial Intelligence and Machine Learning

(With effect from - Academic Year 2026-2027)

(2025 Pattern)

VISION OF THE INSTITUTE

To be a premier institute in technical education by imparting academic excellence, research, social and entrepreneurial attitude.

MISSION OF THE INSTITUTE

- To achieve academic excellence through innovative teaching and learning process.
- To imbibe the research culture for addressing industry and societal needs.
- To inculcate social attitude through community engagement initiatives.
- To provide conducive environment for building the entrepreneurial skills.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

VISION:

To be recognized as a center for quality education in the field of mechanical engineering, integrating top-tier teaching, innovative research, and fostering socially conscious and entrepreneurial engineers.

MISSION:

M1: To impart value-added education by creating an ambiance of academic excellence in teaching-learning processes.

M2: To inculcate a research approach through innovation and skill development centers.

M3: To inculcate a strong sense of social responsibility and empathy among the students.

M4: To imbibe the entrepreneur skill amongst the students by strengthening Industry- Institute interaction.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO1: The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, networking, artificial intelligence and data science for efficient design of computer-based systems of varying complexities.

PEO2: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

PEO3: Successful Career and Entrepreneurship- The ability to employ modern computer languages, environments and platforms in creating innovative career paths to be an entrepreneur and to have a zest for higher studies.

PROGRAM OUTCOMES (POs):

PO1: **Engineering Knowledge:** Apply the knowledge of mathematics, natural science, computing, and engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem Analysis:** Identify, formulate, and analyze complex engineering problems, reaching substantiated conclusions with consideration for the holistic nature of the problem..

PO3: **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: **Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge and research methods, including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

PO5: **Engineering Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling — recognizing their limitations — to

solve complex engineering problems. (Previously titled "Modern Tool Usage.").

PO6: **The Engineer and the World:** analyze and evaluate societal and environmental aspects while solving complex engineering problems, considering their impact on sustainability with reference to economy, health, safety, legal frameworks, culture, and the environment.

PO7: **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity, and inclusion; and adhere to relevant national and international laws. (Diversity and inclusion are now explicit additions.)

PO8: **Individual and Collaborative Team Work:** Function effectively as an individual, and as a member or leader in diverse and multi-disciplinary teams.

PO9: **Communication:** Communicate effectively and inclusively within the engineering community and with society at large — comprehending and writing effective reports and design documentation, and making effective presentations — considering cultural, language, and learning differences.

PO10: **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects in multi-disciplinary environments.

PO11: **Life-Long Learning:** Recognize the need for, and have the preparation and ability for, independent and life-long learning, adaptability to new and emerging technologies, and critical thinking in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: Apply principles of Artificial Intelligence, Machine Learning, Deep Learning, Data Analytics and computational intelligence to analyze and solve real-world problems.

PSO2: Design , develop and evaluate intelligent and agentic AI systems using appropriate AI/ML algorithms, models, tools, frameworks and computing platforms.

PSO3: Develop and deploy scalable, autonomous and responsible AI solutions, including agent-based systems, for interdisciplinary applications while considering performance, security, explainability, ethical and societal requirements.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Second Year B. Tech. – AI & ML: Semester – III (2025 Pattern)

Course Code	Course Type	Course Name	Teaching Scheme (hrs./Week)							Evaluation Scheme					
			L	P	T	H	CR			CI E	ETE	TW	PR	OR	Total
							T H	PR/ Tut	Total						
25AMPC302	PCC	Data Structures	3	-	-	3	3	-	3	40	60	-	-	-	100
25AMPC302P	PCC	Dat Structure Lab	-	2	-	2	-	1	1	-	-	-	25	-	25
25AMPC303	PCC	Object Oriented programming	3	-	-	3	3	-	3	40	60	-	-	-	100
25AMPC304	PCC	Operating Systems	3	-	-	3	3	-	3	40	60	-	-	-	100
25AMPC304P	PCC	Operating System Lab	-	2	-	2	-	1	1	-	-	-	-	25	25
25AMMD301	MDM	Statistics for Artificial Intelligence	3	-	-	3	3	-	3	40	60	-	-	-	100
25ALOE301	OE	Open Elective-I	2	-	-	2	2	-	2	-	-	50	-	50	100
25AMMC301	HSSM-MC	Management Information System	2	-		2	2	-	2	-	-	25	-	-	25
25AMVS302	VSEC	Programming Lab I	-	2	-	2	-	1	1	-	-		50	-	50
25AMCE303	CEP	Mini Project	-	2	-	2	-	1	1	-	-	25	-	-	25
25AMCC305	CC	Liberal Learning - III	-	2	-	2	-	1	1	-		25	-	-	25
25AMIN302	ELC-INT	Internship-I	4 Weeks				-	2	2	-	-	25	-	-	25
Total			**16**	**10**	**0**	**26**	**16**	**7**	**23**	**160**	**240**	**150**	**75**	**75**	**700**

BoS Chairman

ZES's Zeal College of Engineering & Research
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Director

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Second Year B. Tech. – AI & ML: Semester – III (2025 Pattern)

Course Code	Course Type	Open Elective - I
25ALOE301A	OEC	Digital Literacy and Applications
25ALOE301B		Environmental Studies
25ALOE301C		Green Energy and Sustainability
25ALOE301D		Basics of Consumer Electronics
25ALOE301E		Renewable Energy Systems

*** Liberal Learning – I: Choose any one from the following:**

Sr. No.	Course Code	Module	Sr. No.	Course Code	Module
1.	25AMCC305A	Guitar	6.	25AMCC305F	Basketball
2.	25AMCC305B	Singing	7.	25AMCC305G	Cricket
3.	25AMCC305C	Cinematography	8.	25AMCC305H	Rifle and Pistol Shooting
4.	25AMCC305D	Dance	9.	25AMCC305I	Volleyball
5.	25AMCC305E	Synthesizer	10.	25AMCC305J	Football

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Code	Course Type	Course Name	Teaching Scheme							Evaluation Scheme					
			L	P	T	H	CR			CIE	ETE	TW	PR	OR	Total
							TH	PR / Tut	Total						
25AMPC405	PCC	Database Management System	3	-	-	3	3	-	3	40	60	-	-	-	100
25AMPC405P	PCC	Database Management System Lab	-	2	-	2	-	1	1	-	-	-	25	-	25
25AMPC406	PCC	Data Science	4	-	-	4	4	-	4	40	60	-	-	-	100
25AMPC407	PCC	Software Engineering	3	-	-	3	3	-	3	40	60	-	-	25	125
25AMMD402	MDM	Knowledge Representation and Reasoning	3	-	-	3	3	-	3	40	60	-	-	-	100
25ALOE402	OE	Open Elective - II #	2	-	-	2	2	-	2	-	-	50	-	50	100
25AMMC402	HSSM-MC	E-Commerce	2	-	-	2	2	-	2	-	-	25	-	-	25
25AMAE402	AEC	Quantitative Reasoning and Analysis	-	2	-	2	-	1	1	-	-	25	-	-	25
25AMVS404	VSEC	Programming Lab II	-	2	-	2	-	1	1	-	-	-	50	-	50
25AMCC406	CC	Liberal Learning - IV	-	2	-	2	-	1	1	-	-	25	-	-	25
25AMIN402	ELC - INT	Internship-II	4 Weeks				-	-	2	-	-	25	-	-	25
Total			**16**	**8**	**0**	**25**	**13**	**11**	**23**	**160**	**240**	**150**	**75**	**75**	**700**

Second Year B. Tech. – AI & ML: Semester – IV (2025 Pattern)

Liberal Learning – I: Choose any one from the following:

Sr. No.	Course Code	Module	Sr. No.	Course Code	Module
1.	25AMCC406A	Guitar	6.	25AMCC406F	Basketball
2.	25AMCC406B	Singing	7.	25AMCC406G	Cricket
3.	25AMCC406C	Cinematography	8.	25AMCC406H	Rifle and Pistol Shooting
4.	25AMCC406D	Dance	9.	25AMCC406I	Volleyball
5.	25AMCC406E	Synthesizer	10.	25AMCC406J	Football

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4	25AMMD301	Statistics for Artificial Intelligence	
5	25ALOE301	Open Elective-I	
6	25AMMC301	Management Information System	
7	25AMVS302	Programming Lab I	
8	25AMCE303	Mini Project	
9	25AMCC305	Liberal Learning-III	
10	25AMIN302	Internship-I	
Second Year B. Tech.: Semester – IV (2025 Pattern)			
10	25AMPC405	Database Management System	
11	25AMPC406	Data Science	
12	25AMPC407	Software Engineering	
13	25AMMD402	Knowledge Representation and Reasoning	
14	25ALOE402	Open Elective - II #	
15	25AMMC402	E-Commerce	
16	25AMAE402	Quantitative Reasoning and Analysis	
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SYLLABUS
SEMESTER - III

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester:** III
Course: Data Structures									**Code: 25AMPC302**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
03	-	-	03	40	60	-	-	-	100

Prerequisites:

- Basic knowledge of programming (preferably in C/C++)
- Understanding of control structures and functions

Course Objectives:

- To develop a strong understanding of fundamental data structures, algorithms, and their time and space complexity.
- To apply appropriate searching, sorting, hashing, linear, and non-linear data structures for designing efficient solutions to computational problems.

Course Outcomes: Upon successful completion of the course, students will be able to:

CO1	To introduce the fundamental concepts, types, and operations of data structures and algorithms.
CO2	To analyze the time and space complexity of algorithms using asymptotic notations.
CO3	To understand and implement searching, sorting, and hashing techniques.
CO4	To develop skills in implementing linear data structures such as linked lists, stacks, and queues.
CO5	To understand and implement non-linear data structures including trees and graphs.
CO6	To apply appropriate data structures and algorithms to solve computational problems efficiently.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to Data Structures** **Data Structures**: Introduction and Types: - linear and non-linear data structures, static and dynamic data structures **Algorithm**: Time and space complexity, Trade-off, asymptotic notations, Storage Classes in C, **Data Handling Using Structures and Pointers**: -ADT for Array, Array of structures, Pointers and structures, Functions: -Recursive functions. Passing arrays to functions, passing structures to functions, passing pointers to functions	7
2.	**Searching, Sorting Techniques and Hashing** **Searching techniques** – Linear Search, Binary Search **Sorting** – Insertion Sort, Selection Sort, Quick Sort and Merge Sort **Hashing** – Concepts, hash table, issues in hashing, hash functions, properties of a good hash function, collision resolution strategies, open addressing.	6

3.	**Linked lists** **Dynamic Memory Allocation** (malloc, calloc, realloc, free), comparison of sequential and linked organization, **Linked List**: Singly, Doubly, and Circular Linked List concept and implementation, ADT for Linked List, Primitive Operations on Linked List, Applications of linked lists	6
4.	**Linear Data Structures** **Stack:** Concept, Basic Stack operations, Array representation of stack, Multiple Stacks Stack Applications: Reversing data, Arithmetic expression conversion (Infix to Postfix) and Expression evaluation. **Queue:** Concept, Queue operations, Array representation of queue, Types and Applications of queue, Stack and Queue implementation using Linked list	7
5.	**Non-Linear Data Structures-Trees** **Introduction to tree**: Basic Tree Concepts. Binary Tree: Concept & Terminologies, Representation of Binary Tree in memory, Traversing a binary tree. **Binary Search Tree (BST):** Basic Concepts, BST operations, AVL Tree: Basic concepts and rotations of a Tree.	7
6.	**Non-Linear Data Structures –Graph** Graph: Basic Concepts & terminology, Representation of graph: Adjacency matrix, Adjacency list. Operations on graph: Traversing a graph. Spanning tree: Minimum Spanning tree- Kruskal's Algorithm, Prim"s Algorithm	6
	TOTAL	39

Text Books:

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Publications.
2. Reema Thareja, "Data Structures using C", Oxford University Press.

Reference Books:

- Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education.
- Seymour Lipschutz, "Data Structures", Schaum's Outline Series.

E-Resources:

- NPTEL Online Courses: https://nptel.ac.in
- GeeksforGeeks: https://www.geeksforgeeks.org
- Coursera – Data Structures: https://www.coursera.org

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester:** III
Course: Data Structures Lab									**Code: 25AMPC302P**
Teaching Scheme									**Evaluation Scheme**
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	-	-	25	25

Prerequisites:

- Basic understanding of programming fundamentals, problem-solving techniques, and control structures. Familiarity with functions, arrays, pointers/references, and fundamental algorithmic concepts.

Course Objectives:

- To develop practical proficiency in implementing and analyzing fundamental data structures and algorithms through hands-on programming experiments.
- To strengthen problem-solving skills by applying appropriate data structures and algorithms to real-world computational applications.

Course Outcomes: After completion of this course, students will be able to -

1. Apply fundamental data structures and algorithms to develop efficient solutions for computational problems.
2. Analyze and compare the time and space complexity of searching, sorting, and graph algorithms.
3. Implement and utilize arrays, linked lists, stacks, queues, trees, heaps, and graphs for real-world applications.
4. Design and develop data-structure-based solutions through case studies and mini projects using appropriate programming techniques.

List of Assignments: -

1. Implement insertion, deletion, searching, and traversal operations on one- and two-dimensional arrays with dynamic input.
2. Implement linear and binary search using iterative and recursive methods and compare their performance.
3. Implement Bubble, Insertion, Merge, Quick, and Heap Sort and compare their performance for different inputs.
4. Implement max heap and min heap, perform heapify and heap sort, and demonstrate priority-based task handling.
5. Implement singly, doubly, and circular linked lists with insertion, deletion, and traversal operations.
6. Implement stacks using arrays and linked lists for expression conversion, evaluation, and parentheses checking.
7. Implement simple, circular, and priority queues with basic operations and a scheduling application.
8. Implement a Binary Search Tree with insertion, deletion, and tree traversal operations.

9. Represent graphs using adjacency matrix or list and implement BFS and DFS traversal.
10. Implement Dijkstra's algorithm to find the shortest path and display the distance table.
11. Develop a simple prototype using suitable data structures for a railway reservation system, syntax checker, or social network.
12.
13. Develop a mini project using multiple data structures, such as a student record manager, text editor, or file directory system.
Reference Book:
• Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education. • Seymour Lipschutz, "Data Structures", Schaum's Outline Series.

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester:** III
Course: Object Oriented Programming									**Code: 25AMPC303**
Teaching Scheme (Hrs./week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
03	-	-	03	40	60	-	-	-	100

Prerequisites:

Basic Programming Concepts, Procedural Programming Knowledge, Pointers and Memory Management, Mathematical Foundations, Basic Understanding of Algorithms

Course Objectives:

- To develop students' practical programming skills through hands-on implementation of object-oriented concepts.
- To enable students to apply C++ concepts and OOP principles to solve real-world programming problems.

Course Outcomes:

CO1	Students will be able to differentiate between various programming paradigms and apply basic object-oriented concepts in C++
CO2	Students will understand and implement different types of inheritance using C++
CO3	Students will be able to implement static and dynamic polymorphism in C++ programs
CO4	Students will develop generic programs using templates and manage exceptions in C++ programs.
CO5	Students will implement file handling techniques and manipulate file data using C++
CO6	Students will handle advanced OOP concepts such as dynamic memory management and STL usage.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to Programming Paradigms:** Role and importance of programming languages, Characteristics of good programming languages **Overview of programming paradigms**: Procedural, Object-Oriented, Logical, and Functional, Comparison between Procedural and Object-Oriented Programming (OOP). **Features of Object-Oriented Programming (OOP):** Abstraction, Encapsulation, Inheritance and Polymorphism. **C++ Syntax**: Data types, Variables, Operators, Flow Control, Arrays, Pointers **C++ Classes**: Private, Public, Constructors, Destructors, Member Data, Member Functions	7

2.	**Inheritance**: Concept of Class Hierarchy and Derived Classes, **Types of Inheritance**: Single, Multiple, Multilevel, and Hybrid Inheritance Role of Virtual Base Class, Constructor and Destructor Execution in Derived Classes, Base Class Initialization using Derived Class Constructors	6
3.	**Polymorphism**: Static Binding and Dynamic Binding, Static Polymorphism: Function Overloading, Ambiguity in Function Overloading, Operator Overloading (Unary and Binary Operators), Operator Overloading Using Friend Functions, String Manipulation using Operators, **Dynamic Polymorphism:** Base Class Pointers, Object Slicing, Method Overriding, Virtual Functions, Pure Virtual Functions, Abstract Classes	6
4.	**Generic Programming & Exception Handling**: Introduction to Generic Programming, Function Templates, Class Templates, Templates with Multiple Parameters, Exception Handling: Fundamentals, Multiple Catch Blocks, Nested try Statements, Uncaught Exceptions, Stack Unwinding, throw and rethrow	6
5.	**File Handling in C++:** Introduction to File Handling and File Stream Classes, File Operations: Opening, Closing Files, Detecting End of File (EOF), File Modes, File Pointer Manipulation and Sequential I/O Operations, Random Access to Files, Error Handling during File Operations	7
6.	**Advanced Object-Oriented Concepts:** Operator Overloading: Friend Functions, Assignment Operators Dynamic Memory Management: new and delete operators, Smart Pointers and Reference Counting, Introduction to Standard Template Library (STL): Containers, Iterators, Algorithms, Real-world Case Studies in Object-Oriented Design.	7
	TOTAL	39 Hrs.

Text Books:

1. E. Balagurusamy, Object-Oriented Programming with C++, McGraw Hill.
2. Bjarne Stroustrup, The C++ Programming Language, Addison-Wesley
3. Robert Lafore, Object-Oriented Programming in *C++*, SAMS Publishing

Reference Books:

1. Herbert Schildt, *C++:* The Complete Reference, McGraw Hill
2. Stanley B. Lippman, C++ Primer, Addison-Wesley
3. Scott Meyers, Effective C++, Addison-Wesley

E-Resources:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc21_cs02/
2. W3Schools: https://www.w3schools.com/cpp/
3. Coursera: https://www.coursera.org/learn/object-oriented-cpp?specialization=hands-on-cpp

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester:** III
Course: Operating Systems									**Code: 25AMPC304**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
03	-	-	03	40	60	-	-	-	125

Prerequisites:

- Fundamentals of Computer Systems
- Basic knowledge of C programming
- Familiarity with command-line interfaces (optional but desirable)

Course Objectives:

- To develop students' practical understanding of operating system functions, process management, resource management, and memory management.
- To enable students to explore file systems, I/O management, and system calls using Linux.

Course Outcomes: Upon successful completion of the course, students will be able to:

CO1	Enlist functions of OS and types of system calls
CO2	Apply process scheduling algorithms to solve a given problem
CO3	Illustrate deadlock prevention, avoidance and recovery
CO4	Explain memory management technique
CO5	Illustrate I/O and file management policies
CO6	Describe Linux process management

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Fundamental Concepts of Operating system** Operating system functions and characteristics, historical evolution of operating systems, issues in operating system design, User's view of the OS, Types of OS: Batch, time sharing, multiprogramming, distributed, network and real-time systems, Operating-System Services, Types of System Calls, System Programs. BASH Shell scripting: Basic shell commands, shell as a scripting language.	7
2.	**Process Management** Process concept, Process Control Block (PCB), Process Operations, Process Scheduling: Types of process schedulers, Types of scheduling: Preemptive, non-	6

	preemptive. Scheduling algorithms: FCFS, SJF, RR, Priority, Inter process Communication (IPC). Threads: multithreaded model, implicit threads, threading issues	
3.	**Process Coordination** Synchronization: Principles of Concurrency, Requirements for Mutual Exclusion, Mutual Exclusion: Hardware Support, Operating System Support (Semaphores and Mutex), Programming Language Support (Monitors). Classical synchronization problems: Readers/Writers Problem, Producer and Consumer problem, Inter-process communication (Pipes, shared memory: system V) Deadlock: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock	7
4	**Memory Management** Memory Management: Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Buddy System, Relocation, Paging, Segmentation. Virtual Memory: Hardware and Control Structures, Operating System Software	6
5	**I/O and File Management** I/O Management: I/O Devices, Organization of I/O function, I/O Buffering, Disk Scheduling Disk Scheduling policies like FIFO, LIFO, STTF, SCAN, C-SCAN. File Management: Concept, Access methods, Directory Structure, Protection, File System implementation, Directory Implementation, Allocation methods, Free Space management.	7
6.	**Linux** History Of Unix and Linux, Overview of Linux - Linux Goals, Interfaces to Linux, The Shell, Linux Utility Programs, Kernel structure, Processes in Linux – Process management system calls in Linux, Implementation of process and threads in Linux, Process scheduling Linux, Booting	6
TOTAL		39 Hrs.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, WILEY, ISBN978-1-118-06333-0, 9th Edition
2. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, ISBN-10: 0-13-380591-3, ISBN-13: 978-0-13-380591-8, 8th Edition
3. Andrew S. Tanenbaum & Herbert
4. Bos, Modern Operating System, Pearson, ISBN-13:9780133592221, 4th Edition

Reference Books:

- Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media
- Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10: 0131828274

Digital References:

- https://explainshell.com – Shell command explanations
- https://man7.org – Linux manual and system programming guides
- NPTEL Course: "Operating System Fundamentals" – by Prof. P. K. Biswas (IIT Kharagpur)

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)								**Semester:** III	
Course: Operating Systems Lab								**Code: 25AMPC304P**	
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**PR**	**OR**	**Total**
-	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**25**	**25**

Prerequisites:

- Basic knowledge of C programming,
- Familiarity with fundamental data structures and programming concepts.

Course Objectives:

- To develop students' practical skills in operating system concepts through Linux-based experiments.
- To provide students with hands-on experience in Linux system calls, process communication, threading, and basic system administration.

Course Outcomes: After completion of this course, students will be able to -

- Apply Linux commands and shell scripting for file, process, and system management.
- Implement process management, inter-process communication, threading, and synchronization using C.
- Analyze and manage system resources, files, memory, and services using Linux tools and system calls.

List of Assignments: - (Perform Any 10 Practical's)

Use basic Linux commands to manage files, directories, users and system resources

1. Explore the Linux file system and manage file permissions for users, groups, and others.
2. Develop shell scripts to perform basic calculations and display system information.
3. Automate directory backup using shell scripting and schedule the task with cron.
4. Process and analyze text files and system logs using grep, sed and awk,
5. Create and manage processes using fork(),exec() and wait() system calls.
6. Implement the producer-consumer problem using POSIX threads and synchronization mechanism.
7. Implement signal handling in C to respond to system signals and terminate processes safely.
8. Implement inter-process communication using shared memory or memory mapping.
9. Monitor and analyze Linux memory usage under different system conditions.

10. Perform file operations using system calls and demonstrate file permissions and links.
11. Automate basic Linux administration tasks such as user management, package installation, and service monitoring.

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester:** III
Course: Statistics for AI									**Code: 25AMMD301**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
3	-	-	03	40	60	-	-	-	100

Prerequisites:

Knowledge of probability and Statistics

Course Objectives:

- To develop an understanding of fundamental statistical concepts and their applications in data analysis.
- To apply statistical techniques such as hypothesis testing, regression, and time-series analysis for decision-making.
- To use statistical methods in AI applications for data interpretation, prediction, and real-world problem solving.

Course Outcomes: After completion of this course, student will be able to -

CO1	Understand and apply the concepts of discrete and continuous random variables and probability distributions.
CO2	Construct, interpret, and evaluate statistical hypotheses using appropriate statistical inference methods.
CO3	Apply parametric and non-parametric hypothesis testing techniques to draw meaningful conclusions from sample data.
CO4	Analyze relationships between variables using correlation and regression techniques and apply them to prediction and data analysis problems.
CO5	Develop and evaluate time-series models such as ARIMA, SARIMA, and exponential smoothing for trend analysis and forecasting.
CO6	Identify and apply statistical methods for analyzing real-time data in applications such as autonomous systems, recommendation systems, and fraud detection.

Course Contents:

Unit	Description	Duration (Hrs.)
1.	**Random Variables & Bivariate Probability Distribution** Introduction, Random Variable: discrete, continuous with example Bivariate random variable: discrete, continuous, Bivariate probability, distribution, Marginal, Probability Distribution, Independence of Two Discrete Random Variable, Conditional Probability Distribution, Joint Distribution Function of Two-Dimensional Discrete R.V.	6
2.	**Inferential Statistics: Hypothesis** Statistical Inference - Testing of Hypothesis, Non-parametric Methods and Sequential, Analysis: Introduction, Statistical Hypothesis(Simple and-Composite), Test of a Statistical Hypothesis, Null Hypothesis, Alternative Hypothesis, Critical Region, level of Significance, Power of the Test, Principle of likelihood.	7
3.	**Inferential Statistics: Tests For Hypothesis** Most Powerful Test (MP Test), Uniformly Most Powerful Test, likelihood Ratio Test,Properties of Likelihood Ratio Test, Test for the Mean of a Normal Population, Test for the Equality of Means of Two Normal Populations, Test for the Equality of -Means of Several Normal Populations, Test for the Variance of a Normal Population, Test for Equality of Variances of two Normal Populations, Non-parametric Methods, Advantages and Disadvantages of Non-parametric Methods.	7
4.	**Regression & Correlation** Concept of correlation, Types: Positive, Negative, Zero, AI Application: Correlation in feature selection Regression, types of regression (Simple linear regression, Logistic Regression, Multiple Linear Regression)	6
5.	**Time Series Analysis** Introduction, Components of time series data MA model – basic and weighted MA model Time series models AR Model, ARIMA Model, SARIMA, SARIMAX, VAR, VARMAX, Simple exponential smoothing model.	6

6.	**Real-Time Applications in AI** Study the applications of artificial intelligence in real-time systems, including autonomous vehicles, chatbots and virtual assistants, facial recognition systems, real-time fraud detection, personalized recommendation systems, and industrial robotics and automation, with emphasis on their applications, working principles, and practical use cases.	7
Total		**39 Hrs.**

Text Books:

1. Statistics (Dr.P.G.Dixit)
1. Statistics for Data Scientsists, An introduction to probability, statistics and Data Analysis, MauritsKaptein et al,Springer 2022
2. Probability and Statistics for Engineering and Sciences,8th Edition, Jay L Devore, Cengage Learning
3. Introduction to Time Series and Forecasting, Second Edition, Peter J Brockwell, Richard A Davis, Springer.

E-Resources:

- https://www.w3schools.com/html/html_blocks.asp

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OPEN ELECTIVE - I

(Select any one course from the given Open Elective Courses)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester:** III
Course: Open Elective-I [Digital Literacy and Applications]									**Code: 25ALOE301**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
02	-	-	02	-	-	50	50	-	100

Prerequisites:

Basic computer knowledge, Familiarity with using internet and mobile devices

Course Objectives:

- To develop students' basic digital and ICT skills.
- To enable students to use digital tools, online applications, and collaboration platforms effectively.
- To promote safe, ethical, and responsible use of technology.

Course Outcomes: Upon successful completion of the course, students will be able to:

CO1	Demonstrate proficiency in using essential digital tools for everyday tasks.
CO2	Apply safe and secure practices while using the internet and online services.
CO3	Utilize online collaboration platforms for communication and teamwork.
CO4	Develop simple digital content (documents, presentations, basic websites).
CO5	Leverage emerging digital applications for academic, professional, and social needs.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to Digital Literacy:** Evolution of Digital Technology – Role of ICT in modern life – Hardware and Software basics – Overview of digital devices (Computers, Smartphones, Tablets) – Operating Systems and Applications.	4
2.	**Internet and Web Fundamentals:** Basics of Internet – Web Browsers – Search Engines – Online Communication Tools (Email, Chat, Video Conferencing) – Netiquette – Cloud Storage and File Sharing.	5
3.	**Digital Tools for Productivity:** Word Processing (MS Word/Google Docs) – Spreadsheet Fundamentals (MS Excel/Google Sheets) – Presentation Tools (PowerPoint/Canva) – Templates and Online Collaboration (Google Workspace, MS Teams).	4
4.	**Cyber Safety and Digital Ethics:** Online Security Threats – Password Management – Safe Browsing – Data Privacy – Cyberbullying – Digital Footprint – Intellectual Property Rights in the digital era.	4

5	**Social media and Online Applications:** Role of social media in Communication – Online Professional Networking (LinkedIn) – Blogging and Content Sharing Platforms – Basics of Digital Marketing – E-Governance and Online Services (Banking, Payments, Education Portals**).**	5
6	**Introduction to Web and Mobile Applications:** Creating a Simple Blog/Portfolio Website (Using WordPress/Wix) – Overview of Mobile Apps for Education and Productivity – Emerging Technologies (Cloud Computing, IoT, AI) in everyday life.	4
Total		**26 Hrs.**

Text Books:

1. Pradeep K. Sinha, Priti Sinha, "Computer Fundamentals", BPB Publications.

   Rajaraman, "Fundamentals of Computers", PHI Learning.

Reference Books:

- Alan Evans, Kendall Martin, Mary Anne Poatsy, "Technology in Action", Pearson Education.
- Daniel Scott, "Digital Literacy Unpacked", Facet Publishing.

E-Resources:

- NPTEL: https://nptel.ac.in
- Digital Literacy Course, Google: https://learndigital.withgoogle.com
- Microsoft Learn: https://learn.microsoft.com
- W3Schools Basics: https://www.w3schools.com

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester:** III
Course: Management Information System									**Code: 25AMMC301**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**IE**	**ETE**	**TW**	**OR**	**PR**	**Total**
02	-	-	02	-	-	25	-	-	25

Prerequisites:

Basic knowledge of computer fundamentals and business operations.

Course Objectives:

- To Introduce the role of MIS in decision-making and business strategy.
- To Explore various types of information systems and their applications in organizations.
- To Explain the relationship between IT, organizations, and business processes.
- To Discuss contemporary technologies like ERP, BI, CRM, cloud computing, and analytics.
- To Analyze security, privacy, and ethical aspects in information systems.
- To Develop analytical and implementation skills using practical MIS tools.

Course Outcomes:

CO1	Understand the foundational concepts and role of MIS in organizations.
CO2	Explain the types of information systems and their application in business functions.
CO3	Analyze the role of IT infrastructure in MIS including databases, networks, and cloud computing.
CO4	Evaluate enterprise applications like ERP, CRM, and SCM and their impact on business processes.
CO5	Understand decision-making processes, business intelligence, and data analytics in MIS.
CO6	Examine current trends, security, privacy, ethical issues, and implement MIS-based lab exercises.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to MIS** Definition, Components, and Characteristics of MIS, Role of MIS in organizations and managerial decision-making, Strategic use of information systems for competitive advantage, Information system components: Hardware, Software, People, Process, Data. Types of decisions and levels of management Case study: MIS implementation in enterprises	4

2.	**Types of Information Systems** Transaction Processing Systems (TPS), Management Information Systems (MIS),Decision Support Systems (DSS), Executive Support Systems (ESS), Enterprise Resource Planning (ERP) systems, Office Automation Systems (OAS), Functional Business Systems: Marketing, HRM, Finance, Manufacturing, E-Business and E-Commerce systems	5
3.	**IT Infrastructure & Database Management** Basics of IT infrastructure and computing platforms, Cloud computing and virtualization, Introduction to Database Management Systems (DBMS), Data warehousing and data marts. Mobile computing and IoT in MIS	4
4.	**Enterprise Applications** Enterprise Resource Planning (ERP): Features, Modules, Benefits. Customer Relationship Management (CRM): Architecture and Applications. Supply Chain Management (SCM): Functions and Impact. Integration of ERP, CRM, and SCM. Business Process Reengineering (BPR) and automation, Challenges in enterprise application implementation	4
5.	**Decision Support & Business Intelligence** Decision-making process and role of MIS in decision support, Business Intelligence (BI): Tools and Technologies, Data Mining and Big Data Analytics, Dashboards and Visualization tools, Introduction to Artificial Intelligence in MIS, Case Study: BI in retail, banking, or healthcare	5
6.	**Security, Ethics, and Emerging Trends** IT Security: Threats, vulnerabilities, and risk management. Security tools: Firewalls, IDS, encryption, authentication, Ethical and social issues in Information Systems. Legal aspects: Data protection laws (e.g., GDPR), Green computing, sustainability, and IT governance. Recent trends: Cloud MIS, MIS-as-a-Service, Blockchain in MIS	4
	TOTAL	**26 Hrs.**

Text Books:

1. Kenneth C. Laudon, Jane P. Laudon, Management Information Systems: Managing the Digital Firm, Pearson, ISBN: 9781292342482
2. W.S. Jawadekar, Management Information System, Tata McGraw Hill, ISBN: 9780070263710

Reference Books:

- James A. O'Brien, George Marakas, Management Information Systems, McGraw-Hill.
- Raymond McLeod, George Schell, Management Information Systems, Pearson.
- Ralph Stair, George Reynolds, Principles of Information Systems, Cengage Learning.

E-Resources:

- https://nptel.ac.in/courses/110105148
- https://nptel.ac.in/courses/110105083

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester:** III
Course: Programming Lab I									**Code: 25AMVS302**
Teaching Scheme (Hrs./week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	01	-	01	-	-	-	-	50	50

Prerequisites:

Basic understanding of programming logic, flowcharts, and pseudocode.
Fundamental knowledge of data types, variables, and operators

Course Objectives:

- To develop students' practical skills in C++ programming and object-oriented concepts.
- To enable students to apply classes, objects, inheritance, operator overloading, and exception handling.
- To provide hands-on experience in memory management and data structure implementation using C++.

Course Outcomes:

CO1	Write, compile, and execute basic C++ programs for simple problem-solving
CO2	Implement object-oriented programming principles like classes, objects, and inheritance in C++
CO3	Develop programs that perform complex operations such as operator overloading and memory Management.
CO4	Apply dynamic memory allocation and exception handling techniques in C++ programs
CO5	Solve real-world problems by implementing matrix operations and other complex data Structures using C++.
CO6	Demonstrate the use of pointers, constructors, and destructors in C++ applications

List of Experiments:
(Any Nine experiments from list 1 to 11 are mandatory and an experiment 12 is mandatory)

1	Write basic C++ programs demonstrating input/output operations, decision-making statements (if-else, switch-case), looping statements (for, while, do-while), arrays and string handling.
2	Write a C++ program to demonstrate class declaration, object creation, data members, member functions and access of class members.
3	Write a C++ program to demonstrate default, parameterized and copy constructors and understand the order of constructor invocation.
4	Write C++ programs to demonstrate function overloading and unary/binary operator overloading.
5	Write a C++ program to demonstrate the use of friend functions and friend classes to access private/protected members of a class.
6	Write a C++ program to implement a COURSE class with course name, course code, credits, maximum students and an array of enrolled students. MaxStudents: Maximum number of students that can enroll in the course

7	Write a C++ program to dynamically allocate memory for an object using new and delete and access object members using pointers.
8	Write a C++ program to implement a Matrix Abstract Data Type using a class with operations for reading, addition, subtraction and displaying matrices.
9	Write C++ programs to demonstrate single inheritance and multilevel inheritance using suitable real-world examples.
10	Write C++ programs to demonstrate multiple inheritance and hierarchical inheritance using suitable class relationships.
11	Write C++ programs to demonstrate the order of execution of constructors and destructors in inheritance and invoke derived-class members using a base-class pointer.
12	Write C++ programs to demonstrate exception handling using try, throw and catch, including handling of generic/all exceptions.

Reference Books:

1. "Programming: Principles and Practice Using **C++"** by Bjarne Stroustrup
2. "Effective C++: 55 Specific Ways to Improve Your Programs and Designs**"** by Scott Meyers
3. **"**Accelerated C++: Practical Programming by Example**"** by Andrew Koenig and Barbara E. Moo

E-Resources:

1. C++ Programming Tutorial (NPTEL)

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester:** III
Course: Mini Project									**Code: 25AMCE303**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	01	-	01	-	-	25	-	-	25

Preamble:

Project Based Learning (PBL) is an experiential learning approach that encourages students to apply theoretical knowledge to real-world problems. Students work collaboratively to identify problems, explore suitable solutions, and develop practical outcomes. Guided by a faculty mentor, students gain skills in critical thinking, teamwork, problem-solving, communication, and self-directed learning. The project concludes with the presentation and evaluation of the developed solution and learning outcomes.

Companion Course:

Online courses relevant to the project, along with expert lecture on Intellectual property rights, patents and software engineering

Course Objectives:

- To develop students' project planning, critical thinking, and problem-solving skills through Project-Based Learning.
- To enable students to apply engineering knowledge to solve real-world problems considering social, environmental, and economic aspects.
- To provide practical exposure to project development, intellectual property rights, patents, software engineering, and relevant online learning resources.
- To prepare students to design effective solutions and present them through project-based and hackathon-oriented activities.

Course Outcomes: Students will be able to:

CO1	Identify real-world problems and formulate suitable AI/ML-based project objectives.
CO2	Apply AI, ML, and programming concepts to design effective solutions.
CO3	Develop functional AI/ML prototypes using appropriate tools and technologies.
CO4	Evaluate and improve AI/ML solutions through testing and performance analysis.
CO5	Demonstrate teamwork and effective project planning during solution development.
CO6	Present and document project outcomes using appropriate technical communication.

COURSE CONTENTS
Group Structure
Students will work collaboratively in **mentor-guided teams** to plan, manage, and complete projects or activities that address defined real-world problems. 1. Each team should consist of **3 to 6 students**, working cohesively toward a common goal. 2. A **dedicated mentor** will be assigned to each group to support their learning and development throughout the PBL journey.
Project/Problem Selection
1. Projects may originate from any domain, though topics with an IT or technical focus are encouraged. 2. Projects initiated in the first year of engineering may be extended if they show potential and relevance. 3. Preference should be given to projects that involve conceptual modeling and the application of software tools. 4. Multiple solution approaches — such as theoretical analysis, practical implementation, working models, simulations, or software-based solutions — are encouraged. 5. Projects that require a multidisciplinary perspective are highly desirable. 6. Problems should demand in-depth exploration of practical, scientific, or technical areas. 7. The project methodology should incorporate hands-on activities, organizational and field visits, interaction with research institutes, and expert consultations to expose students to the latest technologies and practices.
Assessment
• The department shall ensure rigorous monitoring and assessment of both student progress and the impact of their proposed solutions. • Weekly reviews will be conducted to track the project's progress. • Assessment will include both individual and group performance, facilitated by the assigned mentor. • Students are expected to maintain a culture of authentic collaboration, self-motivation, and peer learning. • Departments must provide guidance, orientation, and access to resources to support the project process. • Students will showcase their learning through public products, reports, or presentations. • *Components of Assessment:* • Individual Evaluation – Assessment of personal involvement, contribution, and understanding. • Group Evaluation – Review of team dynamics, role distribution, communication, and cohesion.

Evaluation and Continuous Assessment

Students and mentors are required to maintain a **PBL workbook** that documents progress, deliverables, and reflections.

- The workbook will serve as a record of **accountability, punctuality, technical writing skills,** and project workflow.
- A **Continuous Assessment Sheet (CAS)** will be maintained by mentors and the department.

Suggested Assessment Criteria and Weightage:

1. Idea Inception – 5%
2. Solution Quality / Problem Solving / Final Output – 40%
3. Documentation (requirements, design, tools, report, etc.) – 25%
4. Patentability Potential – 10%
5. Demonstration (UI, usability, presentation) – 10%
6. Participation in Competitions / Publications – 5%
7. Consideration of Environmental, Ethical, Legal, or Social Aspects – 5%

Rubrics for evaluation should be designed based on these criteria and shared with students for transparency and guidance.

Faculty / Mentor is expected to perform following activities

Faculty mentors are expected to actively support student learning by:

- Revising PBL concepts and assessing initial student skills
- Forming diverse and balanced teams
- Sharing knowledge on IPR (patents, copyrights, publications)
- Discussing case studies to provide practical insight
- Designing and explaining the rubrics for evaluation
- Conducting weekly assessments of deliverables (presentations, reports, concept maps, logbooks)
- Providing continuous guidance (scaffolding)
- Engaging in both formative and summative assessment practices

Reference Books:

1. Project-Based Learning, Edutopia, March 14,2016.
2. What is PBL? Buck Institute for Education.
3. www.schoology.com
4. www.wikipedia.org
5. www.howstuffworks.com

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Liberal Learning - III

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)							**Semester:** III		
Course: Liberal Learning – III (Guitar)							**Course Code:**25AMCC305A		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Indian classical music and Guitar musical instrument.

Course Objectives:

1. To build a strong foundation in Indian classical dance through mastering basic techniques, rhythms, expressions, and repertoire, culminating in a performance.

Course Outcomes: After completion of this course, students will be able to -

CO1	Illustrate the fundamental aspects of Guitar instrument.
CO2	Demonstrate the performance of Guitar Instrument.
CO3	Apply different types Chords.
CO4	Apply basic outline through various prescribed ragas practically.

Course Contents:

Sr. No.	Description	Duration (Hrs.)
1.	Introduction to the Guitar	2
2.	Understanding standard tuning	2
3.	Introduction to tablature and note reading	2
4.	Introduction to basic music theory concepts	2
5.	Understanding scale, intervals, and chords	2
6.	Learning more open chords: D major, D minor, C major, G major	2
7.	Understanding power chords and their shapes	2
8.	Understanding barre chord shapes: F major, B minor	2
9.	Finding Chords by Ear	2
10.	Chord Progressions	2
11.	Advanced Chord Types	2
12.	Transposing Chord	2
13.	Review and Practice	2
14.	Introduction to Scales	2
	TOTAL	**28**

Text Books:

1. David Hodge, "Guitar Theory", DK Publishing.

Reference Books:

1. Russ Shipton, "The Complete Guitar Player", Published by Wise.
2. Vincent Ong, Alfred Khp," Classical Guitar Advanced Studies Repertoires", Dynamic Publication.

E-Resources:

1. https://www.youtube.com/watch?v=BBz-Jyr23M4

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)							**Semester:** III		
Course: Liberal Learning – III (Singing)							**Course Code:**25AMCC305B		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Indian classical music in singing.

Course Objectives:

1. To offer students' knowledge of the basic concepts of Singing in a very easy to understand manner with their practical applicability.

Course Outcomes: After completion of this course, students will be able to -

CO1	Illustrate the fundamental aspects of Singing.
CO2	Demonstrate the performance of Singing.
CO3	Apply basic outline through various prescribed ragas practically.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Voice Culture in Indian Semi Classical Singing.	2
2.	Basics of Singing o Introduction to semi classical singing.	2
3.	Basics of Indian Semi Classical Music.	2
4.	Learning Basic Ragas.	2
5.	Music Theory Basics.	2
6.	Vocal Warm-ups.	2
7.	Introduction to Ear Training.	2
8.	Breathe Control.	2
9.	Resonance and Tone Production.	2
10.	Diction and Articulation.	2
11.	Dynamics and Expression.	2
12.	Introduction to Repertoire.	2
13.	Practice Techniques.	2
14.	Interpretation and Expression.	2
	TOTAL	**28**

Text Books:

1. Dr. Theodore Dimon, "Anatomy of the Voice, This Is a Voice".

Reference Books:

1. Richard Miller, "The Structure of Singing", Schirmer Books, London.
2. Jennifer Hamady, "The Art of Singing", Published by Hal Leonard.

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)							**Semester:** III		
Course: Liberal Learning – III (Cinematography)							**Course Code:**25AMCC305C		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

A basic understanding of film theory, Camera operation, Lighting techniques and visual storytelling is essential for cinematography.

Course Objectives:

1. To make students effectively use their camera's components, study fundamental photography techniques and apply basic to advanced editing skills.

Course Outcomes: After completion of this course, students will be able to -

CO1	Illustrate the fundamental aspects of camera equipment.
CO2	Demonstrate the performance of camera equipment
CO3	Ability to translate creative concepts into visually engaging and coherent film or video projects.
CO4	Mastery in crafting compelling visual narratives through camera angles, lighting, and composition

Course Contents:

Sr. No.	Description	Duration (Hrs.)
1.	Introduction to Photography	2
2.	Understanding camera components (lens, shutter, sensor)	2
3.	Exposure Triangle	2
4.	Introduction to the rule of thirds, leading lines, and framing	2
5.	Understanding autofocus vs. manual focus	2
6.	Introduction to natural and artificial lighting	2
7.	White Balance and Color Theory	2
8.	Motion and Long Exposure	2
9.	Basics of portrait photography	2
10.	Basics of landscape photography	2
11.	Overview of post-processing software (e.g., Adobe Light room, Photoshop)	2
12.	Introduction to advanced editing tools	2
13.	Organizing and Storing Photos	2
14.	Final Project Presentation and Review	2
	TOTAL	**28**

Text Books:

1. Tania Hoser, "Introduction to Cinematography", Taylor & Francis.

Reference Books:

1. Anat Pick, "Screening Nature", Berghahn Books.
2. Blain Brown, "Cinematography: Theory and Practice", Taylor & Francis.

E-Resources:

1. https://youtu.be/V7z7BAZdt2M?si=to4yQ46zEKRbxKOm
2. https://youtu.be/WXdAX0No2hM?si=GZu_mJsmvJ7NGnAU

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)							**Semester:** III		
Course: Liberal Learning – III (Dance)							**Course Code:**25AMCC305D		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Good stamina, flexibility and familiarity with simple rhythmic patterns and beats.

Course Objectives:

1. To build a strong foundation in Indian classical dance through mastering basic techniques, rhythms, expressions, and repertoire, culminating in a performance.

Course Outcomes: After completion of this course, students will be able to -

CO1	Understand the fundamental postures, hand gestures and basic steps of Indian classical dance.
CO2	Understand and perform dance sequences to various rhythmic cycles (Tala) with confidence.
CO3	Convey emotions and stories through facial expressions (Abhinaya) and body language.

Course Contents:

Sr. No.	Description	Duration (Hrs.)
1.	Overview of Indian Classical Dance	2
2.	Fundamental Postures and Hand Gestures (Hasta Mudras)	2
3.	Introduction to Basic Steps (Adavus or Tatkars)	2
4.	Rhythmic Patterns and Clapping (Tala)	2
5.	Advanced Basic Steps	2
6.	Strength and Conditioning	2
7.	Introduction to Basic Expressions (Abhinaya)	2
8.	Integrating Steps and Expressions	2
9.	Intermediate Rhythmic Patterns	2
10.	Improvisation and Creative Movement	2
11.	Introduction to Advanced Movements	2
12.	Review and Feedback	2
13.	Learning a Simple Dance Piece - Part 1	2
14.	Learning a Simple Dance Piece - Part 2	2
	TOTAL	**28**

Text Books:

1. Padma Subrahmanyam, "Indian Classical Dance: A Beginner's Manual", Abhinav Publications.

Reference Books:

1. Dr. Aditi Sriram, "Indian Classical Dance: A Guide", Vikas Publishing House.

E-Resources:

1. https://youtu.be/5apCTHzvkWI?si=p11CR_4XxPocTbjO
2. https://youtu.be/OIKOHzePJCA?si=7pnPZKuvfT5EIWhf

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)						**Semester:** III			
Course: Liberal Learning – III(Synthesizer/Keyboard)						**Course Code:**25AMCC305E			
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Indian classical music and Keyboard musical instrument.

Course Objectives:

1. To offer students' knowledge of the basic concepts of playing Keyboard in a very easy to understand manner with their practical applicability.

Course Outcomes:

CO1	Illustrate the fundamental aspects of Keyboard instrument.
CO2	Demonstrate the performance of Keyboard Instrument.
CO3	Apply different types of Chords.
CO4	Apply basic outline through various prescribed ragas practically.

Course Contents:

Sr. No.	Description	Duration (Hrs.)
1.	Introduction to the Keyboard	2
2.	Understanding Notes and Keys	2
3.	Basic Music Theory	2
4.	Introduction to the C major scale	2
5.	Learning to play simple melodies in C major	2
6.	Introduction to Chords	2
7.	Combining Melodies and Chords	2
8.	Review and practice melodies and chords	2
9.	Introduction to Minor Scales	2
10.	Introduction to additional chords (D major, E minor)	2
11.	Understanding chord progressions (e.g., I-IV-V)	2
12.	Review scales, chords, and progressions	2
13.	Introduction to Arpeggios	2
14.	Dynamics and Expression	2
	TOTAL	**28**

Text Books:

1. Chuan C. Chang, "Fundamentals of Piano Practice", Create space Independent Publishing Platform.

Reference Books:

1. Michael Rodman, "Keyboard for the Absolute Beginners", Alfred Publishing.
2. Davis Dorrough, "Piano Scales".

E-Resources:

1. https://youtu.be/2mPS-2guHVo?si=8X_4KKezIdrMejLH
2. https://youtu.be/tEtukfFv3Wk?si=2iJ8wdD0dfjWauPb

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)							**Semester:** III		
Course: Liberal Learning – III (Basketball)							**Course Code:**25AMCC305F		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To develop foundational basketball skills, including dribbling, passing, shooting, and defense, while understanding game rules and strategies through practical gameplay and scrimmage.

Course Outcomes: After completion of this course, students will be able to -

CO1	Demonstrate basic basketball skills such as dribbling, passing, shooting, and defensive fundamentals effectively.
CO2	Apply offensive and defensive strategies, including transition play, during gameplay and scrimmages.
CO3	Understand and implement basketball game rules and referee gestures accurately in practical situations.

Course Contents:

Sr. No.	Description	Duration (Hrs.)
1.	Introduction to Basketball	2
2.	Basic Skills – Dribbling	2
3.	Basic Skills- Passing	2
4.	Basic Skills- Shooting	2
5.	Defensive Fundamentals	2
6.	Rebounding Basics	2
7.	Ball Handling & Control	2
8.	Shooting Mechanics	2
9.	Offensive Strategies	2
10.	Defensive Strategies	2
11.	Transition Play	2
12.	Gameplay & Scrimmage	2
13.	Game Rules , Refree Gestures	2
14.	Practical	2
	TOTAL	**28**

Text Books:

1. K.K. Sharma, "Basketball: Skills and Drills", Sports Publications.

Reference Books:

1. Dr. P.K. Kher, "Basketball Coaching: A Complete Guide", Khel Prakashan.
2. S. Reddy, "The Ultimate Guide to Basketball Training", Blue Rose Publisher.

E-Resources:

1. Introduction to Exercise Physiology & Sports Performance, IIT Madras, https://nptel.ac.in/courses/109106406

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)							**Semester:** III		
Course: Liberal Learning – III (Cricket)							**Course Code:**25AMCC305G		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To enhance cricket skills from basics to advanced techniques, focusing on tactics, fitness, and specialized fielding and wicket keeping through targeted practice and match simulations.

Course Outcomes: After completion of this course, students will be able to -

CO1	Master fundamental and advanced cricket techniques, including batting, bowling, and specialized fielding and wicket keeping.
CO2	Demonstrate an understanding of game scenarios and tactical strategies, applying them effectively during match simulations and pressure situations.
CO3	Improve physical fitness, strength, and conditioning, with targeted skill enhancement and mid-season assessments to track progress.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Introduction and Fundamentals.	2
2.	Basic Techniques.	2
3.	Introduction to Game Scenarios.	2
4.	Physical Fitness and Match Simulations.	2
5.	Advanced Batting Techniques	2
6.	Advanced Bowling Techniques	2
7.	Specialized Fielding and Wicket keeping	2
8.	Tactical Understanding	2
9.	Refining Batting Techniques	2
10.	Refining Bowling Techniques	2
11.	Fielding Under Pressure	2
12.	Strength and Conditioning	2
13.	Targeted Skill Improvement	2
14.	Mid-Season Assessment	2
	TOTAL	**28**

Text Books:

1. Sanjay Manjrekar, "Cricket Fundamentals", Orient BlackSwan
2. Ravi Shastri, "Winning Cricket: Skills and Strategies", Notion Press

Reference Books:

1. Sachin Tendulkar, "Playing It My Way", Hachette India
2. Rahul Dravid, "Cricket: The Game of Life", Penguin India

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)							**Semester:** III		
Course: Liberal Learning – III (Rifle and Pistol Shooting)							**Course Code:**25AMCC305H		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To develop fundamental skills in rifle and pistol shooting through technical knowledge, practical drills, and mental preparation for competitive performance.

Course Outcomes: After completion of this course, students will be able to -

CO1	Master fundamental and advanced shooting techniques for both rifle and pistol, including aiming, breathing, and triggering.
CO2	Develop strong mental focus and relaxation techniques essential for high-performance shooting and competition readiness.
CO3	Gain hands-on experience in live shooting drills and positional shooting, preparing them for competitive shooting scenarios.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Introduction about shooting game	2
2.	Basic technical knowledge	2
3.	Technique Refinement(aiming, breathing and triggering)	2
4.	Learning about live shooting and technics	2
5.	Practicing standard Positional rifle Shooting	2
6.	Mental Preparation and Focus	2
7.	Practice and learning session of live shooting(rifle)	2
8.	Learning about pistol shooting(pistol)	2
9.	Introduction of pistol positions and dry practice	2
10.	Practical Shooting Drills (basic)	2
11.	Learning about live shooting and technics(standing position)	2
12.	Learning of Concentration, breathing and relaxing exercise for shooting	2
13.	Introduction of competition level and practice	2
14.	Final test and oral (rifle and pistol match)	2
	TOTAL	**28**

Reference Books:

1. David Watson, "ABCs of Rifle Shooting", Gun Digest (Imprint of KP Books), 2014

E-Resources:

1. Introduction to Exercise Physiology & Sports Performance, IIT Madras, https://nptel.ac.in/courses/109106406

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)							**Semester:** III		
Course: Liberal Learning – III (Volleyball)							**Course Code:**25AMCC305I		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

- To develop foundational volleyball skills, including serving, passing, setting, spiking, and blocking, while mastering game rules and strategies through practical gameplay and scrimmage.

Course Outcomes: After completion of this course, students will be able to -

CO1	Demonstrate proficiency in basic volleyball skills such as serving, passing, setting, spiking, and blocking.
CO2	Apply offensive and defensive strategies effectively, including serve receive and transition play, during gameplay.
CO3	Understand and implement volleyball rules and referee gestures, applying them accurately during practical gameplay and scrimmages.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Introduction to Volleyball	2
2.	Basic Skills - Serving	2
3.	Basic Skills- Passing	2
4.	Basic Skills- Setting	2
5.	Spiking Basics	2
6.	Blocking Basics	2
7.	Digging Basics	2
8.	Serve Receive	2
9.	Offensive Strategies	2
10.	Defensive Strategies	2
11.	Transition Play	2
12.	Gameplay & Scrimmage	2
13.	Game Rules , Refree Gestures	2
14.	Practical	2
	TOTAL	**28**

Text Books:

1. Jitendra Kumar, "The Complete Guide to Volleyball", Blue Rose Publisher

Reference Books:

1. N. Ramachandran, "Volleyball: Steps to Success", Sports Publication
2. https://coachtube.com/course/volleyball/volleyball-for-beginners/7004

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)							**Semester:** III		
Course: Liberal Learning – III (Football)							**Course Code:**25AMCC305J		
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To enhance players' technical skills, tactical understanding, physical fitness, teamwork, and sportsmanship, fostering a comprehensive understanding and appreciation of the game.

Course Outcomes: After completion of this course, students will be able to -

CO1	To identify and describe the fundamental skills and strategies involved in football, including ball control, dribbling techniques, basic offensive and defensive tactics.
CO2	To apply advanced dribbling and passing techniques during practice sessions.
CO3	To design and execute a cohesive game plan that integrates set pieces, team chemistry, and communication, evaluating its effectiveness through simulation matches.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Introduction and Basic Skills.	2
2.	Ball Control and Movement.	2
3.	Advanced Dribbling and Passing.	2
4.	Shooting and Finishing.	2
5.	Offensive Tactics.	2
6.	Defensive Tactics.	2
7.	Set Pieces (Offensive and Defensive).	2
8.	Team Chemistry and Communication.	2
9.	Midfield Dominance.	2
10.	Forward Play and Creativity.	2
11.	Defense Organization.	2
12.	Goalkeeper Training.	2
13.	Speed and Agility.	2
14.	Simulation Matches.	2
	TOTAL	**28**

Text Books:

1. Srinivasan J. B, "Football Coaching: A Comprehensive Guide", Sports Publishing.

Reference Books:

1. Rob Ellis, "The Complete Guide to Coaching Soccer", Meyer & Meyer Sport.
2. Udemy – Soccer Courses - https://www.udemy.com/topic/soccer/

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML									**Semester:** III
Course: Internship-II									**Code: 25AMIN302**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
4 Week			02		-	25	-	-	25
Kindly refer the policy of internship on College Website									

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SYLLABUS
SEMESTER - IV

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester:** IV
Course: Database Management System									**Code: 25AMPC405**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
03	-	-	03	40	60	-	-	-	100

Prerequisites:

- Basic knowledge of data structures and programming
- Understanding of file systems and operating system fundamentals

Course Objectives:

- To develop students' understanding of fundamental database concepts and relational database design.
- To enable students to design, manage, and query databases using E-R models, normalization, and SQL.
- To provide practical exposure to transactions, indexing, query optimization, and emerging database technologies such as NoSQL and distributed databases.

Course Outcomes: Upon successful completion of the course, students will be able to:

CO1	Understand basic database concepts and architecture
CO2	Design relational databases using E-R models and normalization
CO3	Write SQL queries to manage, retrieve, and manipulate data
CO4	Apply transaction management, concurrency control, and recovery techniques
CO5	Analyze indexing strategies and query optimization methods
CO6	Explore advanced topics such as NoSQL, distributed, and cloud-based databases

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to Database Systems** Purpose of databases, file system vs DBMS, advantages of DBMS, database users and administrators, DBMS architecture, data models (hierarchical, network, relational), schema and instance, data independence, DBMS languages (DDL, DML).	6
2.	**Entity-Relationship (ER) Modeling and Relational Model** ER model: entity types, attributes, relationships, generalization, specialization, aggregation. Converting ER to relational schema. Relational model: structure, keys, integrity constraints, relational algebra operations.	6

3.	**Structured Query Language (SQL)** Basic SQL commands (SELECT, INSERT, DELETE, UPDATE), constraints, aggregate functions, group by, order by, joins (inner, outer, self), subqueries, views, indexes, and stored processes.	6.
4.	**Normalization and Functional Dependencies** Functional dependencies, decomposition, lossless-join and dependency preservation, normal forms (1NF, 2NF, 3NF, BCNF), multivalued dependencies, join dependencies, denormalization.	7
5.	**Transaction Management and Concurrency Control** Transaction properties (ACID), transaction states, serializability, conflict and view serializability, concurrency control protocols: locking, timestamp ordering, deadlock handling, recovery concepts and techniques.	7
6.	**Query Optimization and Advanced Topics** Query processing overview, evaluation strategies, indexing (B+ trees, hash-based), and introduction to NoSQL, distributed databases, cloud-based databases, and emerging trends in database systems.	7
	TOTAL	**39 Hrs.**

Text Books:

- Korth, Silberschatz & Sudarshan, *Database System Concepts*, McGraw Hill Education
- Ramez Elmasri and Shamkant B. Navathe, *Fundamentals of Database Systems*, Pearson Education

Reference Books:

1. C.J. Date, *An Introduction to Database Systems*, Addison-Wesley
2. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, McGraw Hill
3. Rob and Coronel, *Database Systems: Design, Implementation, and Management*, Cengage Learning

E-Resources:

1. Database Management Systems: https://nptel.ac.in/courses/106/105/106105175/
2. GeeksforGeeks – DBMS: https://www.geeksforgeeks.org/dbms/
3. Oracle SQL Tutorial: https://docs.oracle.com/en/database/

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Program: B. Tech. (AI & ML)									**Semester:** IV
Course: Database Management Lab									**Code: 25AMPC405P**
Teaching Scheme					**Evaluation Scheme**				
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	**02**	**-**	**01**	**-**	**-**	**-**	**-**	**25**	**25**

Prerequisites:

- Basic knowledge of programming and problem-solving.
- Basic understanding of data organization and computer systems.

Course Objectives:

- To develop students' practical skills in database design and SQL programming.
- To enable students to apply database concepts such as normalization, joins, transactions, and constraints.
- To provide hands-on experience in developing and managing database-driven applications.

Course Outcomes: After completion of this course, students will be able to -

- Design and implement relational databases using ER models, normalization, and SQL.
- Develop SQL queries and database programs using joins, subqueries, views, procedures, and triggers.
- Apply transaction management and database concepts to develop real-world database applications.

List of Experiments:

1. Implement basic SQL operations such as creating, inserting, updating, deleting, and retrieving data with integrity constraints.
2. Execute SQL queries on multiple tables using joins, filtering, and aliases.
3. Apply aggregate functions with GROUP BY, HAVING, and ORDER BY for data analysis.
4. Implement nested, correlated, and EXISTS subqueries to retrieve required data.
5. Create views and indexes and analyze their role in query performance.
6. Design an ER model for a real-world application and implement the corresponding relational schema.
7. Normalize a database up to 3NF/BCNF and identify functional dependencies and keys.
8. Create and execute stored procedures and functions with parameters and return values.
9. Implement triggers and cursors for automated and row-level database operations.
10. Demonstrate transaction control using COMMIT, ROLLBACK, and SAVEPOINT, along with basic concurrency control.
11. Develop a database case study by designing an ER model, implementing the schema, and executing relevant queries.

12. Develop a mini database-driven application with schema, queries, documentation, and Screenshot
Reference Books:
1. C.J. Date, *An Introduction to Database Systems*, Addison-Wesley 2. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, McGraw Hill Rob and Coronel, *Database Systems: Design, Implementation, and Management*, Cengage Learning

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester:** IV
Course: Data Science									**Code: 25AMPC406**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
04	-	-	04	40	60	-	-	-	100

Prerequisites:

Python Programming, Statistics, Linear Algebra

Course Objectives:

- To develop students' understanding of Data Science, computational statistics, and data processing technologies.
- To enable students to apply data modeling and analytics techniques using Python.
- To provide practical exposure to modern data analytics tools and emerging trends in Data Science.

Course Outcomes:

CO1	Analyze needs and challenges for Data Science
CO2	Apply statistics for Data Analytics
CO3	Apply the lifecycle of Data analytics to real world problems
CO4	Implement Data Analytics using Python programming
CO5	Implement data visualization using visualization tools in Python programming
CO6	Design and implement Big Databases using the Hadoop ecosystem

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to Data Science** Basics and need of Data Science, Applications of Data Science, Relationship between Data Science and Information Science, Business intelligence versus Data Science, Data: Data Types, Data Collection. Need of Data wrangling, Methods: Data Cleaning, Data Integration, Data Reduction, Data Transformation, and Data Discretization.	7
2.	**Statistical Inference** Need of statistics in Data Science, Measures of Central Tendency: Mean, Median, Mode, Mid-range. Measures of Dispersion: Range, Variance, Mean Deviation, Standard Deviation. Bayes theorem, Basics and need of hypothesis and hypothesis testing, Pearson Correlation, Sample Hypothesis testing, Chi-Square Tests, t-test	6
3.	**Data Analytics Life Cycle** Introduction, Data Analytic Lifecycle: Introduction, Phase 1: Discovery, Phase 2: Data Preparation, Phase 3: Model Planning, Phase 4: Model Building, Phase 5: Communication results, Phase 6: Operationalize.	6

4.	**Predictive Data Analytics with Python** Introduction, Essential Python Libraries, Basic examples. Data Preprocessing: Removing Duplicates, Transformation of Data using function or mapping, replacing values, Handling Missing Data. Analytics Types: Predictive, Descriptive and Prescriptive. Association Rules: Apriori Algorithm, FP growth. Regression: Linear Regression, Logistic Regression. Classification: Naïve Bayes, Decision Trees. Introduction to Scikit-learn, Installations, Dataset, mat plotlib, filling missing values, Regression and Classification using Scikit-learn.	7
5.	**Data Analytics and Model Evaluation** **Clustering Algorithms**: K-Means, Hierarchical Clustering, Time-series analysis. **Introduction to Text Analysis:** Text-preprocessing, Bag of words, TF-IDF and topics. Need and Introduction to social network analysis, Introduction to business analysis. Model Evaluation and Selection: Metrics for Evaluating Classifier Performance, Holdout Method and Random Sub sampling, Parameter Tuning and Optimization, Result Interpretation, Clustering and Time-series analysis using Scikit-learn, Sklenarn. metrics, Confusion matrix, AUC-ROC Curves, Elbow plot.	7
6.	**Data Visualization and Hadoop** F Introduction to Data Visualization, Types of data visualization, Data Visualization Techniques, Tools used in Data Visualization, Challenges to Big data visualization, Visualizing Big Data, Analytical techniques used in Big data visualization, Hadoop ecosystem, Map Reduce, Pig, Hive, Data Visualization using Python: Line plot, Scatter plot, Histogram, Density plot, Box- plot.	6
	TOTAL	**39 Hrs.**

Text Books:

1. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publication, 2012, ISBN0-07-120413-X.
2. Jiawei Han, Micheline Kamber, and Jian Pie, "Data Mining: Concepts and Techniques" Elsevier Publishers Third Edition, ISBN: 9780123814791, 9780123814807.

Reference Books:

1.EMC Education Services, "Data Science and Big Data Analytics- Discovering, analyzing Visualizing and Presenting Data" Ist Edition.

2. DT Editorial Services, "Big Data, Black Book", DT Editorial Services, ISBN: 9789351197577, 2016 Edition.

3.Chirag Shah, "A Hands-On Introduction To Data Science", Cambridge University Press, (2020), ISBN : ISBN 978-1-108-47244-9.

E-Resources:

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester: IV**
Course: Software Engineering									**Code: 25AMPC407**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
03	-	-	03	40	60	-	25	-	125

Prerequisites:

- Basic knowledge of the Internet and the World Wide Web
- Familiarity with business or commerce principles
- Interest in digital platforms and technologies

Course Objectives:

- To develop students' understanding of software engineering principles and software development life cycle models.
- To enable students to apply software design, testing, quality assurance, and project management techniques.
- To provide practical exposure to Agile, DevOps, and software security practices.

Course Outcomes: Upon successful completion of the course, students will be able to:

CO1	Define and explain the foundational principles of software engineering.
CO2	Identify and apply appropriate software process models.
CO3	Analyze and document software requirements using industry-standard techniques.
CO4	Design software using modeling tools and design patterns.
CO5	Apply software testing strategies and evaluate software quality.
CO6	Utilize modern engineering practices such as Agile, DevOps, and CI/CD pipelines.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to Software Engineering:** Introduction to SE, Myths & Principle, Software Development Life Cycle (SDLC) Process Models: Waterfall, Incremental, Spiral, V-Model, Software Engineering Ethics (ACM/IEEE Code), Software vs. Program, Software Characteristics Introduction to CASE Tools	7
2.	**Requirements Engineering & Feasibility Study** Requirement Engineering Phases, Functional & Non-functional Requirements **SRS:** Structure and IEEE Standard Format, Feasibility Analysis: Technical, Operational, Economic, Use Case Modeling and Requirement Tools	6

3.	**Software Design & Modeling** Principles of Design: Modularity, Abstraction, Coupling, Cohesion, Design Techniques: Structured and Object-Oriented, UML Diagrams: Use Case, Class, Sequence, Activity, Introduction to Design Patterns: Singleton, MVC	6
4.	**Software Testing and Maintenance** Testing Lifecycle, Types of Testing (Unit, Integration, System), Testing Techniques: BVA, Equivalence Partitioning, Path Testing, White Box & Black Box Testing, Test Case Design & Test Plan Preparation, Software Maintenance, Configuration Management	7
5.	**Software Project Management** Project Planning, Scheduling, Risk Management, Work Breakdown Structure (WBS), Gantt Charts, Cost Estimation Techniques (COCOMO, FP), Software Metrics: LOC, Cyclomatic Complexity, Tools: JIRA, Trello, GitHub Projects	6
6.	**Advanced Trends in Software Engineering** Agile Software Development: Scrum, Kanban, DevOps Lifecycle, CI/CD Pipelines, Software Reengineering and Reverse Engineering, Software Security: OWASP Basics **Case Study:** Modern Software Stack in Use (e.g., Netflix, Spotify)	7
	TOTAL	**39 Hrs.**

Text Books:

1. Software Engineering: A Practitioner's Approach – Roger S. Pressman (McGraw Hill)
2. Software Engineering – Ian Sommerville (Pearson Education)

Reference Books:

- An Integrated Approach to Software Engineering – Pankaj Jalote (Narosa)
- Software Project Management – Bob Hughes, Mike Cotterell (McGraw Hill)
- Fundamentals of Software Engineering – Rajib Mall (PHI)

Digital References:

- NPTEL: Software Engineering - IIT KGP
- Coursera: Agile with Atlassian Jira (Atlassian)
- GeeksforGeeks: SE Portal
- GitHub Education: Student Developer Pack

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester:** IV
Course: Knowledge Representation and Reasoning									**Code: 25AMMD402**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
03	-	-	03	40	60	-	-	-	100

Prerequisites:

- fundamentals of Artificial Intelligence
- Basic Discrete Mathematics and Logic
- Understanding of algorithms and data structures

Course Objectives:

- To introduce the fundamental concepts of knowledge representation and inference.
- To explore logical formalisms used for modeling intelligent behavior.
- To understand rule-based systems, semantic networks, and ontologies.
- To develop reasoning techniques using propositional and predicate logic.
- To explore automated reasoning tools and their applications in AI.

Course Outcomes: Upon successful completion of the course, students will be able to:

CO1	Understand the role of knowledge representation in intelligent systems
CO2	Apply propositional and predicate logic for representing knowledge
CO3	Model real-world problems using semantic networks and ontologies
CO4	Design and implement rule-based expert systems
CO5	Analyze reasoning techniques such as forward and backward chaining
CO6	Utilize reasoning tools and inference engines in AI applications

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to Knowledge Representation**: Meaning, need, and types of knowledge. Declarative vs. procedural knowledge. Overview of KR techniques: logic-based, semantic network, frames, rules, ontologies, Different Scientific Diagram Utilization for the representation, proofs and method for the latest trends and technologies with respect to AI	6
2.	**Propositional Logic**: Syntax and semantics, truth tables,Properties of Preposition Logic, inference rules, logical equivalences, entailment, satisfiability. Applications of propositional logic in AI.	6
3.	**First Order Predicate Logic (FOPL)**: Syntax, semantics, quantifiers, unification, Properties of Quantifiers, resolution, knowledge base construction. Limitations of FOPL, Tautology, Valid, Contradiction proofs.	7

4.	**Rule-Based Systems and Expert Systems**: Production rules, forward chaining, backward chaining, conflict resolution strategies. Architecture of rule-based expert systems. **Semantic Networks, Frames and Ontologies**: Conceptual graphs, inheritance, slot-filler structure, Description Logics, OWL basics, ontology engineering for AI systems.	7
5.	**Aspect of the Modern AI** : Fundamentals of Probability, Independent and Dependent variables, Axioms of Probability, Rules of Probability : Sum and Multiplication , Types of Probability, List of different Probability Distributions. Introduction of Statistics, Mean, Median, Mode computations, different methods used for statistics representation.	7
6.	**Non-monotonic Reasoning and Uncertainty**: Closed world assumption, default reasoning, belief revision. Introduction to probabilistic logic and fuzzy logic-based representation.	6
	TOTAL	**39 Hrs.**

Text Books:

- Brachman, Ronald J., and Hector J. Levesque. *Knowledge Representation and Reasoning*, Elsevier, 2004.
- Elaine Rich and Kevin Knight, *Artificial Intelligence*, McGraw-Hill.
- Nils J. Nilsson, *Artificial Intelligence: A New Synthesis*, Morgan Kaufmann.

Reference Books:

- Peter Jackson, *Introduction to Expert Systems*, Pearson Education
- John F. Sowa, *Knowledge Representation: Logical, Philosophical, and Computational Foundations*, Brooks/Cole
- Rajendra Akerkar, *Artificial Intelligence*, PHI Learning

Digital References:

- NPTEL Course: Artificial Intelligence: Knowledge Representation & Reasoning
- Stanford AI Materials: https://ai.stanford.edu
- YouTube Series: "AI – Knowledge Representation" by IIT Kharagpur
- MIT OCW: *Artificial Intelligence – KR Topics* [https://ocw.mit.edu]
- OWL & RDF Tutorials: https://www.w3.org/TR/owl-guide/

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OPEN ELECTIVE - II

(Select any one course from the given Open Elective Courses)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)							**Semester: IV**		
Course: Open Elective -II (Cyber Security & Laws)							**Code: 25ALOE402**		
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
02	**-**	**-**	**02**	**-**	**-**	**50**	**50**	**-**	**100**

Prerequisites:

Foundational knowledge in computer science, networking.

Course Objectives:

- To develop students' understanding of cyberspace, cyber laws, and cyber crimes.
- To enable students to identify and analyze risks related to online transactions and cyber activities.
- To familiarize students with legal, regulatory, and organizational aspects affecting IT professionals.

Course Outcomes:

CO1	Illustrate and discuss the basic concepts of cyber security, Devices.
CO2	Understand the aspects related to personal data privacy and security.
CO3	Understand the main components of a cyber security plan.
CO4	Understand about the type and nature of cyber-crimes.
CO5	Articulate the well-known cyber-attack incidents, explain the attack scenarios, and explain mitigation techniques.
CO6	Explain the difference between Systems Cyber Security, Network Cyber Security, and Cryptography, Crypto-Protocols, etc.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to Cyber security:** Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security.	4
2.	**Digital Devices Security, Tools and Technologies for Cyber Security:** End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall, Wi-Fi security, Configuration of basic security policy and permissions.	5

3.	**Cyber security Management, Compliance and Governance:** Cyber security Plan- cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy.	4
4.	**Cybercrimes:** Targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach Cybersquatting, Pharming, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft Cyber Police stations, Crime reporting procedure, Case studies	5
5.	**Cybercrime**: Illustrations, Examples and Mini cases, Real-life examples, Mini Cases-Social Engineering Attacks, Illustration of financial frauds in cyber domain, Digital Signature- Related Crime scenarios, Digital forensics case Illustrations, Online scams**.**	4
6.	**Cyber law:** Cybercrime and legal landscape around the world, IT Act,2000 and its amendments. Limitations of IT Act, 2000. Cybercrime and punishments, Cyber Laws and Legal and ethical aspects related to new technologies- AI/ML, IOT, Block chain, Dark net and Social media, Cyber Laws of other countries.	4.
	TOTAL	**26 Hrs.**

Text Books:

1. Michael E. Whitman, Herbert J. Mattord, (2018). Principles of Information Security, 6th edition, Cenage Learning, N. Delhi.
2. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
3. Cyber Crime an Introduction by Prasad R.S.
4. Cyber Laws by Ed. Kumar Krishna.

Reference Books:

- Angus M. Marshall, "Digital forensics: Digital evidence in criminal investigation", John – Wiley and Sons, 2008.
- Sushma Arora, Raman Arora, Cyber Crimes & Laws, 4th Edition 2021, Publisher: Taxmann, ISBN-10: 9390712491
- N S Nappinai, Technology Laws Decoded, 1st Edition, Publisher: Lexis Nexis, ISBN: 9789350359723

E-Resources: -

- https://onlinecourses.nptel.ac.in/noc23_cs127/preview
- https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
- https://onlinecourses.nptel.ac.in/noc25_cs116/preview

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester:** IV
Course: E-Commerce									**Code: 25AMMC402**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
02	-	-	02	-	-	25	-	-	25

Prerequisites:

- Basic knowledge of the Internet and the World Wide Web
- Familiarity with business or commerce principles
- Interest in digital platforms and technologies

Course Objectives:

- To provide an understanding of fundamental concepts and models in E-Commerce.
- To familiarize students with digital business strategies and payment systems.
- To develop awareness of legal, ethical, and security issues in E-Commerce.
- To give exposure to digital marketing and E-Commerce tools.

Course Outcomes: Upon successful completion of the course, students will be able to:

CO1	Understand the foundations and evolution of E-Commerce and its business models.
CO2	Analyze various payment systems, technologies, and infrastructure of E-Commerce.
CO3	Examine security and legal frameworks applicable to E-Commerce.
CO4	Evaluate the ethical, social, and regulatory concerns in digital commerce.
CO5	Apply digital marketing strategies to online businesses.
CO6	Develop and demonstrate a basic E-Commerce prototype or campaign.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	**Introduction to E-Commerce:** Definition, history, and evolution; traditional vs. electronic commerce; E-Commerce framework and business impact; features and limitations of E-Commerce.	4
2.	**E-Commerce Business Models:** B2B, B2C, C2C, C2B, G2C; revenue models; case studies (Amazon, Flipkart, Meesho, etc.); advantages and challenges.	4
3.	**E-Commerce Infrastructure:** Internet and WWW, web hosting, domain registration, client-server architecture; overview of E-Commerce platforms (Shopify, Wix, WooCommerce).	4
4.	**Electronic Payment Systems & Security:** Payment methods: credit/debit cards, wallets, UPI, net banking; digital signatures; SSL; common threats and prevention; e-fraud case studies.	5

5.	**Legal, Ethical & Regulatory Issues:** Overview of IT Act 2000, data protection laws (GDPR); privacy concerns; ethical and IPR issues in digital business.	4
6.	**Digital Marketing & Strategy:** Introduction to SEO, SEM, affiliate marketing, email campaigns, and social media marketing; use of Google Ads, Meta Ads, CRM tools.	5
	TOTAL	**26 Hrs.**

Text Books:

3. P.T. Joseph, "E-Commerce: An Indian Perspective", PHI Learning
4. Kenneth C. Laudon & Carol Guercio Traver, "E-Commerce 2023", Pearson

Reference Books:

- S.J. Joseph, "E-Commerce: A Managerial Perspective", Prentice Hall
- Elias M. Awad, "Electronic Commerce: From Vision to Fulfillment", Pearson

E-Resources:

- NPTEL: **https://nptel.ac.in**
- Google Digital Garage: **https://learndigital.withgoogle.com**
- HubSpot Academy: **https://academy.hubspot.com**

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Program: B. Tech. (AI & ML)									**Semester:** IV
Course: Quantitative Aptitude & Numerical Analysis									**Code: 25AMAE402**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	.	25	-	-	25

Prerequisites:

- Basic knowledge of Mathematics at Higher Secondary Level
- Familiarity with basic logical reasoning and problem-solving skills

Course Objectives:

- To develop students' quantitative aptitude and numerical problem-solving skills.
- To prepare students for competitive examinations and placement aptitude tests.
- To enhance students' analytical thinking and logical reasoning abilities.

Course Outcomes: Upon successful completion of the course, students will be able to:

CO1	Solve basic and advanced quantitative aptitude problems.
CO2	Apply shortcut methods for fast calculations in aptitude questions.
CO3	Develop logical reasoning skills for competitive exams.
CO4	Use numerical techniques to solve real-life problems.
CO5	Improve accuracy and speed in solving numerical analysis problems.
CO6	Demonstrate confidence in attempting placement and entrance tests.

Guidelines for Instructor's Manual

The instructor's manual should contain detailed solutions and clear explanations for each assignment included in the lab syllabus. It should also mention alternative methods for solving problems where applicable and provide additional practice questions to help students strengthen their understanding. The manual must support instructors in conducting the practical sessions smoothly and effectively.

Guidelines for Student's Lab Journal

Each student must maintain a well-organized lab journal, which should include the problem statement, a detailed step-by-step solution, and the final answer for every assignment. Students should write their observations and conclusions after completing each practical. The journal should reflect neatness, clarity, and completeness, ensuring it serves as a valuable reference for revision.

Guidelines for Lab /TW Assessment

Term work should be evaluated continuously throughout the semester. Marks should be awarded based on the regularity and punctuality of submissions, the correctness and completeness of solutions, and the

student's understanding of the methods used. Viva voce examinations should also be conducted periodically to assess the student's conceptual clarity and problem-solving approach.
Guidelines for Practical Examination
The practical examination should test the student's ability to solve given numerical and aptitude problems accurately within a limited time frame. Along with the problem-solving part, an oral examination should be conducted to check the student's understanding of the methods and logic applied during the practicals. The exam should ensure that students can confidently apply the techniques learned during the course.
Guidelines for Laboratory Conduction
Practical sessions should begin with an explanation of the relevant concepts and shortcut methods, followed by solving a few examples as a demonstration. Instructors should encourage students to discuss alternative approaches and share problem-solving tips among peers. Ample practice problems should be given during lab hours to reinforce learning and improve speed and accuracy.
List of Assignments: -
1. To solve problems based on number systems including even-odd numbers, divisibility rules, and digit sums using shortcut methods.
2. To find the Highest Common Factor (HCF) and Least Common Multiple (LCM) of numbers and apply shortcut techniques for fast calculations.
3. To solve various percentage-based problems related to profit, loss, discounts, and marked price efficiently using quick methods.
4. To apply profit and loss formulas to practical business scenarios and calculate gains or losses using fast techniques.
5. To solve problems on ratio, proportion, and partnership using direct and inverse methods and learn practical applications.
6. To analyze time and work problems involving efficiency, multiple workers, and pipes & cisterns using various shortcut approaches.
7.To calculate time, speed, and distance for different situations including trains, boats & streams, and relative speed problems.
8. To compute simple and compound interest for different principal amounts, rates, and time periods and understand installment calculations.
9. To interpret and analyze data using tables, bar graphs, pie charts, and line graphs and solve related questions accurately.
10. To solve problems on permutations and combinations and apply counting principles for arrangements and selections.
11. To understand and solve basic probability problems including independent and dependent events and real-life applications.
12. To apply the properties of logarithms to simplify and solve exponential equations and real-life numerical problems.

Text Books:
• R.S. Aggarwal, *Quantitative Aptitude for Competitive Examinations*, S. Chand Publishing.
Reference Books:
• Arun Sharma, *How to Prepare for Quantitative Aptitude for CAT*, McGraw Hill. • Abhijit Guha, *Quantitative Aptitude for Competitive Examinations*, Tata McGraw Hill.
E-Resources:
• www.indiabix.com • www.lofoya.com

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Program: B. Tech. (AI & ML)									**Semester:** IV
Course: Programming Lab – II									**Code:** 25AMVS404
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	-	-	50	50

Prerequisites:

- Basic concepts of statistics and probability.
- Basic knowledge of databases and SQL.

Course Objectives:

- To develop students' practical skills in data loading, cleaning, manipulation, and preprocessing using Python and Pandas.
- To enable students to perform exploratory data analysis, statistical analysis, and visualization using Python libraries.
- To provide hands-on experience with real-time and scalable data processing using tools such as Kafka, Spark, Colab, and BigQuery

Course Outcomes: Upon successful completion of the course, students will be able to:

CO1	Apply Python and Pandas techniques to load, manipulate, clean, and preprocess real-world datasets.
CO2	Perform exploratory data analysis and visualize data using statistical and visualization libraries such as Seaborn and Plotly.
CO3	Apply statistical methods, probability distributions, and hypothesis testing to analyze datasets and interpret results.
CO4	Implement and evaluate machine learning models for regression,classification,clustering,and reduction
CO5	Develop practical data processing pipelines using real-time streaming and scalable data analysis tools.
CO6	Track, deploy, containerize, and present machine learning solutions using MLflow, FastAPI/Flask, Docker, Stream lit/Power BI, and cloud-based tools.

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List of Assignments: - (Perform Any 11 Practical's)
1. Perform data wrangling and preprocessing on an open-source dataset using Python and Pandas.
2. Clean, transform, and handle missing values and outliers in an academic performance dataset.
3. Calculate and interpret descriptive statistics and measures of central tendency and variability.
4. Implement linear regression for predicting values using a suitable dataset.
5. Implement logistic regression for classification and evaluate the model using a confusion matrix.
6. Implement Naïve Bayes classification and evaluate its performance using suitable metrics.
7. Perform text preprocessing using tokenization, POS tagging, stop-word removal, stemming, and lemmatization, and apply TF-IDF.
8. Create visualizations such as box plots and analyze relationships between variables using a suitable dataset.
9. Analyze dataset distributions using histograms and box plots and identify significant patterns and outliers.
10. Implement a MapReduce application to process and analyze system log data.
11. Create databases and tables and perform basic data analysis queries using Impala.
12. Develop a basic data processing application using Scala and Apache Spark.
13. Develop a case study involving data collection, analytical planning, model development, and interpretation of results.

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Liberal Learning - IV

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)									**Semester:** IV
Course: Liberal Learning – IV (Guitar)									**Code:** 25AMCC406A
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Indian classical music and Guitar musical instrument.

Course Objectives:

1. To enhance guitar skills through intermediate fingerpicking, lead techniques, and genre exploration, culminating in a polished final performance.

Course Outcomes: After completion of this course, students will be able to -

CO1	Execute intermediate fingerpicking techniques with precision and rhythm.
CO2	Apply advanced lead guitar techniques and pentatonic scales effectively.
CO3	Perform confidently across various genres including blues, rock, folk, and classical.
CO4	Deliver a polished final performance through focused practice and preparation.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Rhythm and Timing.	2
2.	Time Signatures.	2
3.	Understanding Basic Rhythms.	2
4.	Circle of Fifths.	2
5.	Introduction to Minor Scales.	2
6.	Advanced Chord Shapes.	2
7.	Introduction to Lead Techniques.	2
8.	Introduction to Pentatonic Scale.	2
9.	Practice and Review.	2
10.	Exploring Different Genres.	2
11.	Final Project Planning.	2
12.	Intensive Practice.	2
13.	Pre-Performance Preparation.	2
14.	Final Performance.	2
	TOTAL	**28**

Text Books:

1. David Hodge, "Guitar Theory", DK Publishing.

Reference Books:

1. Russ Shipton, "The Complete Guitar Player", Published by Wise.
2. Vincent Ong, Alfred Khp," Classical Guitar Advanced Studies Repertoires", Dynamic Publication.

E-Resources:

1. https://www.youtube.com/watch?v=BBz-Jyr23M4

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Program: B. Tech. (Artificial Intelligence and Machine Learning)									**Semester:** IV
Course: Liberal Learning – IV (Singing)									**Code:** 25AMCC406B
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Indian classical music in singing.

Course Objectives:

1. To develop advanced singing techniques and ear training through Indian classical music, focusing on repertoire selection, effective rehearsal, and performance presentation.

Course Outcomes: After completion of this course, students will be able to -

CO1	Master legato, staccato, and advanced vocal methods in Indian classical music.
CO2	Improve musical ear through rigorous training and diverse classical repertoire.
CO3	Apply effective rehearsal strategies to prepare and present a polished performance.
CO4	Deliver a well-executed performance of selected Indian classical pieces with artistic expression

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Vibrato and Ornamentation.	2
2.	Range Extension.	2
3.	Legato and Staccato.	2
4.	Advanced Ear Training.	2
5.	Basics of Indian Semi Classical Music.	2
6.	Improvisation Techniques.	2
7.	Selecting Repertoire for Performance.	2
8.	Rehearsal Techniques.	2
9.	Dress Rehearsal.	2
10.	Final Performance.	2
11.	Performance Review.	2
12.	Exploring New Repertoire.	2
13.	Advanced Techniques and Styles.	2
14.	Course Recap and Future Directions.	2
	TOTAL	**28**

Text Books:

1. Dr. Theodore Dimon, "Anatomy of the Voice, This Is a Voice".

Reference Books:

1. Richard Miller, "The Structure of Singing", Schirmer Books, London.
2. Jennifer Hamady, "The Art of Singing", Published by Hal Leonard.

E-Resources:

1. https://www.youtube.com/watch?v=4hNq9qykOyE
2. https://www.youtube.com/watch?v=b14gkmECz-Y

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)									**Semester:** IV
Course: Liberal Learning – IV (Cinematography)									**Code:** 25AMCC406C
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

A basic understanding of film theory, Camera operation, Lighting techniques and visual storytelling is essential for cinematography.

Course Objectives:

1. To master videography by learning camera techniques, shooting methods, and editing, culminating in a final project showcasing advanced skills in video production.

Course Outcomes: After completion of this course, students will be able to -

CO1	Operate camera components and techniques for steady, sharp video shooting.
CO2	Apply rule of thirds, framing, and stabilization methods effectively.
CO3	Use advanced editing tools and sound design for polished video projects.
CO4	Deliver a comprehensive final video project demonstrating learned skills.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Introduction to Videography	2
2.	Understanding camera components (lens, sensor, viewfinder)	2
3.	Techniques for steady shooting (tripods, handheld, gimbals)	2
4.	Understanding the rule of thirds, leading lines, and framing in video	2
5.	In-depth explanation of the exposure triangle: aperture, shutter speed, and ISO	2
6.	Importance of audio in videography	2
7.	Techniques for achieving sharp focus	2
8.	Motion and Stabilization	2
9.	Storyboarding and Planning	2
10.	Filming Techniques	2
11.	Introduction to Video Editing	2
12.	Introduction to advanced editing tools (color correction, audio editing, effects)	2
13.	Sound Design and Mixing	2
14.	Final Project Presentation and Review	2
	TOTAL	**28**

Text Books:

1. Tania Hoser, "Introduction to Cinematography", Taylor & Francis.

Reference Books:

1. Anat Pick, "Screening Nature", Berghahn Books.
2. Blain Brown, "Cinematography: Theory and Practice", Taylor & Francis.

E-Resources:

1. https://youtu.be/V7z7BAZdt2M?si=to4yQ46zEKRbxKOm
2. https://youtu.be/WXdAX0No2hM?si=GZu_mJsmyJ7NGnAU

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)									**Semester:** IV
Course: Liberal Learning – IV (Dance)									**Code:** 25AMCC406D
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Good stamina, flexibility and familiarity with simple rhythmic patterns and beats.

Course Objectives:

1. To develop advanced dance techniques, expressive skills, and performance readiness in Indian classical dance, culminating in a final performance.

Course Outcomes: After completion of this course, students will be able to -

CO1	Develop advanced techniques in footwork, postures, and hand gestures, with a focus on fluidity and expression.
CO2	Embody various characters and emotions through in-depth exploration of Abhinaya (expressional dance).
CO3	Execute learned dance pieces with precision, synchronization, and advanced rhythmic variations.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Introduction to Character Portrayal.	2
2.	Rehearsal and Feedback.	2
3.	Advanced Footwork and Postures.	2
4.	Advanced Hand Gestures and Movements.	2
5.	Rhythmic Variations and Combinations.	2
6.	Rehearsal of Dance Piece.	2
7.	Performance Techniques.	2
8.	Integrating Steps and Expressions.	2
9.	Full Dress Rehearsal.	2
10.	Improvisation and Creative Movement.	2
11.	Corrections and Adjustments.	2
12.	Mini Performance.	2
13.	Introduction to Abhinaya in Depth.	2
14.	Preparing a New Short Dance Item.	2
	TOTAL	**28**

Text Books:

1. Kapila Vatsyayan, "Indian Classical Dance", Publications Division Ministry of Information & Broadcasting.

Reference Books:

1. Shubhada Varadkar, "The Glimpse of Indian Classical Dance", Krimiga Books, Krimiga Content Development Pvt. Ltd.

E-Resources:

1. https://youtu.be/VP2jLLk8_jA?si=zg6_muy1w7jE5mbi
2. https://youtu.be/xZEP4XupwJA?si=YBt3RmcHxCRc2JSr

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)									**Semester:** IV
Course: Liberal Learning – IV (Synthesizer/Keyboard)									**Code:** 25AMCC406E
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Basic knowledge of Indian classical music and Keyboard musical instrument.

Course Objectives:

1. To develop advanced musical skills through complex progressions, improvisation, and composition, culminating in a polished performance and mastery of selected repertoire.

Course Outcomes: After completion of this course, students will be able to -

CO1	Apply complex chord progressions and advanced scales effectively in performance.
CO2	Demonstrate proficiency in improvisation and advanced chord voicings.
CO3	Perform selected repertoire with refined technique and stage presence.
CO4	Successfully showcase learned skills through a polished recital or performance.

Course Contents:

Unit	**Description**	**Duration (Hrs.)**
1.	Introduction to more complex progressions (e.g., ii-V-I)	2
2.	Basics of improvisation	2
3.	Learning advanced scales (e.g., blues scale, pentatonic scale)	2
4.	Learning advanced chord voicings and inversions	2
5.	Advanced Arpeggios and Runs	2
6.	Basics of composing music	2
7.	Initial practice on selected repertoire	2
8.	Focused practice on repertoire pieces	2
9.	Understanding stage presence and performance techniques	2
10.	Final adjustments and practice on repertoire	2
11.	Attending or reviewing a masterclass	2
12.	Receiving personalized feedback on playing	2
13.	Dress rehearsal for recital or performance	2
14.	Showcasing learned skills and pieces	2
	TOTAL	**28 hrs.**

Text Books:

1. Chuan C. Chang, Fundamentals of Piano Practice, Createspace Independent Publishing Platform

Reference Books:

1. Michael Rodman, "Keyboard for the Absolute Beginners", Alfred Publishing.
2. Davis Dorrough, "Piano Scales".

E-Resources:

1. https://youtu.be/2mPS-2guHVo?si=8X_4KKezIdrMejLH
2. https://youtu.be/tEtukfFv3Wk?si=2iJ8wdD0dfjWauPb

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)									**Semester:** IV
Course: Liberal Learning – IV (Basketball)									**Code:** 25AMCC406F
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To master advanced basketball skills, strategies, and mental conditioning to excel in team play, complex scenarios, and tournament preparation.

Course Outcomes: After completion of this course, students will be able to -

CO1	Demonstrate mastery of advanced dribbling, passing, shooting, and defensive techniques.
CO2	Apply complex defensive systems, advanced team play, and game strategies in mixed scenarios.
CO3	Develop the mental toughness, conditioning, and strategic insights needed for successful tournament performance

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Advanced Dribbling Techniques	2
2.	Advanced Passing Techniques	2
3.	Advanced Shooting Techniques	2
4.	Advanced Defense Techniques	2
5.	Position Specific Training	2
6.	Conditioning & Strength Training	2
7.	Mental Toughness & Focus	2
8.	Advance Team Play	2
9.	Complex Defensive System	2
10.	Mixed Scenarios & Situational Drills	2
11.	Tournament Preparation	2
12.	Advance Game Play & Strategy	2
13.	Mastery & Final Assessment	2
14.	Final Scrimmage	2
	TOTAL	**28**

Text Books:

1. K.K. Sharma, "Basketball: Skills and Drills", Sports Publications

Reference Books:

1. Dr. P.K. Kher, "Basketball Coaching: A Complete Guide", Khel Prakashan
2. S. Reddy, "The Ultimate Guide to Basketball Training", Blue Rose Publisher

E-Resources:

1. Introduction to Exercise Physiology & Sports Performance, IIT Madras, https://nptel.ac.in/courses/109106406

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)									**Semester:** IV
Course: Liberal Learning – IV (Cricket)									**Code:** 25AMCC406G
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To develop advanced cricket skills and strategies in batting, bowling, and fielding, with a focus on mental conditioning, tactical execution, and competitive performance through intensive practice and match simulations.

Course Outcomes: After completion of this course, students will be able to -

CO1	Demonstrate advanced techniques in batting, bowling, and fielding, including targeted drills and intensive practice.
CO2	Apply batting and bowling strategies, and execute tactical plans during match simulations and competitive play.
CO3	Develop strong mental conditioning and teamwork skills, preparing for high-performance in competitive matches and final assessments.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Batting Strategies.	2
2.	Bowling Strategies.	2
3.	Fielding Strategies.	2
4.	Match Simulations and Tactical Execution.	2
5.	Targeted Skill Improvement.	2
6.	Mental Conditioning.	2
7.	Intensive Match Simulations.	2
8.	Advanced Batting Drills.	2
9.	Advanced Bowling Drills.	2
10.	Fielding and Wicket keeping in Game Conditions.	2
11.	Game Analysis and Strategy Sessions.	2
12.	Final Skill Polishing.	2
13.	Teamwork and Communication.	2
14.	Competitive Matches and Final Assessments.	2
	TOTAL	**28**

Text Books:

1. Sanjay Manjrekar, "Cricket Fundamentals", Orient BlackSwan
2. Ravi Shastri, "Winning Cricket: Skills and Strategies", Notion Press

Reference Books:

1. Sachin Tendulkar, "Playing It My Way", Hachette India
2. Rahul Dravid, "Cricket: The Game of Life", Penguin India

E-Resources:

1. Sports and Performance Nutrition, IIT Madras, https://onlinecourses.nptel.ac.in/noc24_hs82/preview

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)									**Semester:** IV
Course: Liberal Learning – IV(Rifle and Pistol Shooting)									**Code:** 25AMCC406H
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To achieve advanced proficiency in rifle shooting through specialized training, technical refinement, and mental preparation for competitive performance.

Course Outcomes: After completion of this course, students will be able to -

CO1	Master advanced rifle shooting techniques and positions to achieve higher scores.
CO2	Develop strong mental preparation and focus techniques for peak performance and overcoming technical hurdles.
CO3	Gain specialized training and match practice, preparing them for ISSF events and advanced shooting challenges.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Understand and learning about advance rifle position	2
2.	Advance technical knowledge	2
3.	Advance Technique Refinement	2
4.	Learning about advance shooting and technics for achieving score	2
5.	Specialized Training	2
6.	Mental Preparation and Focus	2
7.	Peak Performance and analyses	2
8.	Advanced Skills Development	2
9.	Tactical Applications and working about single shoot	2
10.	Advanced Challenges and Readiness	2
11.	Review and Consolidation	2
12.	Focus on technical and mental hurdles	2
13.	Person to person attention	2
14.	Match practice and preparation as per ISSF event	2
	TOTAL	**28**

Reference Books:

1. David Watson, "ABCs of Rifle Shooting", Gun Digest (Imprint of KP Books), 2014

E-Resources:

1. Introduction to Exercise Physiology & Sports Performance, IIT Madras, https://nptel.ac.in/courses/109106406

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)									**Semester:** IV
Course: Liberal Learning – IV(Volleyball)									**Code:** 25AMCC406I
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To achieve advanced proficiency in volleyball by mastering complex techniques, strategic systems, and mental conditioning, while preparing for competitive play and tournament scenarios.

Course Outcomes: After completion of this course, students will be able to -

CO1	Demonstrate expertise in advanced serving, spiking, setting, and blocking techniques tailored to specific positions.
CO2	Implement complex offensive and defensive systems and adapt to mixed scenarios through situational drills and gameplay.
CO3	Develop mental toughness, conditioning, and strategic insights necessary for successful tournament preparation and performance.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Advanced Serving Techniques	2
2.	Advanced Spiking Techniques	2
3.	Advanced Setting Techniques	2
4.	Advanced Blocking Techniques	2
5.	Position – Specific Training	2
6.	Conditioning & Strength Training	2
7.	Mental Toughness & Focus	2
8.	Game Analysis & Feedback	2
9.	Complex Offensive System	2
10.	Complex Defensive System	2
11.	Mixed Scenarios & Situational Drills	2
12.	Advanced Gameplay & Strategies	2
13.	Review & Reinforcement	2
14.	Tournament Preparation	2
	TOTAL	**28**

Text Books:

1. Jitendra Kumar, "The Complete Guide to Volleyball", Blue Rose Publisher

Reference Books:

1. N. Ramachandran, "Volleyball: Steps to Success", Sports Publication

E-Resources:

1. https://coachtube.com/course/volleyball/volleyball-for-beginners/7004

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (Artificial Intelligence and Machine Learning)								**Semester:** IV	
Course: Liberal Learning – IV (Football)								**Code:** 25AMCC406J	
Teaching Scheme (Hrs/week)				**Evaluation Scheme (Marks)**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
-	02	-	01	-	-	25	-	-	25

Prerequisites:

Proper health, Basic knowledge of rules of the game.

Course Objectives:

1. To enhance players' technical skills, tactical understanding, physical fitness, teamwork, and sportsmanship, fostering a comprehensive understanding and appreciation of the game.

Course Outcomes: After completion of this course, students will be able to -

CO1	To explain key concepts of transition play, positional drills, and the importance of endurance and stamina in football.
CO2	Apply advanced tactics during simulation matches, analyze high-pressure situations.
CO3	Students will design a game week routine that covers match preparation, mental and physical readiness, and post-match analysis, evaluating its impact on team performance and skills.

Course Contents:

Sr. No.	**Description**	**Duration (Hrs.)**
1.	Transition Play.	2
2.	Positional Drills.	2
3.	Endurance and Stamina.	2
4.	Video Analysis and Feedback.	2
5.	Advanced Tactics and Strategy.	2
6.	High-Pressure Situations.	2
7.	Leadership and Team Roles.	2
8.	Refining Skills and Tactics.	2
9.	Match Preparation.	2
10.	Mental and Physical Preparation.	2
11.	Game Week Routine.	2
12.	Post Goalkeeper Training.	2
13.	Post-Match Analysis and Recovery.	2
14.	Simulation Matches.	2
	TOTAL	**28**

Text Books:

1. Srinivasan J. B, "Football Coaching: A Comprehensive Guide", Sports Publishing.

Reference Books:

1. Rob Ellis, "The Complete Guide to Coaching Soccer", Meyer & Meyer Sport.

E-Resources:

1. Udemy – Soccer Courses - https://www.udemy.com/topic/soccer/

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Program: B. Tech. (AI & ML)									**Semester: IV**
Course: Internship-III									**Code: 25AMIN402**
Teaching Scheme				**Evaluation Scheme**					
Lecture	**Practical**	**Tutorial**	**Credit**	**CIE**	**ETE**	**TW**	**OR**	**PR**	**Total**
4 Week			02		-	**25**	**-**	**-**	**25**
Kindly refer the policy of internship on College Website									

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