

Marathwada Mitramandal's College of Engineering
Karvenagar, Pune- 52

An Autonomous Institute Affiliated to SPPU

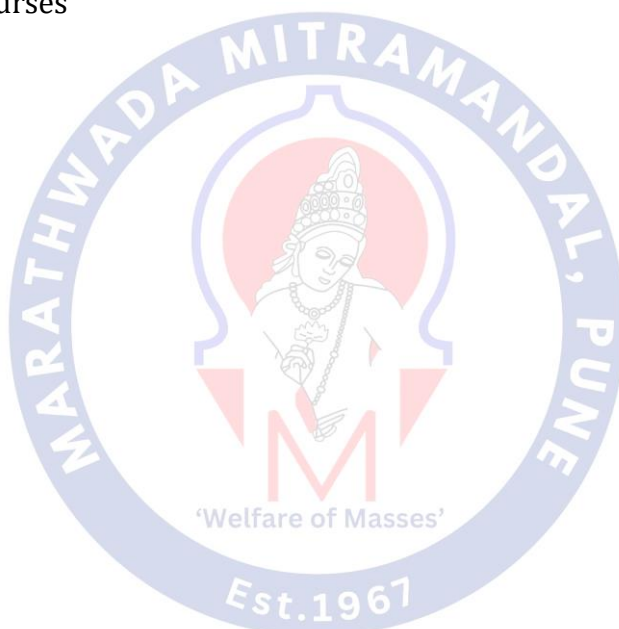


Curriculum for
Second Year B. Tech Artificial Intelligence and Data
Science
A.Y. 2026-27

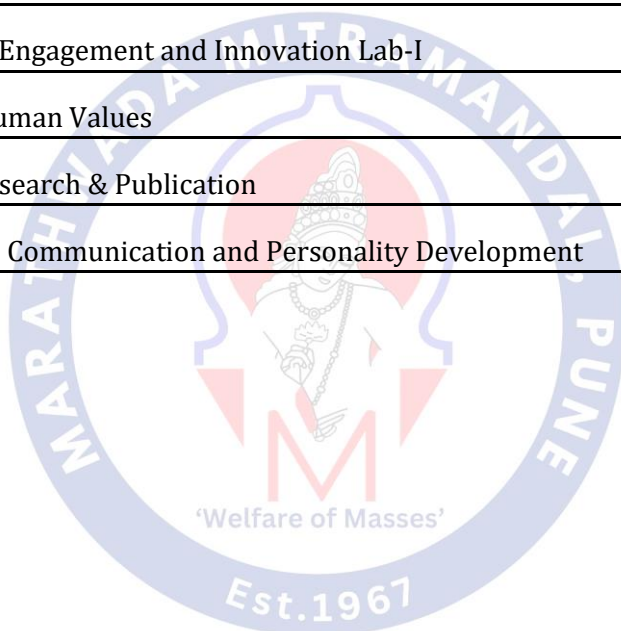
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Institute Vision

To be a globally renowned institution through excellence in engineering education for sustainable and holistic development

Institute Mission

M1: Empower students with cutting-edge technologies and global competencies

M2: Foster culture of research and entrepreneurial mindset

M3: Imbibe social and professional values

M4: Provide an inclusive environment for lifelong learning

Department Vision

Emerge globally as a leading center for Artificial Intelligence and Data Science education, contributing to sustainable development.

Department Mission

In alignment with the institute's mission, the AlandDS department is committed to:

M1: Equip students with advanced Artificial Intelligence knowledge for industry-ready skills.

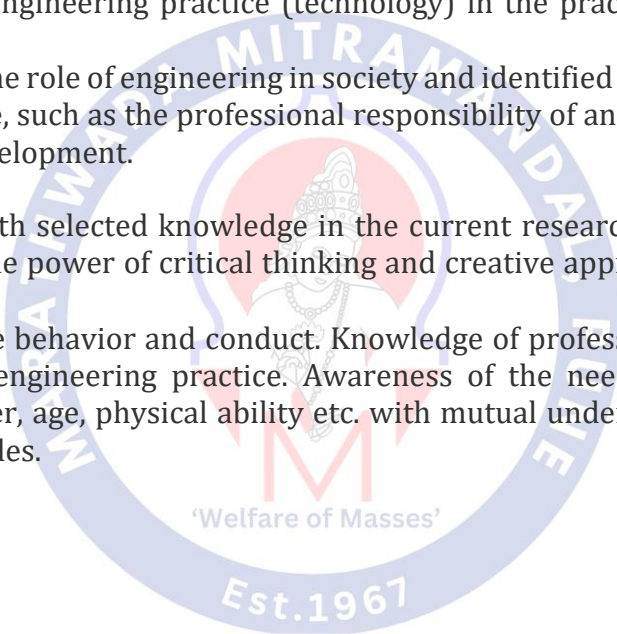
M2: Cultivate a culture of research and entrepreneurship to drive innovation and problem-solving.

M3: Inculcate social and professional values for ensuring holistic development.

M4: Foster a lifelong learning that supports upskilling and global engagement.

Knowledge and Attitude Profile (WK)

- WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
- WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
- WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
- WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
- WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
- WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
- WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
- WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
- WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.



Program Outcomes (PO)

- P01: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of complex engineering problems.
- P02: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
- P03: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
- P04: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis and interpretation of data to provide valid conclusions.(WK8).
- P05: 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. (WK2 and WK6)
- P06: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.(WK1, WK5, and WK7).
- P07: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national and international laws. (WK9)
- P08: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams
- P09: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- P010: 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, and to manage projects and in multidisciplinary environments.
- P011: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Educational Objectives (PEO)

Graduates of the AilandDS program will be able to:

PEO1: Apply, analyze, and evaluate computing skills for problem-solving.

PEO2: Engage in continuous learning through professional development, certifications, emerging technologies in Artificial Intelligence and Data Science.

PEO3: Demonstrate ethical behaviour, effective communication and leadership skills in diverse environments.

PEO4: Build successful careers in industry or entrepreneurship, demonstrating competence and adaptability in a dynamic global environment.

Program Specific Outcomes (PSOs)

Upon successful completion of the program, graduates will be able to:

PSO1: Demonstrate the ability to understand, apply, and develop fundamental computer programs and AI and Data Science solutions using key concepts such as data analytics, machine learning, deep learning and natural language processing.

PSO2: Develop and implement AI and data-driven models by critically analyzing complex problems, designing effective solutions, and evaluating their impact across diverse real-world applications.

PSO3: Utilize emerging AI and Data Science technologies to innovate, promote entrepreneurial ventures, and develop successful careers in industry and research, while embracing lifelong learning and higher education.

Abbreviations

BSC:	Basic Science Course
UG:	Undergraduate Programme
ESC:	Engineering Science Course
PCC:	Program Core Courses
PEC:	Program Elective Courses
MDM:	Multidisciplinary Minor Courses
OEL:	Open Elective
VSE:	Vocational and Skill Enhancement Course
AEC:	Ability Enhancement Course
EEM:	Entrepreneurship/Economics/Management
IKS:	Indian Knowledge System
VEC:	Value Education Course
RMD:	Research Methodology
CEP/FPR:	Comm. Eng. Project (CEP)/Field Project (FP)
PRJ:	Project
INT/OJT:	Internship/On-Job Training
CCC:	Co-Curricular Courses
IT:	Internal Tool
ET:	External Tool
ETE:	End –Term Examination
CIE:	Continuous Internal Evaluation
TW:	Term work
OR:	Oral Examination
PR:	Practical Examination
L:	Lecture
P:	Practical
T:	Tutorial
OL:	Online Teaching
ODL:	Open Distance Learning

Curriculum Structure Semester -III

Second Year B. Tech Artificial Intelligence and Data Science SEMESTER- III

Course Code	Course Name	Course Type	Teaching Scheme (Hrs./week)			Examination Scheme						Credits			
			L	P	T	CIE	ETE	TW	PR	OR	Total	L	P	T	Total
AI24PCC201	Problem Solving and Object-Oriented Programming	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
AI24PCC202	Operating System and Administration	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
AI24PCC203	Discrete Mathematics	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
AI24MDM210	*(Multidisciplinary Minor theory)	MDM	2	-	-	40	60	-	-	-	100	2	-	-	2
AI24PCC205	Problem Solving and Object-Oriented Programming Laboratory	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
AI24PCC206	Operating System and Administration Laboratory	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
AI24MDM211	*(Multidisciplinary Minor Laboratory)	MDM	-	2	-	-	-	25	-	-	25	-	1	-	1
AI24CEP208	Community Engagement and Innovation Lab-I	CEP	-	4	-	-	-	50	-	-	50	-	2	-	2
AI24VEC212	Universal Human Values	HSSM-VEC	-	-	2	-	-	50	-	-	50	-	-	2	2
AI24RMD213	Scientific Research & Publication	RMD	-	-	2	-	-	25	-	-	25	-	-	2	2
SH24AEC202	Professional Communication and Personality Development	HSSM-AEC	-	-	2	-	-	50	-	-	50	-	-	2	2
Total			11	10	6	160	240	200	100	-	700	11	5	6	22

* Refer separate MDM Booklet

Abbreviations:

L- lecture

P- Practical

T- Tutorial

CIE-Continuous Internal Evaluation

ETE- End Term Examination

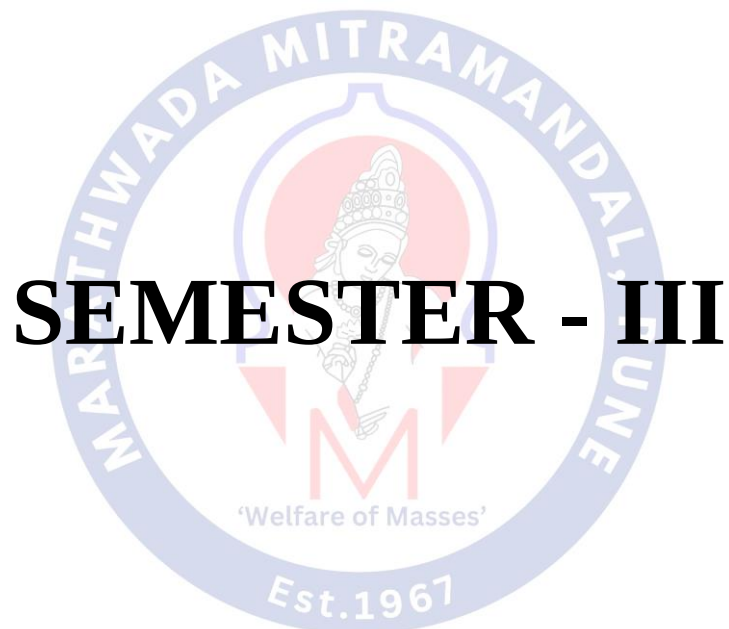
TW- Term work

PR- Practical OR- Oral

L : 1 Hr.= 1 credit

P: 2 Hr. = 1 Credit

T: 1 Hr. = 1 Credit



Second Year B. Tech Artificial Intelligence and Data Science

Semester III

Course Code: AI24PCC201

Course Name: Problem Solving and Object-Oriented Programming

Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL
3	-	-	-	-	40	60	-	-		100	3	-	-	3

Prerequisite: C Programming**Course Objectives:**

- To introduce students to foundational concepts of problem solving and programming using structured and logical approaches.
- To develop the ability to convert real-world problems into computational algorithms and implement them in a programming language.
- To explain the principles of Object-Oriented Programming (OOP) and their role in designing modular and maintainable software systems.
- To provide exposure to software development using object-oriented techniques such as abstraction, encapsulation, inheritance, and polymorphism.

To build competency in developing complete applications using C++, focusing on OOP features, code reuse, and real-world applicability.

Course Outcomes:

After completing the course, the students will be able to:

CO1: Understand problem solving and programming concepts.

CO2: Implement algorithms in specific programming languages.

CO3: Design Object Oriented solutions for small systems involving multiple objects.

CO4: Apply Object Oriented software principles in problem solving.

CO5: Develop the application using Object oriented programming language (C++)

Unit	Contents	Duration (Hrs.)
1.	General Problem-Solving Concepts Types of problems, problems solving with computers, difficulties with problem-solving, Problem-Solving Aspects, Problem Solving Concepts for computer- constants and variables, data types, functions, operators, expressions and equations, Programming Concepts – communicating with computers, organizing the problem, using the tools, testing the solution, coding the program, Top-down design	6
2.	Fundamental algorithms Exchanging Values of two variables, Counting, summation of set of numbers, factorial computation, sine function computation, Fibonacci series, reverse of digit, BCD conversion, Char to number conversion), Factoring methods - square root of number, smallest divisor, GCD of two number, prime number, prime factors of integer, pseudo random number generation, raising the number to a large power Processing Array Algorithms and Text processing Algorithms.	8

3.	Introduction to OOP Introduction to procedural, modular, object-oriented and generic programming techniques, Limitations of procedural programming, Need of object-oriented programming, fundamentals of object-oriented programming: objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism, Extensions to C++ Variable declarations, global scope, 'const', reference variables, comments, default parameters, function prototypes, function overloading, inline functions, default and constant arguments, 'cin', 'cout', formatting and I/O manipulators, new and delete operators Defining a class, data members and methods, public, private and protected members, inline member functions, static data members, static member functions, 'this' pointer, constructors, destructors, friend function, dynamic memory allocation, array of objects, pointers and classes, class as ADTs and code reuse.	8
4.	Polymorphism and Inheritance Introduction, Need of operator overloading, overloading the assignment, binary and unary operators, overloading using friends, rules for operator overloading, type conversions Concept and need, single inheritance, base and derived classes, friend classes, types of inheritance, hybrid inheritance, member access control, static class, multiple inheritance, ambiguity, virtual base class, polymorphism, virtual functions, pure virtual functions, abstract base class, virtual destructors, early and late binding, container classes	10
5.	Templates and Exception Handling Introduction, Templates: Function template and class template, function overloading vs. function templates, member function templates and template arguments, Introduction to Generic Programming: Introduction to Standard Template Library (STL), containers, iterators and algorithms, study of container template classes for vectors and stacks and related algorithms, Namespaces: Introduction, Rules of namespaces Exception Handling: Introduction, syntax for exception handling code: try-catch- throw, Multiple Exceptions, Exceptions with arguments, Introduction to RTTI	8
Total Hours		40
Text Books		
1. R. G Dromey, "How to Solve it by Computer", ISBN 978-81-317-0562-9 2. Maureen Spankle, "Problem Solving and Programming Concepts", ISBN 81-317-0711-3 3. Robert Lafore, "Object-Oriented Programming in C++", SAMS Techmedia		
Reference Books		
1. Joyce Farrell, "Programming Logic and Design" ISBN 978-81-315-0263-1 2. E. Balaguruswamy, "Object-oriented Programming with C++" Tata McGraw Hill, 5th edition		
Online References		
1. Programming in C++ - https://nptel.ac.in/courses/106105151 2. Programming in C++ - https://www.learn-cpp.org/ 3. Programming in C++ - https://www.tutorialspoint.com/cplusplus/cpp_references.htm		

Second Year B. Tech Artificial Intelligence and Data Science														
Semester III														
Course Code: AI24PCC202							Course Name: Operating System and Administration							
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL
3	-	-	-	-	40	60	-	-		100	3	-	-	3
Prerequisite: Fundamentals of Computer Science														
Course Objectives: - To describe the core roles and functions of an Operating System, including process and memory management, file systems, and security. - To explain the structure and operation of file systems, including organization, access control, and various file system types. - To apply concepts of process scheduling, inter-process communication, memory management techniques, and virtual memory. - To discuss network management, backup strategies, and system recovery techniques for data protection and integrity. - To analyze system performance metrics and apply optimization techniques, alongside understanding virtualization technologies and their impact. Course Outcomes: After completing the course, the students will be able to: CO1: Understand the role of Operating Systems. CO2: Understand the file systems. CO3: Apply the concepts of process and memory management. CO4: Apply the concept of Network, Backup and Recovery. CO5: Understand and apply the concepts of System Performance and Virtualization.														
Unit	Contents										Duration (Hrs.)			
1.	Operating Systems and User Management General Overview: History of Unix, System Structure, User perspective, Operating system Services, Architecture of Unix operating system, Kernel, Types of kernels, Operating system booting process, Buffer management in Unix/Linux, Buffer Cache. Introduction to Linux OS, BASH Shell scripting: shell commands. Creating, deleting, and modifying user accounts and groups, Understanding user permissions and roles. Managing access control lists										8			
2.	File System Management Pathnames, File system Mounting and unmounting, user-based file structure, File Types, File Attributes, Internal Representation of Files, Access Control lists. Systems calls for the files systems, File management, File Concept, Access methods, Free Space Management. Disk Partitioning Tools, Disk space Management.										6			

3.	Process and Memory Management Process: Concept of a Process, Process States, Process Description, Process Control, Managing system processes, System resource limits, Automating tasks with cron jobs and Task Scheduler. Processes and Threads, Multithreading, Thread programming Using Pthreads. Scheduling: Types of Scheduling, Scheduling Algorithms. Concurrency Control: Process/thread Synchronization, Readers/Writers Problem, Producer and Consumer problem. Deadlock: Principles of Deadlock, Strategies to deal with deadlock. Memory Management: Memory Partitioning, Paging, Demand Paging.	10
4.	Network, Backup and Recovery Network: Basic network configuration, Network configuration tools, Firewall configuration, VPN and SSH configuration for secure remote access. System logs and monitoring network activity. Introduction to system security (permissions, firewalls, SELinux, and AppArmor). Backup: Backup strategies and tools (tar, rsync, Windows Backup), Automating backups and scheduling with cron jobs, Restoring systems from backups. Recovery: Disaster recovery techniques, Snapshotting and using system recovery tools (Linux Rescue Mode, Windows Recovery Environment).	8
5.	System Performance and Virtualization Monitoring system performance (top, htop, vmstat, Windows Performance Monitor). CPU, memory, and disk performance optimization. Troubleshooting performance bottlenecks. Tuning the kernel parameters and system settings. Introduction to virtualization (VMware, Hyper-V, VirtualBox). Setting up virtual machines and resource allocation.	8
Total Hours		40
Text Books		
1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913, ISBN-13: 9780133805918 2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley and Sons, Inc., 9th Edition, 2012, ISBN 978-1-118-06333-0 3. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN- 10: 0596009526, ISBN-13: 978-0596009526.		
Reference Books		
1. Trent R. Hein, Evi Nemeth, Garth Snyder, Ben Whaley, Dan Mackin, UNIX and Linux System Administration Handbook, Addison-Wesley Professional, ISBN: 9780134278308 2. Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10: 0131828274, ISBN-13: 978- 0131828278. 3. Thomas W. Doeppner, Operating System in depth: Design and Programming, WILEY, ISBN: 978- 0-471-68723-8. 4. Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project. 5. Andrew S. Tanenbaum and Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition. 8. Mendel Cooper, Advanced Shell Scripting Guide, Linux Documentation Project, Public domain. 4. Yashwant Kanetkar, UNIX Shell Programming, BPB Publication		
Online References		
1. Introduction to Operating Systems: https://www.udacity.com/course/introduction-to-operating-systems--ud923 2. Operating System Fundamentals: https://nptel.ac.in/courses/106/105/106105214/		

Second Year B. Tech Artificial Intelligence and Data Science														
Semester III														
Course Code: AI24PCC203										Course Name: Discrete Mathematics				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL
3	-	-	-	-	40	60	-	-	-	100	3	-	-	3
Prerequisite: Engineering Mathematics - I and II														
Course Objectives: - To perform fundamental set manipulations using discrete structures. - To resolve problems using mappings and associations. - To utilize counting techniques and likelihood theory in problem-solving. - To apply graph and tree methods for solving challenges. - To implement concepts from number theory in practical applications. Course Outcomes: After completing the course, the students will be able to: CO1: Use fundamental discrete structures and perform various set operations. CO2: Solve the problems logically using discrete objects like functions and relations. CO3: Analyze and evaluate the combinatorial problems by using probability theory. CO4: Use graph and Tree techniques in problem-solving. CO5: Identify techniques of number theory and its application.														
Unit	Contents										Duration (Hrs.)			
1.	Mathematical Reasoning and Set theory Fundamentals of logic: Propositions, Truth Tables, Logical Connectivity, Propositional logic and its applications Set Theory: Introduction, Set Representation, Types of Sets, Set Operations, Laws of set theory, Cardinality of set. Mathematical Induction: Introduction, proof technique, Case Study on Verification for the correctness of computer program using principle of mathematical induction										8			
2.	Relations and Functions Relation: Relation Definition, Properties of Binary Relations, Closure of Relations, Warshall's Algorithm, Equivalence Relations and Equivalence Classes, Partial Ordering Relations. Function: Function Definition, Composition of Functions, Injective, Surjective and Bijective Function, Inverse of a Function, The Pigeonhole Principle. Case Study on Resource Allocation using Pigeonhole Principle.										8			
3.	Combinatorics and Discrete Probability: Combinatorics: Rules of Sum and Product, Permutations, Combinations, Principle of inclusion and exclusion, Recurrence Relation. Discrete Probability: Discrete Probability, Conditional Probability, Bayes Theorem, Applications of Combinatorics and Discrete Probability. Case Study on Task Scheduling in Operating Systems.										8			

4.	Graphs and Trees: Graph theory: Basic Terminology, Types of Graphs, Paths and Circuits, Hamiltonian and Euler Paths and Circuits, Isomorphic Graphs, Planar Graph, Dijkstra's Shortest Path Algorithm. Case study on Navigation Systems: Google Maps or GPS systems using Dijkstra's algorithm. Trees: Trees, Rooted Trees, Prefix Codes, Huffman Algorithm for Optimal Tree, Spanning Trees, Minimum Spanning Trees, Kruskal's and Prim's Algorithms. Case Study on File Systems in Operating Systems.	8
5.	Introduction to Number Theory: Divisibility of Integers: Properties of Divisibility, Division Algorithm, Greatest Common Divisor GCD and its Properties, Euclidean Algorithm, Extended Euclidean Algorithm, Prime Factorization Theorem, Congruence Relation, Modular Arithmetic, Euler Phi Function, Euler's Theorem, Fermat's Little Theorem, Additive and Multiplicative Inverses, Chinese Remainder Theorem. Case Study on Cryptographic Algorithms.	8
Total Hours		40
Text Books		
1. C. L. Liu, "Elements of Discrete Mathematics", Tata McGraw-Hill, 4th Edition, 2017, ISBN 978- 1259006395. 2. Kenneth H. Rosen, —Discrete Mathematics and its Applications , Tata McGraw-Hill, ISBN 978-0-07-288008-3, 7th Edition. 3. MILLER and FREUND'S PROBABILITY AND STATISTICS FOR ENGINEERS NINTH EDITION Global Edition by Richard A. Johnson Pearson Publication		
Reference Book		
1. G. V. Kumbhojkar, Probability and Random Processes, C. Jamnadas and Co., 14th Edition, 2010. 2. N. Biggs, —Discrete Mathematics , 3rd Edition, Oxford University Press, ISBN 0 –19 850717 – 8. 3. Eric Gossett, "Discrete Mathematical Structures with Proofs", Wiley India Ltd, ISBN:978-81- 265-2758-8. 4. Sriram P and Steven S., "Computational Discrete Mathematics", Cambridge University Press, ISBN 13: 978-0-521-73311-3. 5. David M. Burton, "Elementary Number Theory", and 7th Edition, McGraw-Hill.		
Online References		
1. Combinatorics - https://nptel.ac.in/courses/106106183 2. Mathematical Reasoning and Set theory - https://nptel.ac.in/courses/106103205 3. Fundamentals of logic - https://nptel.ac.in/courses/106105192 4. Graph theory - https://nptel.ac.in/courses/111106050 5. Trees - https://nptel.ac.in/courses/111106102		

Second Year B. Tech Artificial Intelligence and Data Science														
Semester-III														
Course Code: AI24PCC205										Course Name: Problem Solving and Object-Oriented Programming Laboratory				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	-	50	-	50	-	1	-	1
Prerequisite: C Programming														
Course Objectives: - To understand the fundamentals of C++ programming, including functions, control structures, and data types. - To develop problem-solving skills using C++ through algorithm design for mathematical and logical operations. - To implement object-oriented programming concepts such as classes, inheritance, polymorphism, constructors, and destructors. - To use advanced C++ features such as templates, exception handling, STL containers, and dynamic memory allocation. - To analyze and evaluate C++ programs for correctness, efficiency, and real-world applicability.														
Course Outcomes: After completing the course, the students will be able to: CO1: Apply algorithmic techniques to solve computational problems such as Fibonacci series, prime generation, and frequency counts. CO2: Demonstrate proficiency in manipulating data using arrays, including set operations and searching for specific elements. CO3: Implement object-oriented programming features such as constructors, destructors, and memory management in C++. CO4: Develop applications using static and dynamic polymorphism and inheritance to promote code reusability and abstraction. CO5: Utilize templates and STL containers such as vectors to implement generic and efficient C++ programs.														
List of Experiments														
Sr. No.	Name of the Experiment										Duration (Hrs.)			
1.	Design and implement Fibonacci series. Where $n \geq 1$. The first few terms are : 0,1,1,2,3,5,8,13..... OR Given a number n generates n^{th} member of Fibonacci sequence										2			
2.	Design and implement an algorithm to establish all the primes in the first n positive integers										2			
3.	Given a set of n students examinations marks(in the range of 0 to 100) make a count of the number of students that obtained each possible mark . OR Represent sets using one dimensional arrays and implement functions to perform i) Union ii)										2			

	intersection,iii) difference, iv) symmetric difference of two sets. OR Given a randomly ordered array of n elements determine the kth smallest element in the set.	
4.	Count the number of times a given word occurred in a given text. OR Text line length adjustments to reformat the so no lines of more than n chars printed and no word should extend across two lines .	2
5.	Develop a program in C++ using concepts constructor, default constructor, copy constructor, destructor, static member functions, friend class, this pointer, inline code and dynamic memory allocation operators-new and delete as well as exception handling.	4
6.	Implement a concept of static polymorphism.	2
7.	Implement a concept inheritance and dynamic polymorphism.	4
8.	Implement function template and class template.	2
9.	Write C++ program using STL's using vector containers.	4
10.	Write a program in C++ to use map associative containers.	2
Total Hours		26
Text Books		
1. R. G Dromey ,“How to Solve it by Computer”, ISBN 978-81-317-0562-9 2. Maureen Spankle ,“Problem Solving and Programming Concepts”, ISBN81-317-0711-3 3. Robert Lafore , “Object-Oriented Programming in C++”, SAMS Techmedia		
Reference Books		
1. Joyce Farrell ,“Programming Logic and Design” ISBN 978-81-315-0263-1 2. E. Balaguruswamy, “Object-oriented Programming with C++” Tata McGraw Hill, 5th edition		
Online References		
1. Programming in C++ - https://nptel.ac.in/courses/106105151		

Second Year B. Tech Artificial Intelligence and Data Science														
Semester III														
Course Code: AI24PCC206					Course Name: Operating System and Administration Laboratory									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	PR	OR	TOTAL	L	P	T	TOTAL
-	2	-	-	-	-	-	-	50	-	50	-	1	-	1
Prerequisite: Fundamentals of Programming Language														
Course Objectives: - To use basic and advanced Linux commands for file management, permissions, and system navigation. - To write shell and AWK scripts to automate tasks and handle data operations. - To implement CPU scheduling, multithreading, and page replacement algorithms. - To apply inter-process communication and demonstrate process states using fork, exec, and wait. - To configure automation tools like cron jobs and basic network security settings like firewall rules. Course Outcomes: After completing the course, the students will be able to: CO1: Demonstrate the use of basic and advanced Linux commands for file management, permissions, and system navigation. CO2: Develop and execute shell and AWK scripts to automate system tasks and perform arithmetic and data operations. CO3: Implement process and memory management concepts such as CPU scheduling, multithreading, and page replacement algorithms. CO4: Apply inter-process communication techniques and demonstrate process states using system calls like fork, exec, and wait. CO5: Configure system-level automation tools and basic network security settings such as cron jobs and firewall rules.														
List of Experiments														
Sr. No.	Name of the Experiment										Duration (Hrs.)			
1.	A) Study of Basic Linux Commands: echo, ls, read, cat, touch, test, loops, arithmetic comparison, conditional loops, sed, wc, cat, sort, cut, grep, head, tail, more, less Commands, multiple shells.										4			
	B) Study of Linux Commands for File System Directories and File system organization, File system tree, root directory, bin, Read, Write and Executing permissions, Directory Permissions related Commands: chmod, chown, File system Mounting and unmounting, Know your username, Adding and deleting users, becoming super user, changing password, /etc/passwd and /etc/shadow files Related Commands: who, whoami, useradd, userdel, su, passwd										4			
2.	Write a shell program to implement an address book with options given below: a) Create address book. b) View address book. c) Insert a record. d) Delete a record. e) Modify a record. f) Exit										4			
3.	Write a menu driven awk program to implement operation on numbers with options given below: a) Addition b) Subtraction c) Multiplication d) Division e) Exit										2			
4.	Implement the program for CPU Scheduling Algorithms.										4			

5.	Implement the program in which the main program accepts the integers to be sorted. The main program uses the FORK system call to create a new process called a child process. The parent process sorts the integers using a sorting algorithm and waits for the child process using WAIT system call to sort the integers using any sorting algorithm. Also demonstrate zombie and orphan states. The demonstration of FORK, EXECVE and WAIT system calls along with zombie and orphan states using ps, kill.	2
6.	Inter-process Communication using Shared Memory Application to demonstrate: Reader writer Program in which writer process creates a shared memory segment and writes the message to the shared memory segment. The reader process reads the message from the shared memory segment and displays it to the screen.	2
7.	Implement Multi-threading concept.	2
8.	Implement the program for Page Replacement Algorithms: FCFS, LRU, and Optimal	4
9.	Apply automation techniques in an operating system environment, using tools like cron jobs (Linux/Unix), Task Scheduler (Windows), shell scripting, batch scripts, and other OS utilities.	2
10.	Firewall configuration using network configuration tools.	2
Total Hours		28
Text Books		
1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913, ISBN-13: 9780133805918 2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley and Sons, Inc., 9th Edition, 2012, ISBN 978-1-118-06333-0 3. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN- 10: 0596009526, ISBN-13: 978-0596009526.		
Reference Books		
1. Trent R. Hein, Evi Nemeth, Garth Snyder, Ben Whaley, Dan Mackin, UNIX and Linux System Administration Handbook, Addison-Wesley Professional, ISBN: 9780134278308 2. Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10: 0131828274, ISBN-13: 978- 0131828278. 3. Thomas W. Doeppner, Operating System in depth: Design and Programming, WILEY, ISBN:978- 0-471-68723-8. 4. Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project. 5. Andrew S. Tanenbaum and Herbert Bos, Modern Operating System, Pearson, ISBN-13: 9780133592221, 4th Edition. 6. Das, Sumitabha, UNIX Concepts and Applications, TMH, ISBN-10: 0070635463, ISBN-13: 978- 0070635463, 4th Edition. 7. Kay Robbins and Steve Robbins, UNIX Systems Programming, Prentice Hall, ISBN-13: 978- 0134424071, ISBN-10: 0134424077, 2nd Edition.		
Online References		
1. Introduction to Operating Systems: https://www.udacity.com/course/introduction-to-operating-systems--ud923 2. Operating System Fundamentals: https://nptel.ac.in/courses/106/105/106105214/		

Second Year B. Tech Artificial Intelligence and Data Science															
Semester III															
Course Code: AI24CEP208					Course Name: Community Engagement and Innovation Lab-I										
Teaching Scheme (Hours/Week)					Examination Scheme						Credits				
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL	
-	4	-	-	-	-	-	50	-	-	50	-	2	-	2	
Prerequisites: Basic knowledge of Python programming , Data analysis and Excel															
Course Objectives: - To learn and apply core and advanced Python data structures. - To use regular expressions, OOP, and file handling in Python. - To perform data analysis using NumPy, Pandas, SciPy, Matplotlib, and Seaborn. - To build web applications using Flask with frontend, backend, and database integration. - To create interactive dashboards and reports using Power BI.															
Course Outcomes: After completing the course, the students will be able to: CO1: Apply various data structures and pattern matching with regular expressions to solve real-world problems. CO2: Apply data visualization libraries and scientific computing concepts to extract insights from data. CO3: Design web applications using Flask and build interactive dashboards in Power BI. CO4: Implement authentication and test Flask applications for performance and security. CO5: Integrate Power BI reports into Flask applications.															
Content related to assignments: Data Structures: Lists, Set, Tuple, Dictionaries, Advanced Data Structure: Named tuples, Frozen sets, Enumerations, Counter, default, dict , deque, Pattern Matching with Regular Expressions, OOP Concepts, file handling, Data Visualization Libraries: Matplotlib, Seaborn, Scientific Computing: SciPy and NumPy, Pandas. Flask: Setting up the environment, Flask application structure, Flask Templates and Frontend Integration, Building the Backend, Database Integration, User Authentication and Authorization, Testing Flask Applications. Power BI: Introduction, Power BI Desktop and Power BI Service, Connecting and Importing Data,Data Transformation (Power Query), Building a Data Model, Creating Visualizations, Data Analysis Expressions (DAX), Sharing and Publishing, Best Practices.															
List of Lab Activities															
Sr. No.	Activities													Duration (Hrs.)	
1.	Create a program to log daily expenses and categorize them. Perform following operations: - Add, view, and delete expenses - Calculate total monthly expenses													4	
2.	Text File Processor: Develop a program that processes a text file using RE and performs tasks such as formatting, searching, and replacing.													4	

3.	Create a Project for Bank account management that uses OOP to manage bank accounts and demonstrates exceptional handling in file operations, database operations, and user input.	4
4.	Visualizing COVID-19 Data: Use Matplotlib and Seaborn to visualize COVID-19 cases, deaths, and vaccination rates over time.	4
5.	On any sales dataset create DAX measures to: • Calculate Total Sales (Sales = Quantity * Unit Price) • Calculate Average Sales per Transaction • Create a calculated column for Discounted Price = Unit Price * (1 - Discount) Find the maximum sale per product	4
6.	Create a report that helps a retail store to understand its sales performance including: Total Sales, Total Quantity, Total Profit, Sales by Region (Map or Bar Chart), Sales by Product Category (Pie or Donut Chart), Monthly Sales Trend (Line Chart), Top 5 Products by Sales	4
7.	Design a dashboard to track employee metrics for HR: Number of Employees, Employees by Department (Bar Chart), Average Age, Average Tenure, Gender Distribution (Pie Chart), Employees by Location (Map)	4
8.	Create a student academic performance dashboard: Total Students, Pass Rate, Average Score by Subject (Bar Chart), Student Count by Class, Grade Distribution (Donut Chart), Trend of Scores Over Semesters	4
Total Hours		32
Project Based Learning (PBL) Topics		
P1	Create a feedback form using Flask, store the responses, perform basic NLP sentiment analysis, and visualize the results in Power BI dashboards.	
P2	Develop a Flask portal for HR staff to upload employee data and view Power BI reports segmented by department, tenure, and performance ratings.	
P3	Build a Flask app for budget input and approvals, and use Power BI to display spending vs. budget by department and time period.	
P4	Create a patient management system using Flask for data entry and administration, and visualize analytics in Power BI.	
P5	Create a Flask web app where teachers can enter student marks, and a Power BI dashboard displays subject-wise and class-wise performance.	
P6	Build a Flask interface for adding/removing items and a Power BI dashboard to show sales by product.	
P7	Create a Flask system where librarians enter book lending records, and Power BI visualizes borrow rates by book, category, and user.	
P8	Website Visitor Log with Analytics- Flask collects visit data (timestamp, IP, page), and Power BI shows visits by day, time, and page.	
Total Hours		28 Hrs

Text Books

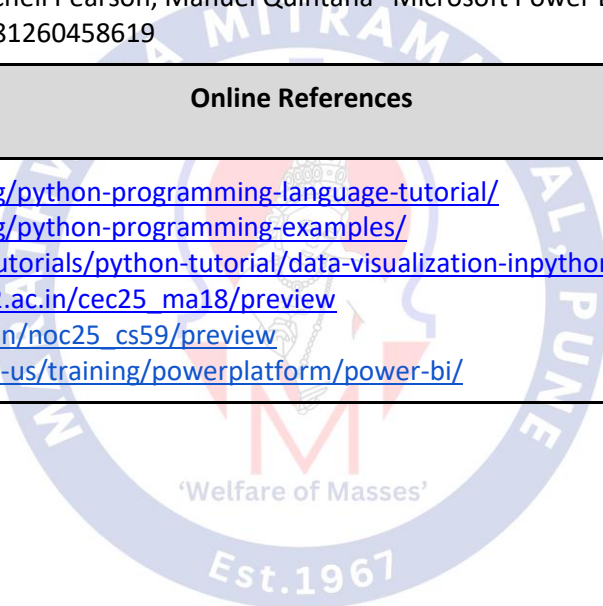
1. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.
2. VanderPlas, J. (2016). Python Data Science Handbook. O'Reilly Media.
3. M. Grinberg, "Flask Web Development", O'Reilly Media, 2014.
4. Alberto Ferrari and Marco Russo, "Introducing Microsoft Power BI", Microsoft Press Publisher

Reference Books

1. E. Matthes, "Python Crash Course", No Starch Press, 2016.
2. S. Tosi, "Matplotlib for Python Developers", Packt Publishing, 2013.
3. S. J. Rojas G., "Learning SciPy for Numerical and Scientific Computing", Packt Publishing, 2013.
4. J. Stouffer, "Learning Flask Framework", Packt Publishing, 2015.
5. G. Dwyer, "Flask by Example", Apress, 2016.
6. D. Beazley and B. Kernighan, "Python Cookbook", O'Reilly Media, 2013.
7. M. Lutz, "Learning Python", O'Reilly Media, 2013.
8. Devin Knight, Brian Knight, Mitchell Pearson, Manuel Quintana "Microsoft Power BI Complete Reference" McGraw-Hill Education , ISBN: 9781260458619

Online References

1. <https://www.geeksforgeeks.org/python-programming-language-tutorial/>
2. <https://www.geeksforgeeks.org/python-programming-examples/>
3. https://www.simplilearn.com/tutorials/python-tutorial/data-visualization-inpython#what_is_data_visualization
4. https://onlinecourses.swayam2.ac.in/cec25_ma18/preview
5. https://onlinecourses.nptel.ac.in/noc25_cs59/preview
6. <https://learn.microsoft.com/en-us/training/powerplatform/power-bi/>

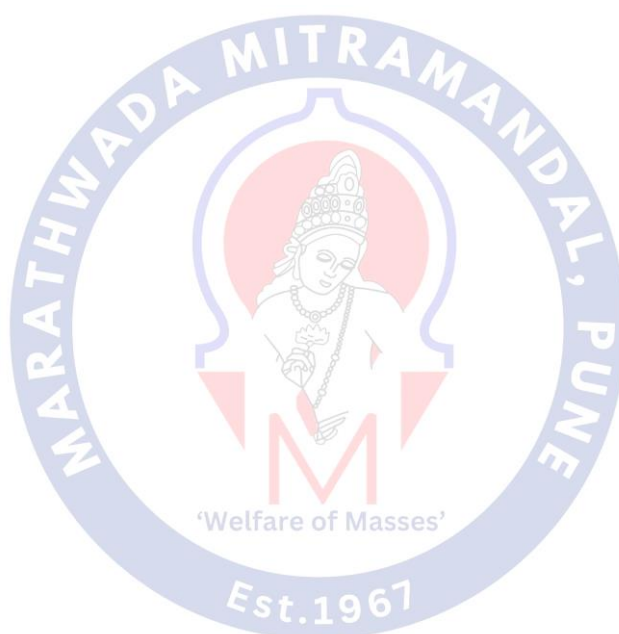


Second Year B. Tech Artificial Intelligence and Data Science															
Semester - III															
Course Code: AI24VEC212										Course Name: Universal Human Values					
Teaching Scheme (Hours/Week)					Examination Scheme						Credits				
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL	
-	-	2	-	-	-	-	50	-	-	50	-	-	2	2	
Prerequisites: 1. Readiness for Self-Exploration The course is not about memorizing facts but about a process of dialogue between what you are and what is naturally acceptable to you. You should be prepared to: • Verify proposals: Treat course content as "proposals" to be tested against your own Natural Acceptance rather than dogmas to be accepted blindly. • Validate experientially: Be willing to test these values in your daily living to see if they actually lead to harmony and happiness. 2. Openness to Holistic Thinking The syllabus moves from the individual to the family, society, and finally nature. You need an initial willingness to: • Look beyond individual success toward mutual fulfillment. • Acknowledge the interconnectedness between yourself and the "four orders" of nature (physical, bio, animal, and human).															
Course Objectives: • Development of a holistic perspective based on self- exploration about themselves (human-beings), family, society and nature/existence. • Understanding of the harmony in the human-beings, family, society and nature/existence. • Strengthening of self-reflection. • Development of commitment and courage to act.															
Course Outcomes: After the completion of course, the students can: CO1: Recognize the concept of self-exploration as the process of value education and see they have the potential to explore on their own right. CO2: Explore the human being as the coexistence of self and body to see their real needs / basic aspirations clearly. CO3: Explain relationship between one self and the other self as the essential part of relationship and harmony in the family CO4: Interpret the interconnectedness, harmony and mutual fulfilment inherent in the nature and the entire existence															
Unit	Content														
1.	Introduction to Value Education and Harmony in the Human Being - Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity- the Basic Human Aspirations and their Fulfilment - Right Understanding, Relationship and Physical Facility - Happiness and Prosperity- Current Scenario - Method to Fulfil the Basic Human Aspirations														

2.	Harmony in the Human Being : i. Understanding Human being as the Co-existence of the Self and the Body ii. Distinguishing between the Needs of the Self and the Body iii. The Body as an Instrument of the Self iv. Understanding Harmony in the Self v. Harmony of the Self with the Body vi. Programme to Ensure self-regulation and Health	
3.	Harmony in the Family, Society and Nature : i. Harmony in the Family- the Basic Unit of Human Interaction "Trust"- the Foundational Value Relationship ii. 'Respect'- as the Right Evaluation iii. Values in Human-to-Human Relationship iv. Understanding Harmony in the Society v. Vision for the Universal Human Order vi. Understanding Harmony in Nature – Interconnectedness and Mutual Fulfillment	
4.	Professional Ethics and Application of Values: i. Competence in Professional Ethics: Ability to Utilize Values in Decision-Making ii. Ethical Human Conduct – The Foundation of Universal Human Order iii. Integration of Human Values with Technical Education	
Sr. No	List of Tutorial (Select any 08 activities out of 10 contributing to 26 hours)	Hours
1	Structured Self-Exploration Reflection Report	4
2	Case Study analysis on Contemporary Life Issues	4
3	Value Identification from Everyday Scenarios	4
4	Reflective Journal – Harmony in Self	2
5	Group Discussion - Topics e.g The Goal of Education (Siksha-Sanskar), Health and Responsibility (Swasthya-Sanyam), Production and Nature, The Cycle of Nature, Identifying the Root Cause, Defining Conduct	2
6	Role Play: Human Relationships	2
7	Debate: Material Growth versus Human Well-Being	2
8	Scenario Evaluation: Right Understanding in Personal Decisions	4
9	Engineering Ethics	2
10	Peer Interaction on Social Responsibility	2
Total Hours for 08 Activities		26
Text Books		
1. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034- 47-1 2. The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G 3. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers. 4. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press 5. AICTE Model Curriculum for Universal Human Values .		

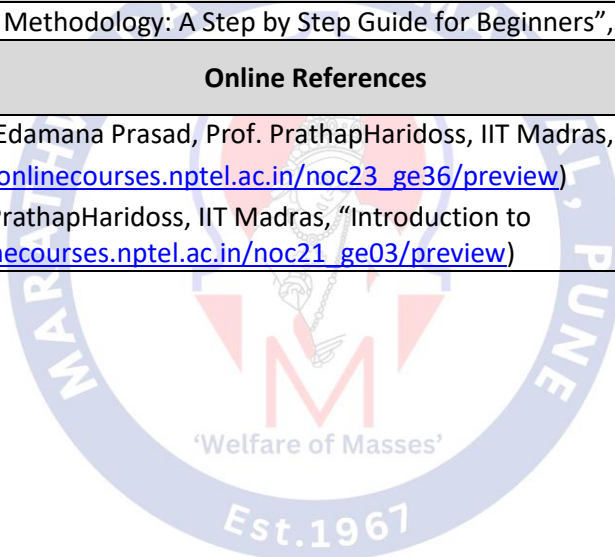
Journals and Articles

1. Dr. SARVESHWARI SHEKHAWAT (May-2025). Universal Human Values and Professional Ethics: A Path to Sustainable Development. *INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT*, 10(5), 276-287.
<https://ijnrd.org/papers/IJNRDD001043.pdf>
2. Rani, S., Beenu, Jindal, H., Gautam, N., & Kumar, S. (2022). Importance of Universal Human Values for Life: A Study. *Asian Journal of Science and Applied Technology*, 11(1), 36-48.
<https://doi.org/10.51983/ajsat-2022.11.1.3204>



Second Year B. Tech Artificial Intelligence and Data Science														
Semester- III														
Course Code: AI24RMD213					Course Name: Scientific Research and Publications									
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
		2	-	-	-	-	25	-		25	-	-	2	2
Prerequisite: ----														
Course Objectives: - To introduce undergraduate students to the fundamentals of research and its importance in engineering innovation. - To develop awareness about research publications, patents, IPR, and research ethics. - To inculcate ethical research practices and scientific writing skills.														
Course Outcomes: After learning the course, the students will be able to: CO1: Apply the fundamental concepts of research in engineering to real-world engineering problems and demonstrate their significance. CO2: Apply basic research methodology and technical writing skills. CO3: Explain the process of research publications and intellectual property rights. CO4: Practice ethical standards in research activities.														
Sr.No	Contents													
1	Introduction and Importance of Research Research definition and meaning, Classification of research: basic, applied, experimental, analytical, and interdisciplinary research, Research in engineering and technology, Importance of research in innovation, sustainability, and societal development, Research problem identification and formulation													
2	Research Methodology and Technical Writing Introduction of Research methodology, steps involved in conducting research, Research design and methods of data collection, Basics of Data analysis and interpretation, Structure of a technical/research paper, Literature survey: purpose, sources, and review process, Use of digital research databases, Abstract writing, keywords, and conclusion writing, Referencing styles and citation tools													
3	Research Publications, Patents, and IPR Research publications: journals, conferences, review papers, and book chapters, Indexing and quality metrics, impact factor, h-index, citation count, Predatory journals and conferences. Intellectual Property Rights (IPR): Introduction, Types of IPR: patents, copyrights, trademarks, industrial designs, Patent process: prior art search, patent filing procedure, overview of patent drafting, Role of patents in engineering and entrepreneurship													
4	Research Ethics and Professional Conduct Research ethics and responsible conduct of research, Plagiarism: types, consequences, and prevention, plagiarism detection tools, acceptable similarity index, falsification, and duplication, authorship ethics and conflict of interest, ethical issues in sponsored and collaborative research, Overview of institutional ethics committees and ethical guidelines													
List of Tutorials														
Sr. No	Name of the tutorial													Duration (Hrs)
1	Identification and formulation of a research problem statement derived from relevant societal challenges, followed by a critical discussion on sustainable and feasible solutions.													4
2	Systematic literature review related to the identified research problem to understand the current state of knowledge, research gaps, and scope for innovation.													2

3	Development of a structured research methodology, including preparation of a detailed flowchart outlining the proposed research approach and experimental/analytical steps.	4
4	Hands-on activity on patent search and analysis, along with an introduction to the patent drafting process aligned with the proposed research methodology.	4
5	Activity on plagiarism detection tools and an in-depth discussion on research ethics, academic integrity, and responsible conduct of research.	4
6	Guided activity on writing a review paper based on the selected research topic, focusing on structure, critical analysis, and scholarly presentation.	4
7	Oral presentation and documentation of the research work, demonstrating the application of the proposed methodology, findings from literature, ethical compliance, and innovation potential.	4
Total Hrs		26
Text Books		
1. Kothari C.R., "Research Methodology: Methods and Techniques", New age International Publications- 2024. 2. Dipankar Deb, RajeebDey, Valentina E. Balas, "Engineering Research Methodology: A Practical Insight for Researchers", Springer Nature Singapore - 2019		
Reference Books		
1. Ranjit Kumar, "Research Methodology: A Step by Step Guide for Beginners", SAGE Publications Pvt. Ltd - 2024		
Online References		
1. NPTEL Course: By Prof. Edamana Prasad, Prof. PrathapHaridoss, IIT Madras, "Research Methodology" (https://onlinecourses.nptel.ac.in/noc23_ge36/preview) 2. NPTEL Course: By Prof. PrathapHaridoss, IIT Madras, "Introduction to Research" (https://onlinecourses.nptel.ac.in/noc21_ge03/preview)		



Second Year B. Tech Artificial Intelligence and Data Science														
Semester-III														
Course Code: SH24AEC202										Course Name: Professional Communication and Personality Development				
Teaching Scheme (Hours/Week)					Examination Scheme						Credits			
L	P	T	OL	ODL	CIE	ETE	TW	OR	PR	TOTAL	L	P	T	TOTAL
-	-	2	-	-	-	-	50	-	-	50	-	-	2	2
Prerequisite: Basic understanding of LSRW skills, grammar, and vocabulary of the English Language.														
Course Objectives: - To develop students' rhetorical and persuasive abilities for effective oral communication and audience engagement. - To familiarize students with key business and managerial terminologies essential for effective communication and decision-making. - To strengthen analytical and critical thinking skills for constructing logical arguments and making informed decisions. - To cultivate professional and technical writing competence, ensuring clarity, accuracy, and etiquette in communication.														
Course Outcomes: After learning the course, the students will be able to: CO1 Demonstrate effective rhetoric, persuasive skills, audience engagement, and adaptability in communication. CO2: Apply visual aids, body language, voice modulation, and confidently manage audience questions and maintain engagement throughout. CO3: Analyze information and construct logical arguments to solve problems and make informed decisions. CO4: Exhibit professional and technical writing skills and avoid common pitfalls, ensuring clear, polite, and informative communication.														
Contents														
1	Public Speaking Using Persuasive language and understanding the context in public speaking Controlling nervousness, building confidence, stage presence, poise, and impact Employing voice modulation, pace, volume and pitch.													
2	Presentation Skills Structuring a presentation and using visual aids Understanding audience connection strategies and feedback Handling QandA sessions with confidence.													
3	Critical Thinking Working on Case Studies and Situational Analysis Structuring the argument and handling rebuttal Analyzing logical fallacies and cognitive biases.													
4	Technical Writing Structuring emails for different purposes (requests, complaints, updates, and follow-ups) Avoiding common mistakes and making the right use of CC, BCC, and reply-all options Blog/article/ newsletter/survey report format and examples.													
5	Group Discussion Implementing coherence and cohesion in structuring the argument Integrating non-verbal communication in the conversation Managing disagreement and aggression in the discussion.													

List of Tutorials		
Sr. No.	Name of the Tutorial	Duration (Hrs.)
1	Ice-breaking Session	2
2	Storytelling	4
3	Idea Presentation	4
4	Advertisement Creation	4
5	Case Study Analysis	2
6	Debate	2
7	Email Writing (Professional and Personal)	2
8	Blog Writing	2
9	Survey Reports	2
10	Group Discussion	2
Total Hours		26
Text Books		
1. Stephen E. Lucas, <i>The Art of Public Speaking</i> , McGraw Hill Publication, ISBN-10: 1260914275 ISBN-13: 9781260914276. 2. JaishriJethwaney and Sanjay Bhargava, <i>Corporate Communication: Principles and Practices</i> . 3. Dr. Ranjit Singh, <i>Critical Thinking and Problem Solving</i> . 4. Rajendra Pal and J. S. Korlahalli, <i>Essentials of Business Communication</i> , Sultan Chand and Sons, 2011. ISBN: 8180547299, 9788180547294.		
Reference Books		
1. Shiv Khera, <i>You Can Win</i> , Bloomsbury India, ISBN-10: 9382951717 · ISBN-13: 9789832951711. 2. Carmine Gallo, <i>Talk Like TED</i> , Macmillan Business. 3. Garr Reynolds, <i>Presentation Zen: Simple Ideas on Presentation Design and Delivery</i> , New Riders. 4. Peter Facione and Carol Ann Gittens, <i>Think Critically</i> . 5. Lewis Vaughn, <i>The Power of Critical Thinking</i> , Oxford University Press. 6. Emily Post and Peter Post, <i>The Etiquette Advantage in Business: Personal Skills for Professional Success</i> .		
Online References		
1. NPTEL Course: <i>Technical English for Engineers</i> – https://onlinecourses.nptel.ac.in/noc20_hs56/preview 2. SWAYAM Course: <i>English for Research Paper Writing</i> – https://onlinecourses.swayam2.ac.in/ntr24_ed15/previe 3. SWAYAM Course: <i>Personality Development and Communication Skills</i> – https://onlinecourses.swayam2.ac.in/cec22_cm03/preview		