Department of Artificial Intelligence and Data Science
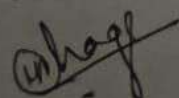
S.Y. B.Tech Curriculum Structure Sem-III and IV

Second Year B. Tech Artificial Intelligence and Data Science Semester- 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
*	*(Multi Disciplinary 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
*	*(Multi Disciplinary Minor Laboratory)	MDM	-	2	-	-	-	25	-	-	25	-	1	-	1
AI24CEP208	Engineering Design and Innovation Lab-I	CEP	-	4	-	-	-	50	-	-	50	-	2	-	2
AI24VEC209	Saint Traditions of India: Special reference to Maharashtra	VEC	-	-	2	-	-	50	-	-	50	-	-	2	2
SH24AEC202	Professional Communication and Personality Development	AEC	-	-	2	-	-	50	-	-	50	-	-	2	2
Total			11	10	4	160	240	175	100	-	675	11	5	4	20

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

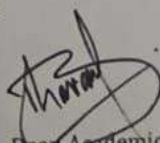| Course Code	Course Name	Course Type	Teaching Scheme(Hrs./wee)			Examination Scheme						Credits			
			L	P	T	CIE	ETE	TW	PR	OR	Total	L	P	T	Total
AI24PCC251	Data Structure and Algorithms	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
AI24PCC252	Database Management System	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
AI24PCC253	Applied Statistics	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
*	*(Open Elective)	OEL	3	-	-	40	60	-	-	-	100	3	-	-	3
AI24PCC255	Data Structure and Algorithms Laboratory	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
AI24PCC256	Database Management System Laboratory	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
AI24VSE257	Engineering Design and Innovation Lab-II	VSE	-	4	-	-	-	50	-	-	50	-	2	-	2
AI24EEM258	Campus to Corporate	EEM	-	-	2	-	-	50	-	-	50	-	-	2	2
SH24VEC201	Media Literacy and Critical Thinking	VEC	-	-	2	-	-	50	-	-	50	-	-	2	2
Total			12	8	4	160	240	150	100	-	650	12	4	4	20

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

HoD AI&DS

Dr. Mrs. Manisha R. Dhage

Dean Academics

Dr. Bharati P. Vasagi

Principal

Dr. Sachin Sakhare

Marathwada Mitra Mandal's

COLLEGE OF ENGINEERING

Karvenagar, Pune - 52.
An Autonomous Institute affiliated to SPPU

Accredited with A++ Grade by NAAC
Recipient of Best College award by SPPU | Accredited by NBA
Recognized under 2(f) and 12(B) of UGC Act 1956

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Curriculum Structure and Syllabus
Second Year B.Tech.
Artificial Intelligence and Data Science

Academic Year 2025-26

Marathwada Mitra Mandal's College of Engineering

Karvenagar, Pune- 52

An Autonomous Institute Affiliated to SPPU

Curriculum Structure and Syllabus

Second Year B. Tech Artificial Intelligence and Data Science

A.Y. 2025-26

CONTENTS

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 AIandDS 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.

Second Year Artificial Intelligence and Data Science Engineering

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)

PO1: 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.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: 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)

PO4: 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).

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. (WK2 and WK6)

PO6: 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).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national and international laws. (WK9)

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

PO9: 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

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, and to manage projects and in multidisciplinary environments.

PO11: 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 AIandDS 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

Second Year Artificial Intelligence and Data Science Engineering

Assessment Tool Guidelines for Continuous Internal Evaluation (CIE)

AY: 2025-26

Distribution of CIE 40 marks for each subject is as below:

Sr. No.	Unit No.	Weightage	Assessment Tools
1	Unit 1	8 Marks	Class Test
2	Unit 2	8 Marks	
3	Unit 3	8 Marks	1. Quizzes 2. Home Assignments 3. Case Study 4. Field work 5. Report writing 6. Presentations/Seminar Topics 7. Mini projects/Course Projects 8. Mind map 9. Poster Presentation 10. Problem Solving and Coding 11. Parametric Study 12. Any other assessment tool with permission of BoS chairperson
4	Unit 4	8 Marks	
5	Unit 5	8 Marks	

1. Above are the suggestive assessment tools for CIE.
2. The class test is a one-time assessment; no retests will be conducted
3. Module coordinators should review and verify the assessment tools implemented for each course.
4. Course coordinators are required to maintain softcopy records of the respective CIE assessment tools used for their classes.

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Second Year Artificial Intelligence and Data Science Engineering

Curriculum Structure Sem-III and IV

Second Year B. Tech Artificial Intelligence and Data Science Semester- 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
*	*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
*	* Multidisciplinary Minor Laboratory	MDM	-	2	-	-	-	25	-	-	25	-	1	-	1
AI24CEP208	Engineering Design and Innovation Lab-I	CEP	-	4	-	-	-	50	-	-	50	-	2	-	2
AI24VEC209	Saint Traditions of India: Special reference to Maharashtra	VEC	-	-	2	-	-	50	-	-	50	-	-	2	2
SH24AEC202	Professional Communication and Personality Development	AEC	-	-	2	-	-	50	-	-	50	-	-	2	2
Total			11	10	4	160	240	175	100	-	675	11	5	4	20

* Refer separate MDM Booklet

Second Year B. Tech Artificial Intelligence and Data Science Semester- SEMESTER IV															
Course Code	Course Name	Course Type	Teaching Scheme(Hrs./wee)			Examination Scheme						Credits			
			L	P	T	CIE	ETE	TW	PR	OR	Total	L	P	T	Total
AI24PCC251	Data Structure and Algorithms	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
AI24PCC252	Database Management System	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
AI24PCC253	Applied Statistics	PCC	3	-	-	40	60	-	-	-	100	3	-	-	3
*	*Open Elective	OEL	3	-	-	40	60	-	-	-	100	3	-	-	3
AI24PCC255	Data Structure and Algorithms Laboratory	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
AI24PCC256	Database Management System Laboratory	PCC	-	2	-	-	-	-	50	-	50	-	1	-	1
AI24VSE257	Engineering Design and Innovation Lab-II	VSE	-	4	-	-	-	50	-	-	50	-	2	-	2
AI24EEM258	Information Systems and Engineering Economic	EEM	-	-	2	-	-	50	-	-	50	-	-	2	2
SH24VEC201	Environment Sustainability	VEC	-	-	2	-	-	50	-	-	50	-	-	2	2
Total			12	8	4	160	240	150	100	-	650	12	4	4	20

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 Artificial Intelligence and Data Science Engineering

SEMESTER III

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	OR	PR	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	8

	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.	
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.
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.
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

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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 kernel, 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, 4thEdition, 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", and7th 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>=1 . The first few terms are : 0,1,1,2,3,5,8,13…… OR Given a number n generates nth 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) 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.	2

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.
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.
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.
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: AI24CEP208					Course Name: Engineering Design 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	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	4

	demonstrates exceptional handling in file operations, database operations, and user input.	
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: AI24VEC209   **Course Name: Saint Traditions of India: Special Reference to Maharashtra**

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	-	-	2	2

Course Objectives:
- To understand the emergence and evolution of saint traditions in India, with a special focus on Maharashtra.
- To analyze the lives, teachings, and contributions of key saints, particularly those from Maharashtra.
- To examine the relationship between saint traditions, religious practices, and socio-political contexts across historical periods.
- To explore the influence of saint traditions on human rights, human values, and their relevance to the principles enshrined in the Indian Constitution.

Course Outcomes:
After completing the course, the students will be able to:
CO1: Understand relevance of Saint Traditions.
CO2: Analyze saints' lives, teachings, and contributions, particularly in Maharashtra.
CO3: Explore the philosophical and social side of Saint Traditions.
CO4: Examine the relationship between saint traditions, religious practices, and socio-political contexts.
CO5: Discuss the impact of these traditions on human rights, human values, and the Indian Constitution.

Unit	Contents
1	**Introduction to Saint Traditions** Approaches to study The emergence of saint traditions and main characteristics Importance of engaging with saint traditions Study with reference to Saints - Dnyaneshwar, Namdev, Tukaram, Eknath, and Chokhamela
2	**Life and Times of Saints** Biographies and hagiographies of saints. Saints as reformers and social critics. The role of saints in resisting societal oppression.
3	**Philosophical and Social Change** Philosophy of love and devotion: Bhakti as liberation. Integration of Advaita Vedanta and Bhakti. Inclusivity: Rejecting casteism and promoting equality.
4	**Saint Traditions and Religious Practices** Influence on religious rituals and temple practices. Bhajans, Kirtans, and Influence of Varkari tradition and Pandharpur pilgrimage. Interaction with other religious traditions (Islamic Sufi influence).
5	**Relevance of Saint Traditions Today** Human rights and values: Equality, social justice, compassion, and non-violence. Contributions to Marathi literature and folk traditions. Bhakti ideals in the context of secularism and pluralism

	List of tutorials	
Sr. No.	**Name of the Tutorial**	**Duration (Hrs.)**
1	Explore various saint traditions across India with the aid of the presentation/video making	2
2	Sketch the lives of various saints with the aid of drawings/paintings/presentations/video/street play	4
3	Portray the Saints as reformers and social critics with the aid of the presentation/video making/group discussion	4
4	Case study of any societal oppression which were resisted by the saints in Maharashtra	4
5	Debate on the role of Bhakti as liberation action.	2
6	Discussion on role of saints on Rejecting casteism and promoting equality with visit/participation in Vaari/Shrines or discussion on the same topic.	2
7	Visit or study and present about Interaction of Vaari Tradition with other religious traditions (Islamic Sufi).	2
8	Discussion on relevance of Human rights and values: Equality, social justice, compassion, and non-violence in modern society.	2
9	Study any Marathi literature or folk traditions or interact with any artist of such background.	2
10	Study Bhakti ideals with respect to values enshrined in the Preamble of the Indian Constitution.	2
	Total Hours	26

Text Books

1. W. H. McLeod, The Sants: Studies in a Devotional Tradition of India Karine Schomer, Motilal Banarsidass Publ., ISBN**:** 978-8120808501
2. Sharma, Krishna. Bhakti and the Bhakti Movement: A New Perspective, Munshiram Manoharlal Publishers, ISBN: 978-8121509187

Reference Book

1. Shahabuddin, Bhakti Movement in Medieval India (Social and Political Perspectives), Manohar Publishers, ISBN: 9788173048005

Online References

1. NCERT Text Book Reference, https://ncert.nic.in/textbook/pdf/lhhs202.pdf
2. BYJU's Notes, https://byjus.com/free-ias-prep/bhakti-movement-ncert-notes/

Second Year B.Tech Engineering													
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, *The Art of Public Speaking*, McGraw Hill Publication, ISBN-10: 1260914275 | ISBN-13: 9781260914276.
2. Jaishri Jethwaney and Sanjay Bhargava, *Corporate Communication: Principles and Practices*.
3. Dr. Ranjit Singh, *Critical Thinking and Problem Solving*.
4. Rajendra Pal and J. S. Korlahalli, *Essentials of Business Communication*, Sultan Chand and Sons, 2011. ISBN: 8180547299, 9788180547294.
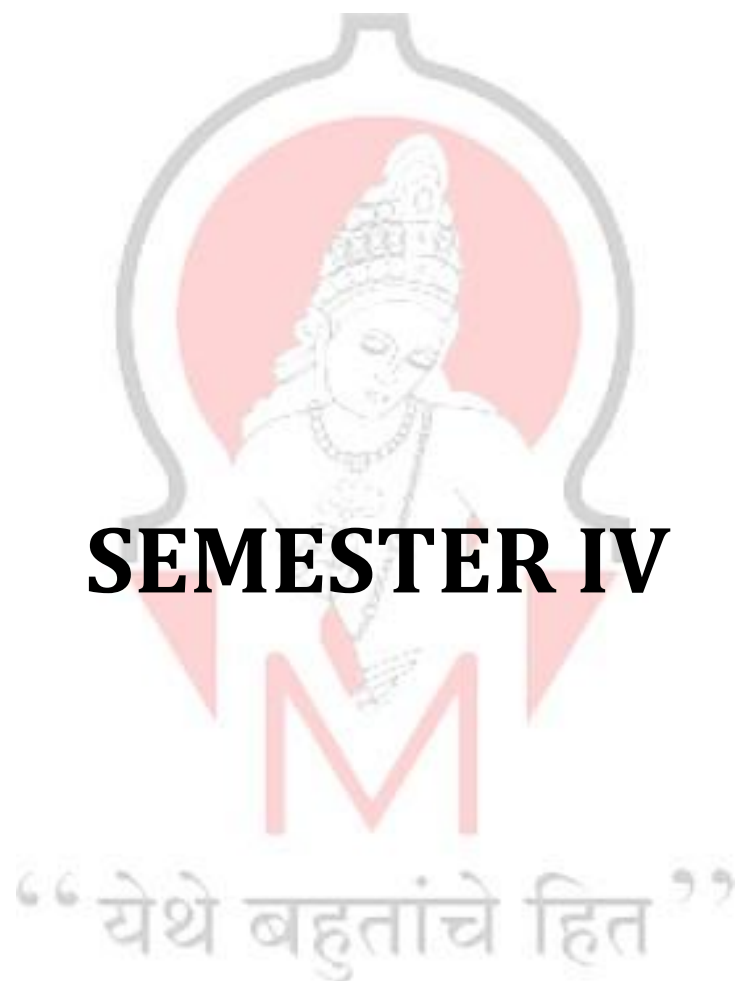
Reference Books

1. Shiv Khera, *You Can Win*, Bloomsbury India, ISBN-10: 9382951717 · ISBN-13: 9789832951711.
2. Carmine Gallo, *Talk Like TED*, Macmillan Business.
3. Garr Reynolds, *Presentation Zen: Simple Ideas on Presentation Design and Delivery*, New Riders.
4. Peter Facione and Carol Ann Gittens, *Think Critically*.
5. Lewis Vaughn, *The Power of Critical Thinking*, Oxford University Press.
6. Emily Post and Peter Post, *The Etiquette Advantage in Business: Personal Skills for Professional Success*.

Online References

1. NPTEL Course: *Technical English for Engineers* – https://onlinecourses.nptel.ac.in/noc20_hs56/preview
2. SWAYAM Course: *English for Research Paper Writing* – https://onlinecourses.swayam2.ac.in/ntr24_ed15/previe
3. SWAYAM Course: *Personality Development and Communication Skills* – https://onlinecourses.swayam2.ac.in/cec22_cm03/preview

SEMESTER IV

"" येथे बहुतांचे हित ""

Second Year B. Tech Artificial Intelligence and Data Science

Semester IV

Course Code: AI24PCC251	Course Name: Data Structures and Algorithms

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: Problem Solving and Object-Oriented Programming, Discrete Mathematics

Course Objectives:
- To understand and classify data structures based on their type, behavior (linear/nonlinear, static/dynamic), and usage in real-world applications.
- To analyze the efficiency of algorithms using time and space complexity with Big O, Ω, and θ notations.
- To implement and apply key data structures such as arrays, linked lists, stacks, queues, trees, and graphs for problem-solving.
- To design and evaluate algorithms for searching, sorting, hashing, and graph-based operations to optimize performance in software solutions.

Course Outcomes:
After completing the course, the students will be able to:
CO1: Analyze algorithms with respect to time and space complexity
CO2: Select appropriate searching and/or sorting techniques in the application development
CO3: Apply the concept of Abstract Data Types to represent and manipulate data structures
CO4: Apply learned algorithm and data structures to solve the problems
CO5: Design and implement different hashing functions

Unit	Contents	Duration (Hrs.)
1	**Introduction** **Introduction to Data Structures**: Concept of data, Data object, Data structure, Concept of Primitive and non-primitive, linear and nonlinear, static and dynamic, persistent and ephemeral data structures, Definition of ADT **Analysis of algorithms :** Frequency count and its importance in analysis of an algorithm, Time complexity and space complexity, Big 'O', 'Ω' and 'θ' **Sequential organization**: Single and multidimensional array and address calculation **Linked organization**: Concept of linked organization, Singly Linked List, Doubly Linked List, Circular Linked List (Operations: Create, Display, Search, Insert, Delete)	8
2	**Searching and Sorting** **Searching and Sorting**: Need of searching and sorting, Concept of internal and external sorting, sort stability, **Searching methods**: Linear and binary search algorithms, **Sorting methods**: Bubble, insertion, Quick, Merge **Hashing:** Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, Different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques- linear probing, quadratic probing, rehashing, chaining with and without replacement	8

3	**Stack and Queues** **Stack:** Concept of stack, Concept of implicit and explicit stack, stack as an ADT using sequential and linked organization, Applications of stack: recursion, converting expressions from infix to postfix or prefix form, evaluating postfix or prefix form, **Queue**: Concept of queues as ADT, Implementation of queue using array and linked organization, Concept of circular queue, double ended queue, Applications of queue: priority queue.	8
4	**Trees** **Tree:** Trees and binary trees-concept and terminology, Expression tree, Binary tree as an ADT, Binary search tree, Recursive and Non recursive algorithms for binary tree traversals ,Binary search tree as ADT(Insert Search Delete, level wise Display), **Types of Trees**: OBST, AVL Trees, **Threaded binary Tree**: Concept of threaded binary tree (inorder, preorder and postorder). Preorder and In-order traversals of in-order threaded binary tree **Applications of Trees**-Heap, Huffman	8
5	**Graph** Concept and terminologies, Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Breadth First Search Traversal, Depth First Search Traversal, Prim's and Kruskal's algorithm for minimum spanning tree, Shortest path using Dijkstra's algorithm, topological sorting.	8
	Total Hours	**40**

Text Books

1. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 1995, ISBN 16782928
2. Y. Kanetkar, "Data Structures in C++," 5th ed. BPB Publications, 2023.

Reference Book

1. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.
2. G. A. Pai, Data Structures and Algorithms. McGraw-Hill Education, 2019.
3. T. A. Gilberg and B. A. Forouzan, Data Structures: A Pseudocode Approach with C++. Cengage Learning, 2008.

Online References

1. https://nptel.ac.in/courses/106106133
2. https://nptel.ac.in/courses/106102064
3. https://www.coursera.org/specializations/data-structures-algorithms

Second Year B. Tech Artificial Intelligence and Data Science														
Semester IV														
Course Code: AI24PCC252							**Course Name: Database Management System**							
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: Discrete Mathematics , Data Structures and Algorithms

Course Objectives:
- To understand the fundamental concepts of Database Management Systems
- To acquire the knowledge of database query languages and transaction processing
- To understand systematic database design approaches
- To acquire the skills to use a powerful, flexible, and scalable general-purpose databases to handle Big Data

Course Outcomes:
After completing the course, the students will be able to:
CO1: Apply sorting and searching algorithms on structured data
CO2: Implement and utilize linear data structures
CO3: Develop and traverse hierarchical data structures
CO4: Model and analyze graph-based real-world problems
CO5: Design and compare hashing techniques

Unit	Contents	Duration (Hrs.)
1	**Introduction to Database Management Systems and ER Model** Introduction, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models. Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity-Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting ER and EER diagram into tables.	8
2	**SQL and PL/SQL** SQL: Characteristics and Advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators. Tables: Creating, Modifying, Deleting, Updating. SQL DML Queries: SELECT Query and clauses, Index and Sequence in SQL. Views: Creating, Dropping, Updating using Indexes, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, SQL Functions, Nested Queries.PL/SQL: Concept of Stored Procedures and Functions, Cursors, Triggers	8
3	**Relational Database Design** Relational Model: Basic concepts, Attributes and Domains, CODD's Rules. Relational Integrity: Domain, Referential Integrities, Enterprise Constraints. Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF.	8
4	**Database Transaction Management** Introduction to Database Transaction, Transaction states, ACID properties, Concept of Schedule, Serial Schedule. Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non recoverable Schedules. Concurrency Control: Lock-based, Time-stamp based Deadlock handling. Recovery methods: Shadow-Paging and Log-Based Recovery, Checkpoints.	8

	Log-Based Recovery: Deferred Database Modifications and Immediate Database Modifications.	
5	**NoSQL Databases** Introduction to Distributed Database System, Advantages, Disadvantages, CAP Theorem. Types of Data: Structured, Unstructured Data and Semi-Structured Data. NoSQL Database: Introduction, Need, Features. Types of NoSQL Databases: Key-value store, document store, graph, wide column stores, BASE Properties, Data Consistency model, ACID Vs BASE, Comparative study of RDBMS and NoSQL. MongoDB (with syntax and usage): CRUD Operations, Indexing, Aggregation, MapReduce, Replication, Sharding.	8
	Total Hours	**40**

Text Books

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition
2. Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81-7808-861-4
3. Elmasri R., Navathe S. "Fundamentals of Database Systems", 4th edition, Pearson Education, 2003

Reference Book

1. C. J. Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719
2. S. K. Singh, "Database Systems: Concepts, Design and Application", Pearson Education, ISBN 978-81-317-6092-5
3. Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O'Reilly Publications, ISBN: 978-1-449-34468-9

Online References

1. Database Management System - https://onlinecourses-archive.nptel.ac.in/noc18_cs15/preview
2. NoSQL: Different NoSQL Systems - http://www.nptelvideos.com/lecture.php?id=6518

Second Year B. Tech Artificial Intelligence and Data Science

Semester IV

Course Code: AI24PCC253   **Course Name: Applied Statistics**

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**

Course Objectives:
- To understand and apply measures of central tendency and dispersion using real-world datasets.
- To analyze relationships between variables using correlation, regression, and probability distributions.
- To differentiate between population and sample, and apply appropriate sampling techniques and the Central Limit Theorem.
- To formulate and test statistical hypotheses using parametric and non-parametric methods for data-driven decision-making.

Course Outcomes:
After completing the course, the students will be able to:
CO1: Identify the use of appropriate statistical terms to describe data
CO2: Use appropriate statistical methods to collect, organize, display, and analyze relevant data.
CO3: Use distribution functions for random variables
CO4: Distinguish between correlation coefficient and regression
CO5: Understand tests for hypothesis and its significance

Unit	Contents	Duration (Hrs.)
1	**Descriptive Statistics: Measures Of Central Tendency** Frequency Distribution, Continuous Frequency Distribution, Graphic Representation of a Frequency Distribution, Histogram, Frequency Polygon, Averages or Measures of Central Tendency or Measures of Location, Requisites for an Ideal Measure of Central Tendency, Arithmetic Mean, Weighted Mean, Median, Mode, Geometric Mean, Harmonic Mean	8
	#Exemplar/Case Studies: Create Measures of central tendency for a real life example dataset like the payroll dataset or titanic dataset etc.	
2	**Descriptive Statistics: Measures of Dispersion** Dispersion, Characteristics for an Ideal Measure of Dispersion, Measures of Dispersion, Range, Quartile Deviation, Mean Deviation, Standard Deviation and Root Mean Square Deviation, Coefficient of Dispersion, Coefficient of Variation, Skewness, Kurtosis	8
	#Exemplar/Case Studies. Create measures of dispersion for a real life example dataset like students dataset , iris detection etc	
3	**Correlation and Regression :** Bivariate Distribution, Scatter diagrams, Correlation, Karl Pearson's coefficient of correlation, Rank correlation, Regression, Lines of Regression, Regression Coefficients, **Probability Distributions** Distribution Function, Bernoulli Distribution, Binomial Distribution, Poisson Distribution, Uniform distribution, Exponential distribution, Gaussian distribution.	8
	#Exemplar/Case Studies. Use Binomial distribution, for the problem of reducing errors by vendors who process credit-card applications for a large credit-card bank etc.	

4	**Population and Sample:** Sampling –Introduction, Types of Sampling, Purposive Sampling, Random Sampling, Simple Sampling, Stratified Sampling, Parameter and Statistic, Sampling Distribution, Central Limit Theorem. **Statistical Inference :** Introduction, Statistical Hypothesis (Simple and-Composite), Test of a Statistical Hypothesis, Null Hypothesis, Alternative Hypothesis	8
	#Exemplar/Case Studies. Create Measures of central tendency for a real life example dataset like the payroll dataset or titanic dataset etc.	
5	**Testing of Hypothesis : Parametric and Non-Parametric Methods**:, Critical Region, Two Types of Errors, Level of Significance, Chi-square distribution ,T-test, F-test	8
	#Exemplar/Case Studies : Study hypothesis testing for any examples like To determine whether the female proportion of the adult population is high or any similar example	
	Total Hours	**40**

Text Books

1. S. C. Gupta, V. K. Kapoor, "Fundamentals of Mathematical Statistics (A Modern Approach)", Sultan Chand and Sons Educational Publishers, Tenth revised edition, ISBN: 81-7014-791-3
2. J. Medhi, "Statistical Methods: An Introductory Text", Second Edition, New Age International Ltd, ISBN: 8122419577

Reference Book

1. Reference Books: 1. Glen Cowan, "Statistical Data Analysis" , University Of Siegen, Clarendon Press, Oxford, 1998, ISBN: 0198501552
2. Ken Black, "Applied Business Statistics", Wiley, 7th Edition, ISBN: 9788126537075

Online References

MOOC Courses:
1. Introduction to Probability and Statistics https://onlinecourses.nptel.ac.in/noc20_ma22/preview
2. Introduction to Data Analytics https://nptel.ac.in/courses/110/106/110106072/

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Second Year B. Tech Artificial Intelligence and Data Science														

Semester IV														

Course Code: AI24PCC255					Course Name: Data Structures and Algorithms 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: Problem Solving and Object-Oriented Programming, Discrete Mathematics

Course Objectives:
- To develop practical skills in implementing fundamental data structures such as arrays, linked lists, stacks, queues, trees, graphs, and hash tables.
- To apply various sorting and searching algorithms for organizing and retrieving data efficiently in real-world scenarios.
- To design and implement algorithmic solutions using abstract data types (ADTs) for expression evaluation, traversal, and manipulation of complex data structures.
- To analyze and solve graph-related problems using algorithms like Dijkstra's, Prim's, and Kruskal's, and demonstrate proficiency in representing data through adjacency matrices and lists.

Course Outcomes:
After completing the course, the students will be able to:
CO1: Apply sorting and searching algorithms on structured data
CO2: Implement and utilize linear data structures
CO3: Develop and traverse hierarchical data structures
CO4: Model and analyze graph-based real-world problems
CO5: Design and compare hashing techniques

Sr. No.	List of Experiments	Duration (Hrs.)
1	Consider a student database of SEIT class (at least 15 records). Database contains different fields of every student like Roll No, Name and SGPA.(array of structure) a) Design a roll call list, arrange list of students according to roll numbers in ascending order (Use Bubble Sort) b) Arrange list of students alphabetically. (Use Insertion sort) c) Arrange a list of students to find out first ten toppers from a class. (Use Quick sort) d) Search students according to SGPA. If more than one student has the same SGPA, then print a list of all students having the same SGPA. (use Linear Search) e) Search a particular student according to roll number using binary search without recursion	4
2	Implement stack as an abstract data type using singly linked list and use this ADT for conversion of Infix expression to postfix expression and postfix expression evaluation OR Infix expression to prefix expression and prefix expression evaluation	4
3	Implement Circular Queue using Array. Perform following operations on it. a) Insertion (Enqueue) b) Deletion (Dequeue) c) Display (Note: Handle queue full condition by considering a fixed size of a queue.)	2
4	Construct an Expression Tree from postfix or prefix expression. Perform recursive and	4

	non-recursive In-order, Pre order and Post-order traversals	
5	Implement binary search tree and perform following operations: a) Insert (Handle insertion of duplicate entry) b) Delete c) Search d) Display tree (Level-wise, print total count of leaf nodes)	4
6	Implement In-order Threaded Binary Tree and traverse it in In-order and Pre-order	2
7	Represent a graph of your college campus using adjacency list /adjacency matrix. Nodes should represent the various departments/institutes and links should represent the distance between them. Find a minimum spanning tree a. Prim's Algorithm b. Kruskal's Algorithm	2
8	Represent a graph of the city using the adjacency matrix /adjacency list. Nodes should represent the various landmarks and links should represent the distance between them. Find the shortest path using Dijkstra's algorithm from single source to all destinations.	2
9	Implementation of Hash table using array and handle collisions using a. Linear probing with and without replacement b. Chaining with and without replacement	2
	Total Hours	**26**

Text Books

1. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 1995, ISBN 16782928
2. Y. Kanetkar, "Data Structures in C++," 5th ed. BPB Publications, 2023.

Reference Book

1. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.
2. G. A. Pai, Data Structures and Algorithms. McGraw-Hill Education, 2019.
3. T. A. Gilberg and B. A. Forouzan, Data Structures: A Pseudocode Approach with C++. Cengage Learning, 2008.

Online References

1. https://nptel.ac.in/courses/106106133
2. https://nptel.ac.in/courses/106102064
3. https://www.coursera.org/specializations/data-structures-algorithms

Second Year B. Tech Artificial Intelligence and Data Science

Semester IV

Course Code: AI24PCC256	Course Name: Database Management System 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: Discrete Mathematics , Data Structures and Algorithms

Course Objectives:
- To understand the fundamental concepts of Database Management Systems
- To acquire the knowledge of database query languages and transaction processing
- To understand systematic database design approaches
- To acquire the skills to use a powerful, flexible, and scalable general-purpose databases to handle Big Data

Course Outcomes: On completion of the course, learner will be able to–
CO1: Implement SQL queries for given requirements, using different SQL concepts
CO2: Implement PL/SQL concepts such as stored procedures , functions, triggers for given requirement
CO3: Implement NoSQL queries using MongoDB
CO4: Design and develop front-end application and connect to SQL/ NOSQL database through back-end using compatible drivers
CO5: Design and develop application using database considering specific requirements

Sr. No.	List of Experiments	Duration (Hrs.)
1	Design and develop any database application which will demonstrate use of SQL objects like database, Table and different database constraints.	4
2	Design and implement SQL DML statements like: Insert, Update, Delete and View. Also demonstrate use of sequence and index. queries for any real-time application	4
3	Design and implement SQL queries to demonstrate use of Order by, group by clause in SQL along with different aggregate functions used in SQL.	2
4	Design and implement SQL queries to demonstrate use of different types of joins (cross join, inner join, left outer, right outer, full outer join, Natural join)	2
5	To study and implement sub-queries or nested queries using set membership (in, not in), set comparison (<some, >=some, <all etc.) in SQL.	4
6	Study and write a stored procedure and function. Write a database Trigger (Row level and Statement level).	4
7	Design the Database Cursor. Implement all types: Implicit, Explicit, Cursor FOR Loop, and Parameterized Cursor. OR Design and Develop MongoDB queries for aggregation pipeline. Design and Develop Mapreduce function in MongoDB.	4
8	Write a program to implement MySQL/Oracle database connectivity with any front end language to implement Database navigation operations (add, delete, edit etc.)	2

9	Develop an application by using front-end technologies like Java, PHP, Python and connect it with a database.	2
	Total Hours	**28**

Text Books

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition
2. Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81-7808-861-4
3. Elmasri R., Navathe S. "Fundamentals of Database Systems", 4th edition, Pearson Education, 2003

Reference Book

1. C. J. Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719
2. S. K. Singh, "Database Systems: Concepts, Design and Application", Pearson Education, ISBN 978-81-317-6092-5
3. Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O'Reilly Publications, ISBN: 978-1-449-34468- 9

Online References

1. Database Management System - https://onlinecourses-archive.nptel.ac.in/noc18_cs15/preview
2. NoSQL: Different NoSQL Systems - http://www.nptelvideos.com/lecture.php?id=6518

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Second Year B. Tech Artificial Intelligence and Data Science

Semester-IV

Course Code: AI24VSE257	Course Name: Engineering Design and Innovation Lab-II

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

Course Objectives:
- To understand the principles of object-oriented programming using Java.
- To develop dynamic and responsive web applications using modern web development platforms.
- To implement client-side and server-side scripting for interactive web functionality.
- To integrate business logic into web applications for real-world use cases.

Course Outcomes:
After completing the course, the students will be able to:
CO1: Develop java application by using different java classes, interface, abstract class and different access controls.
CO2: Create the effective web applications for business functionalities using latest web development platforms
CO3: Apply client side and server side scripting for web applications.
CO4: Create the effective web applications for business functionalities using latest web development platforms

Content related to assignments:
Java Programming
Core java Concepts: Features of Java ,OOPs concepts , Java virtual machine , Reflection byte codes, Byte code interpretation Java Classes: Abstract classes, Static classes ,Inner classes ,Packages, Wrapper classes Interfaces, This, Super, Access control.
Exception handling: Exception as objects, Exception hierarchy ,Try catch finally, Throw, throws
Multi threading: Thread Life cycle, Multi-threading advantages and issues ,Simple thread program, Thread synchronization.

List of Experiments		
Sr. No	Name of the Experiment	Duration (Hrs.)
1	a) Write a java program to find the Fibonacci series using recursive and non recursive functions. b) Write a java program to multiply two given matrices. c) Write a java program that reads a line of integers and displays each integers and the sum of all integers use String Tokenizer d) Write a java program that checks whether a given string is palindrome or not	4
2	Design a real-time system for managing an employee payroll system. The program should include concept of abstract, inner class wrapper class and use of this and super keyword	4
3	Write a java program for exception handling for any real-time application.	4
4	Write a java program that connects to a database using JDBC	4
5	Calculate and interpret summary statistics for different types of variables (numerical, categorical). a. Load a simple dataset (e.g., students' test scores or company sales data). b. For numerical variables, calculate the Mean, median, mode, standard deviation, variance,	4

	and range. c. For categorical variables, calculate the frequency count and mode.	
6	Analyze skewness and kurtosis in distributions. a. Load a dataset with multiple numerical variables. b. Compute the skewness and kurtosis of each variable using scipy.stats.skew() and scipy.stats.kurtosis(). c. Plot histograms and interpret the skewness (positive or negative) and kurtosis (leptokurtic or platykurtic) of the distributions.	4
7	Compare the distribution of different datasets. a. Load two different datasets (e.g., two types of fruits' measurements or two years of sales data). b. Compare the central tendency (mean/median) and spread (variance/standard deviation) of the two datasets. c. Visualize the comparison with box plots, histograms, and kernel density plots. Interpret whether the distributions are similar or differ significantly.	4
8	Understand quantiles and percentiles in descriptive statistics. a. Load a dataset with numerical columns. b. Calculate the 25th, 50th, and 75th percentiles using numpy.percentile() and pandas.quantile(). c. Compare these with the mean and median values and Plot a box plot to visualize the quartiles and outliers.	4
	Total Hours	**32**

	Project Based Learning (PBL) Topics	
P1	Write a simple application that allows you to add, update, and delete student information, like name, roll number, and marks using java.	
P2	Develop a java application, a basic banking system where users can create an account, deposit money, withdraw money, and check their balance. Use the concept of inheritance.	
P3	Develop a java application that allows users to add, update, and delete items in an inventory, track quantities, and prices. Use the concept of exception handling in the program.	
P4	Build a quiz application in java where users can answer multiple- choice questions. The app should show the result and score at the end.	
P5	Design School Performance Data Analysis using python to analyze data on student grades, attendance, or test scores use Mean/median/mode, correlation, regression analysis.	
P6	Analyze impact of Screen time on student GPA(Grade Point Average) using Sampling methods, confidence intervals, Chi-square tests.	
P7	Analyze Performance Trends in Local Sports Teams using python • Analyze team statistics (points per game, fouls, assists, etc.) • Compare averages, variation, and consistency of players	
P8	Analyze Spending Habits of Teenagers Collect data on weekly expenses (food, clothes, entertainment). Analyze spending patterns with measures of center and spread.	
	Total Hours	**28 Hrs**
Text Books		

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, 2019.
2. Steven Holzner, Java 2 Black book, Dream tech press, 2011.
3. Reference Books: 1. Glen Cowan, "Statistical Data Analysis" , University Of Siegen, Clarendon Press, Oxford, 1998, ISBN: 0198501552

Reference Books

1. Cay S. Horstmann, Gary Cornell, "Core Java Volume – I Fundamentals", 11th Edition, Prentice Hall, 2019.
2. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
3. Timothy Budd, Understanding Object-oriented programming with Java, Third Edition, Pearson Education, 2008.

Online References

1. Programming in Java - https://onlinecourses.nptel.ac.in/noc20_cs58/preview
2. Python for Data Science - https://onlinecourses.nptel.ac.in/noc23_cs99/preview

Second Year B. Tech Artificial Intelligence and Data Science														
Semester IV														
Course Code: AI24EEM258						**Course Name: Information Systems and Engineering Economics**								
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

Course Objectives:
- To introduce various types of Information Systems and their applications in organizations.
- To examine managerial challenges and decision-making related to Information Systems.
- To understand the components, functions, and benefits of Information Systems in business contexts.
- To apply cost-benefit and economic analysis for evaluating alternatives and supporting organizational decisions.

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

CO1: To prepare the students to various forms of the Information Systems and its application in organizations.

CO2: To expose the students to the managerial issues relating to information systems and help them identify and evaluate various options in Information Systems.

CO3: To prepare the students with understanding of the role, advantages and components of an Information System.

CO4: To help students integrate their learning from functional areas, decision making process in an organization and role of Information Systems to have a vintage point in this competitive world.

CO5: To prepare engineering students to analyze cost / revenue data and should be able to do economic analyses in the decision-making process to justify or reject alternatives / projects on an economic basis for an organization.

Contents	
1	**Basics of Management Theory and Practices** Role of Information Systems in Organizations, The Information System Manager and his challenges, Concepts of Information Systems, Information Systems and Management Strategy, Components of Information System, integration and automation of business functions and developing business models, Role and advantages of Transaction Processing System, Expert Systems and Artificial Intelligence, Executive Support Systems and Strategic Information Systems. **Case Studies - Information Systems in the Indian Railways, Information Systems in an e-Commerce Organization.**
2	**Information System (IS)** Managing Information Systems, Ethical and Social Issues, Information Technology Infrastructure and Choices, Information Systems Security and Control **Case Studies -Information Technology Infrastructure in a Bank, Information Technology Infrastructure in a manufacturing / process industry.**
3	**Leveraging Enterprise Management technologies** Information Systems Development and Project Management, Managing Data Resources, Business Process Integration and Enterprise Systems, Business Process Reengineering, Total Quality Management and Enterprise Management System viz. ERP, SCM, CRM , Ecommerce, E-Governance. **Case Studies -** in-house or cloud based ERP implementation, UIDAI Unique Identification Authority of India. **Tool:** SAP S/4HANA

4	**Economic and Decision-Making Process** Engineering Economic Decisions, Time Value of Money, Understanding Money Management, Programmed and Non- Programmed decisions, Decision Support Systems, Models and approaches to DSS **Case Studies-** Economic decisions done in Multi-national companies. **Tool: Trello, Qlik**
5	**Economics Management** Equivalence Calculations under Inflation, Present-Worth Analysis, Annual-Equivalence Analysis, Accounting for Depreciation and Income Taxes, Project Cash-Flow Analysis. **Case Studies -**comparative analysis of software enterprises from similar domains, cash flow analysis done in start-up companies **Tool: ProfitCents**

List of Tutorials

Sr. No	Name of the Tutorial	Duration (Hrs.)
1	Define and explain the importance of management and information systems in organizations. Describe the components of information systems and their role in organizational decision-making.Develop a business model for an e-commerce organization using information systems.	6
2	Develop a comprehensive information systems plan for a small business. Analyze the ethical and social implications of a new information system. Design a secure information technology infrastructure for a medium-sized organization.	6
3	Develop a project plan for an enterprise system implementation.Design a data warehouse for a retail organization. Analyze the business benefits of implementing an ERP system.	6
4	Develop a financial plan for a small business, including investment, financing, and dividend decisions. Analyze a case study on decision support systems and evaluate the effectiveness of the DSS.Design a decision support system for a manufacturing company, including database, model base, and user interface.	6
5	Perform equivalence calculations under inflation for a given investment project. Conduct present-worth analysis and annual-equivalence analysis for a given investment project. Account for depreciation and income taxes in a given investment project.Perform project cash-flow analysis for a given investment project.	6
	Total Hours	30

Text Books

1. Rahul De, MIS: Management Information Systems in Business, Government and Society‖, Wiley India, ISBN: 13: 978-81-265-2019-0.
2. Chan S. Park, "Fundamentals of Engineering Economics‖, 3rd Edition, Pearson Education, ISBN 13: 978-02-737- 7291-0
3. Management Information Systems, Effy OZ, Thomson Learning/Vikas Publications
4. Management Information Systems, James A. O'Brein, Tata McGraw-Hill

Reference Book

1. Turban and Wali, Information Technology on Management, Willey India, ISBN: 9788126558711
2. William G. Sullivan, Elin M. Wicks, C. Patrick Koelling, Engineering Economy, Pearson Education, ISBN13: 978-01- 334-3927-4
3. Management Information System, W.S Jawadekar, Tata Mc Graw Hill Publication.

4. Management Information System, David Kroenke, Tata Mc Graw Hill Publication.
5. MIS: Management Perspective, D.P. Goyal, Macmillan Business Books

Online References

1. Management Information system: https://onlinecourses.nptel.ac.in/noc20_mg60/preview
2. Economics: https://onlinecourses.nptel.ac.in/noc23_ec06/preview

Second Year B. Tech Artificial Intelligence and Data Science													
Semester - IV													
Course Code:SH24VEC201							Course Name: Environment Sustainability						
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: A basic understanding of environmental science, geography, or social studies

Course Objectives:
- Understand the foundational concepts of sustainability, including its social, environmental, and economic dimensions, and the global need for sustainable development.
- Gain insights into the 17 United Nations Sustainable Development Goals (SDGs) and the role of technology, international cooperation, and policy in achieving them.
- Identify and explain different types of pollution (air, water, solid waste), their sources and impacts, and sustainable approaches to waste management including the 3Rs (Reduce, Reuse, Recycle) and zero-waste concepts.
- Evaluate global and local environmental challenges, including climate change, global warming, ozone depletion, and resource degradation.

Course Outcomes:
After the completion of course, the students can:
CO1: Describe the fundamental ideas of environmental sustainability.
CO2: Examine sustainability's social, economic, and environmental facets.
CO3: Analyse how human actions affect Environmental systems.
CO4: Propose strategies for sustainable development in various sectors.

Unit	Content
1	Introduction to Environmental Sustainability: Global environmental issues, Foundations of Environmental Sustainability. Sustainability: Challenges, potential; role of technology, policies.
2	Environmental Pollution and Waste Management: Air Pollution: Sources and Effects of Air Pollution. Water Pollution: Sources of Water Pollution, Sustainable Wastewater Treatment. Solid Waste zero Waste Concepts (3R Concept).
3	Climate Change and Energy: Understanding Climate Change, Science and impacts of climate change Climate modeling and adaptation, Sustainable Energy Solutions, Renewable energy technology, Efficient energy system and conservation
4	Sustainable Development Practices: Sustainability in Cities, infrastructure and cities that are sustainable, green buildings and smart cities.

Sr. No	List of Tutorial (Select any 08 activities out of 10 contributing to 26 hours)	Hours
1	Examine the river pollution in Pune.	4
2	Prepare a climate change strategy for your town, city, or building.	4
3	Initiate a campaign to bring emphasis to a sustainability concern.	4
4	Examine The Current Environmental Issue	2
5	Examine a successful sustainability attempt from the real world	2
6	Home energy audit: Have students make a list of all the appliances and light bulbs in their house. How much energy does their house use if all the lights are on for 4 hours per day? If their appliances are on for 2 hours per day? How much energy could they save if they switched to energy-efficient appliances or lightbulbs?	2
7	Use recycled material in art projects: recycled materials can make beautiful art projects	2

	such as jewelry, planters, and birdhouses. Incorporating materials that would otherwise be thrown away into art projects can show your students how to find new uses for these items.	
8	Life cycle: One way to show students what happens when you put something in the trash versus recycling or reusing the object is to do a life cycle analysis. This is a flowchart that shows the environmental impacts of an object, from extracting the raw materials to decomposition and everything in between. When something is put in the trash instead of being reused or recycled, the life cycle assessment will show a bigger environmental impact. When something is reused or recycled, the environmental impact is less because raw materials don't need to be extracted to create something new.	4
9	Go on a field trip: Visit your local landfill, recycling center, or a nearby composting facility where the students can see firsthand what is happening to waste and learn about the lifecycle of waste and its effect on the environment.	2
10	Compare carbon footprints of different materials used in construction or manufacturing in India.	2
	Total Hours for 08 Activities	**26**

Text Books

1. Sharma, "P.D. Ecology and Environment", Rastogi Publications,2020.
2. Kaushik, C.P., Kaushik, Anubha, "Perspectives in Environmental Studies New Age",International Publishers, 2021.
3. Agarwal, S.K. "Environmental Management", APH Publishing Corporation, 2005.

Journals and Articles

1. Kalam, A.P.J. Abdul, Srijan Pal Singh, "Target 3 Billion Innovative Solutions Towards Sustainable Development", Penguin Books,2011.
2. Kolbert, Elizabeth, "The Sixth Extinction: An Unnatural History", Henry Holt and Co.,2014.

Online References

1. NPTEL Course : Prof. Trupti Mishra, IIT Bombay "Business and Sustainable Development" [https://nptel.ac.in/courses/110101153]
2. NPTEL Course :By Prof. Brajesh Kumar Dubey , IIT Kharagpur "Sustainable Engineering Concepts And Life Cycle Analysis" [https://onlinecourses.nptel.ac.in/noc23_ce90/preview]

AICTE Approved Programmes

Branch	Intake			Career Options
	B.Tech.	**M.Tech.**	**Working Professional** Direct Second Year	
Computer Engineering	180	Computer Engineering:18	---	Data Science, Artificial Intelligence (AI), Big Data Analytics, High Performance Computing (HPC), Machine Learning, Database Engineering, Computer Networks, Cyber Security, IOT
Electrical Engineering	60	Power Electronics & Drives: 06	30	Public Sector, Power Sector, Software Development, Maintenance Engineering, Contractor & Supervisor, Energy Auditor, Internet of Things (IoT), Robotics and Automation, Industry 4.0, Chartered Engineer, Electric Vehicles,
Electronics & Telecommunications Engineering	180	VLSI and Embedded System: 06	---	Internet of Things (IoT), Robotics and Automation, Industry 4.0, Wireless Communication 4G, 5G, 6G, Artificial Intelligence, VLSI, Embedded Systems, Satellite Communication, Data Science, Power Electronics, Computer Networking, Blockchain Technology, Signal Processing, Electronic Design
Information Technology	180	Data Science: 06	---	Software Development &Testing, Cyber Security, Cloud Computing, Big Data Analytics, IoT, Machine Learning, Artificial Intelligence, Blockchain, Database Management, Data Engineer, Data Science
Mechanical Engineering	120	Design Engineering: 06	30	Machine Design, System Modeling, Simulation, Robotics, Mechatronics, Rapid Prototyping, 3D Printing, Composite Materials, Automotive & Electrical Vehicles, Manufacturing Sector, HVAC Systems, Energy Engineering and Process Industry, Robotics, Data Science, Public Sector, Power Sector, Software Development, Mechanical Design Engineer, Design Quality Assurance Manager, Engineering, Service, Teaching, Designing Machines & Tools
Artificial Intelligence and Data Science	180	---	---	Cyber Security Analyst, Software Development Expert, Artificial Intelligence Engineer, Data Scientist, Data Analysis, Machine Learning Engineer, Machine Learning Architect, Product Analyst, Software Architect, Data Warehouse Engineer, Product Manager, Front-end Developer, Full Stack Developer
Ph.D Research Center in Computer Engineering.				

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◈ CII ◈ ISHRAE ◈ ACM ◈ ISRD ◈ GDSC ◈ IE(I)

◈ TATA ◈ ASHRAE ◈ IETE ◈ DICCI ◈ IEEE ◈ ISACA

◈ MCCIA ◈ SAEINDIA ◈ CSI ◈ ISTE ◈ STP

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