परीक्षा नियंत्रण प्रकोष्ठ, जबलपुर इंजीनियरिंग महाविद्यालय, जबलपुर (म.प्र.)

क्रमांक / प.नि.प्र. / 2024 / 2682 जबलपुर, दिनांक 18 / 10 / 2024

सूचना

महाविद्यालय में अध्ध्यनरत B.Tech. (AICTE) / B.Tech. (PTDC) [AICTE] [Regular/Ex.] विद्यार्थियों को सूचित किया जाता है कि वे नवम्बर 2024 की परीक्षा एवं आगामी सत्र की परीक्षाओं में सम्मिलित होने से पूर्व अपने पेपर / विषय का Equivalence Syllabus महाविद्यालय के पोर्टल से Download कर प्राप्त कर सकते हैं अथवा महाविद्यालय के परीक्षा नियंत्रण प्रकोष्ठ में संपर्क कर सकते हैं। नवम्बर 2024 परीक्षा एवं आगामी सत्र की परीक्षा में उन्हें अपने पेपर / विषय में Equivalence Syllabus में ही सम्मिलित होना है। अतः Equivalence Syllabus की जानकारी न होने की दशा में सम्पूर्ण जिम्मेदारी स्वयं छात्र / छात्राओं की होगी।

Equivalence Syllabus हेतु निम्नानुसार Link का उपयोग कर सकते है:–

https://www.jecjabalpur.ac.in/UploadContent/frm_ViewScheme.aspx

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जबलपुर इंजीनियरिंग महाविद्यालय
जबलपुर

पृ.क्रमांक / प.नि.प्र. / 2024 / जबलपुर, दिनांक / 10 / 2024

प्रतिलिपिः–

01. समस्त विभागाध्यक्ष, जबलपुर इंजीनियरिंग महाविद्यालय, जबलपुर।
02. पीटीडीसी कार्यालय, जबलपुर इंजीनियरिंग महाविद्यालय, जबलपुर।

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जबलपुर

EQUIVALENCE OF SUBJECTS OF DIFFERENT SCHEMES OF UNDER GRADUATE COURSES (B.Tech.)
OF Artificial Intelligence & Data Science

S.No.	Schemes	Subject Code & Subject Name (Semester) Having Equivalence in Syllabus	Final Subject code & subject (after equivalence)
1	AICTE	AI303 Data Structure & Algorithm **B.Tech. III Sem.**	AI33 Data Structure and Algorithm **B.Tech. III Sem.**
	Scheme 2023	AI33 Data Structure and Algorithm **B.Tech. III Sem.**	
2	AICTE	AI304 Object Oriented Programming Using Java **B.Tech. III Sem.**	AI34 Object Oriented Programming Using JAVA **B.Tech. III Sem.**
	Scheme 2023	AI34 Object Oriented Programming Using JAVA **B.Tech. III Sem.**	
3	AICTE	AI305 Digital Logic Design & Computer Organization **B.Tech. III Sem.**	AI35 Digital Logic Design & Computer Organization **B.Tech. III Sem.**
	Scheme 2023	AI35 Digital Logic Design & Computer Organization **B.Tech. III Sem.**	
4	AICTE	AI402 Database Management System **B.Tech. IV Sem.**	AI43 Data Base Management System **B.Tech. IV Sem.**
	Scheme 2023	AI43 Data Base Management System **B.Tech. IV Sem.**	
5	AICTE	AI403 Operating System **B.Tech. IV Sem.**	AI44 Operating System **B.Tech. IV Sem.**
	Scheme 2023	AI44 Operating System **B.Tech. IV Sem.**	
6	AICTE	AI404 Introduction in Artificial Intelligence and Machine Learning **B.Tech. IV Sem**	AI42 Introduction to AI and ML **B.Tech. IV Sem.**
	Scheme 2023	AI42 Introduction to AI and ML **B.Tech. IV Sem.**	

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7	AICTE	AI405 Microprocessor and Microcontroller **B.Tech. IV Sem.**	AI45 Microprocessor & Microcontroller **B.Tech. IV Sem.**
	Scheme 2023	AI45 Microprocessor & Microcontroller **B.Tech. IV Sem.**	
8	AICTE	BT511 Professional Ethics **B.Tech. V Sem.**	BT51 Professional Ethics **B.Tech. V Sem.**
	Scheme 2023	BT51 Professional Ethics **B.Tech. V Sem.**	
9	AICTE	AI502A Probability and Random Process. **B.Tech. V Sem.**	AI51A Probability and Random Process. **B.Tech. V Sem.**
	Scheme 2023	AI51A Probability and Random Process. **B.Tech. V Sem.**	
10	AICTE	AI502B Theory of Computation **B.Tech. V Sem.**	AI51B Theory of Computation **B.Tech. V Sem.**
	Scheme 2023	AI51B Theory of Computation **B.Tech. V Sem.**	
11	AICTE	AI502C Information Theory & Coding **B.Tech. V Sem.**	AI51C Information Theory & Coding **B.Tech. V Sem.**
	Scheme 2023	AI51C Information Theory & Coding **B.Tech. V Sem.**	
12	AICTE	AI503 Deep Learning **B.Tech. V Sem.**	AI52 Deep Learning **B.Tech. V Sem.**
	Scheme 2023	AI52 Deep Learning **B.Tech. V Sem.**	
13	AICTE	AI504 Data Science **B.Tech. V B.Tech. Sem.**	AI53 Data Science **B.Tech. V B.Tech. Sem.**
	Scheme 2023	AI53 Data Science **B.Tech. V B.Tech. Sem.**	

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14	AICTE	AI505 Digital & Wireless Communication **B.Tech. V Sem.**	AI54 Digital & Wireless Communication **B.Tech. V Sem.**
	Scheme 2023	AI54 Digital & Wireless Communication **B.Tech. V Sem.**	
15	AICTE	AI601A Application of AI **B.Tech. VI Sem.**	AI61A Application of AI **B.Tech. VI Sem.**
	Scheme 2023	AI61A Application of AI **B.Tech. VI Sem.**	
16	AICTE	AI601B Optimization Methods in AI **B.Tech. VI Sem.**	AI61B Optimization Methods in AI **B.Tech. VI Sem.**
	Scheme 2023	AI61B Optimization Methods in AI **B.Tech. VI Sem.**	
17	AICTE	AI601C Information Retrieval **B.Tech. VI Sem.**	AI61C Information Retrieval **B.Tech. VI Sem.**
	Scheme 2023	AI61C Information Retrieval **B.Tech. VI Sem.**	
18	AICTE	AI602A Economics & Social Issues **B.Tech. VI Sem.**	AI62A Economics & Social Issues **B.Tech. VI Sem.**
	Scheme 2023	AI62A Economics & Social Issues **B.Tech. VI Sem.**	
19	AICTE	AI602B Software Engineering **B.Tech. VI Sem.**	AI62B Software Engineering **B.Tech. VI Sem.**
	Scheme 2023	AI62B Software Engineering **B.Tech. VI Sem.**	
20	AICTE	AI602C Quantum Computing **B.Tech. VI Sem.**	AI62C Quantum Computing **B.Tech. VI Sem.**
	Scheme 2023	AI62C Quantum Computing **B.Tech. VI Sem.**	
21	AICTE	AI603 Compiler Design **B.Tech. VI Sem.**	AI63 Compiler Design **B.Tech. VI Sem.**
	Scheme 2023	AI63 Compiler Design **B.Tech. VI Sem.**	

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22	AICTE	AI604 Internet of Things (I.O.T.) **B.Tech. VI Sem.**	AI64 Internet of Things (I.O.T.) **B.Tech. VI Sem.**
	Scheme 2023	AI64 Internet of Things (I.O.T.) **B.Tech. VI Sem.**	
23	AICTE	AI605 Robotics Technology **B.Tech. VI Sem.**	AI65 Robotics Technology **B.Tech. VI Sem.**
	Scheme 2023	AI65 Robotics Technology **B.Tech. VI Sem.**	
24	Scheme 2024	AI701M Big Data Analysis **B.Teh. VII Sm.**	AI73 Big Data Analysis **B.Tech. VII Sem.**
	Scheme 2023	AI73 Big Data Analysis **B.Tech. VII Sem.**	
25	Scheme 2024	AI702M Digital Image Processing **B.Tech. VII Sem.**	AI74 Digital Image Processing **B.Tech. VII Sem.**
	Scheme 2023	AI74 Digital Image Processing **B.Tech. VII Sem.**	
26	Scheme 2024	AI703M Satistical Data Analysis **B.Tech. VII Sem.**	AI75 Statistical Data Analysis **B.Tech. VII Sem.**
	Scheme 2023	AI75 Statistical Data Analysis **B.Tech. VII Sem.**	
27	Scheme 2024	AI704M A, AI-Natural Language Processing **B.Tech. VII Sem.**	AI 71A AI-Natural Language Processing (NLP) **B.Tech. VII Sem.**
	Scheme 2023	AI 71A AI-Natural Language Processing (NLP) **B.Tech. VII Sem.**	
28	Scheme 2024	AI704M B, Block Chain Technique **B.Tech. VII Sem.**	AI71B Block Chain Technique **B.Tech. VII Sem.**
	Scheme 2023	AI71B Block Chain Technique **B.Tech. VII Sem.**	

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29	Scheme 2024	AI704M C, Simulation & Modelling **B.Tech.VII Sem.**	AI71C Simulation & Modelling **B.Tech..VII Sem.**
	Scheme 2023	AI71C Simulation & Modelling **B.Tech.VII Sem.**	
30	Scheme 2024	AI705M A Cloud Computing **B.Tech. VII Sem.**	AI72A Cloud Computing **B.Tech. VII Sem.**
	Scheme 2023	AI72A Cloud Computing **B.Tech. VII Sem.**	
31	Scheme 2024	AI705M B Network Management **B.Tech. VII Sem.**	AI72B Network Management **B.Tech. VII Sem.**
	Scheme 2023	AI72B Network Management **B.Tech. VII Sem.**	
32	Scheme 2024	AI705M C, Cyber Security **B.Tech. VII Sem.**	AI72C Cyber Security **B.Tech. VII Sem.**
	Scheme 2023	AI72C, Cyber Security **B.Tech. VII Sem.**	
33	Scheme 2024	AI801M A, Financial Engineering **B.Tech. VIII Sem.**	AI81A Financial Engineering **B.Tech. VIII Sem.**
	Scheme 2023	AI81A, Financial Engineering **B.Tech. VIII Sem.**	
34	Scheme 2024	AI801M B, DevOps & MLOPs **B.Tech. VIII Sem.**	AI81B DevOps & MLOPs **B.Tech. VIII Sem.**
	Scheme 2023	AI81B, DevOps & MLOPs **B.Tech. VIII Sem.**	
35	Scheme 2024	AI801M C Advanced AI Algorithms-Gen AI **B.Tech. VIII Sem.**	AI81C Advanced AI Algorithms-Gen AI **B.Tech. VIII Sem.**
	Scheme 2023	AI81C Advanced AI Algorithms-Gen AI **B.Tech. VIII Sem.**	
36	Scheme 2024	AI802M A, Compter Vision **B.Tech. VIII Sem.**	AI82A Compter Vision **B.Tech. VIII Sem.**
	Scheme 2023	AI82A, Compter Vision **B.Tech. VIII Sem.**	

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37	Scheme 2024	AI802M B, Bio Informatics B.Tech. VIII Sem.	AI82B Bio Informatics **B.Tech. VIII Sem.**
	Scheme 2023	AI82B Bio Informatics B.Tech. VIII Sem.	
38	Scheme 2024	AI802M C Design Thinking B.Tech. VIII Sem.	AI82 C Design Thinking **B.Tech. VIII Sem.**
	Scheme 2023	AI82 C Design Thinking B.Tech. VIII Sem.	

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Bachelor of Technology (B.Tech.) III Semester (Artificial Intelligence & Data Science)

COURSE CONTENTS **w. e. f. July 2023**

Subject Code	Subject Name & Title	Maximum Marks Allocated						Hours/ Weeks			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI33	Data Structures and Algorithms	70	20	10	30	20	150	3	-	2	4

Module-I: Introduction:
Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion ,deletion ,traversal etc .;Analysis of an Algorithm, Asymptotic Notations, Time-Space Tradeoff. **Searching** : Linear Search and Binary Search Techniques and their complexity analysis.

Module-II: Stacks and Queues:
ADT Stack and its operations: Algorithm and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation-corresponding algorithms, ADT Queue, Types of queue: Simple Queue, Circular Queue, Priority Queue. Operations on each Type of Queues: Algorithms and their analysis.

Module-III: **Linked Lists:**
Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Doubly Linked list: operations on it. Circular Linked list: operations on it.

Module-IV: Trees:
Basic tree Terminologies, Different types of Trees : Binary Tree , Threaded Binary Tree , Binary Search Tree , AVL Tree , Tree operations on each of the trees and their algorithm with complexity analysis. Applications of Binary Trees , B+ Tree : definitions and operations .

Module V: Sorting and Hashing:
Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing, Collision handling techniques. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

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Reference Books:

Fundamentals of data structures in C"2nd edition,by S Sahni,Universities Press.
How to Solve it by Computer",2nd Impression by R.G. Dromey ,Pearson Education.
"Data Structures using C and C++"2nd edition, Tenenbaum, P HI publication.
"Introduction to algorithms "3rd edition by Cormen , MIT press.

Listof Experiment AI33Lab

1. Write a program to implement Linear Search and Binary search algorithms. Print the number comparisons done by the algorithms for the input list.
2. Write a program to implement Stack. Implement its push, pop, peek and display operations.
3. Write a program to implement Queue. Implement its insert, delete and display operations.
4. Write a program to implement Singly Linked List and its operations like insertion and deletion of elements from head and tail.
5. Write a program to implement Circular Linked List and its operations like insertion and deletion of elements from head and tail.
6. Write a program to implement Doubly Linked List and its operations like insertion and deletion of elements from head and tail.
7. Write a program to implement Binary Search Tree and Print the number of comparison required to search an element in it.
8. Write a program to implement Insertion Sort Algorithm.
9. Write a program to implement Quick Sort Algorithm
10. Write a program to implement Knapsack problem using Greedy approach.
11. Write a program to implement All-Pair-Shortest-Path problem.
12. Write a program to implement n-queen problem using Backtracking approach.

Course Outcomes:

After completion of course the students will be able to:

CO1:	Describe various data structures such as arrays, linked lists, stacks, queues, trees and Graphs and the operations performed on them.
CO2:	Apply the concepts of various data structures such as linked lists, stacks, queues, trees and graphs to write algorithms and programs to implement them.
CO3:	Analyse various searching and shorting algorithms such as Linear search, Binary search, Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort to estimate their time and space complexity.
CO4:	Develop solution of the given problem using appropriate data structures.

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COURSE CONTENTS w. e. f. July 2023

Subject Code	Subject Name & Title	Maximum Marks Allocated						Hours/ Weeks			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI34	Object Oriented Programming Using Java	70	20	10	30	20	150	3	-	2	4

Module-I: Introduction
Introduction to Object Oriented Thinking & Object Oriented Programming: Comparison with Procedural Programming, features of Object oriented paradigm–Merits and demerits of methodology; Object model; Elements of OOPS, processing.

Module-II: Encapsulation and Data Abstraction-
Concept of Objects: State, Behavior &Identity of an object; Classes: identifying classes and candidates for Classes Attributes and operations, Access modifiers, Static member sofa Class, Instances, Message passing, and Construction and destruction of Objects.

Module-III: Relationships –
Inheritance: purpose and its types, 'is a' relationship; Association, Aggregation. Concept of Abstract classes, interface.

Module-IV: Polymorphism:
Introduction, Method Overriding & Overloading, static and run time Polymorphism.

Module-V: Multithreading in Java:
Difference between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter thread communication.
Java Exception Handling: Try, catch, throw, throws and finally. Types of exceptions: user defined and built-in exceptions.

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Reference Books:

An Introduction to Object-Oriented Programming, Timothy Budd Addison Wesley Publication.
Understanding Object-Oriented Programming with Java, T. Budd, Pearson Education.
Object-Oriented Programming through Java, P. Radha Krishna, Universities Press.
Thinking in Java, Bruce Eckel, Prentice Hall.
Java the complete reference, Herbert schildt, McGraw Hill
Programming in Java, S. Malhotra and S. Choudhary, Oxford University.
Object Oriented Analysis & Design, Booch, Addison Wesley.
Principles of Object Oriented Analysis and Design, James Martin, PrenticeHall/PTR.

List of Experiment AI34 Lab

1. Write a program to demonstrate the encapsulation and data hiding capabilities of classes
2. Write a program to demonstrate the use of constructors and destructor.
3. Write a program to implement Function Overloading using member function
4. Write a program to implement Function Overloading using friend function
5. Write a program to overload + operator to add two time objects.
6. Write a program to overload + operator to concatenate two strings.
7. Write a program to implement Single Inheritance
8. Write a program to implement Multiple Inheritance
9. Write a program to implement Stack using object oriented approach.
10. Write a program to implement Queue using object oriented approach.
11. Write a program to implement Singly Linked List using object oriented approach.

Course Outcomes:

After completion of course the students will be able to:

CO1:	Explain the concepts of Object Oriented Programming, and the Java's concepts of Multithreading and Exception Handling.
CO2:	Apply the concepts of OOP to solve the given problem via Java Program.
CO3:	Implement the concepts of OOP, Multithreading and Exception Handling Using Java Program.

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COURSE CONTENTS **w. e. f. July 2023**

Subject Code	Subject Name & Title	Maximum Marks Allocated						Hours/ Weeks			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI35	Digital Logic design & Computer Organization	70	20	10	30	20	150	3	-	2	4

Module-I: Basic Structure of Computers:
Computer types, Functional units , Basic operational concepts , Bus structures, Software Performance, multi processor and multi computers , computer generations, data representation: binary numbers , fixed point representation , Floating point representation. Number Base conversions , octal and hexadecimal numbers, complements, Signed binary numbers, Binary codes.

Module II: Digital Logic Circuits - I:
Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions .Flip-flops, Combinational Circuits.
Digital Logic Circuits - II: Registers, Shift Registers, Binary counters, Decoders, Multiplexers, Programmable Logic Devices.

Module III: Computer Arithmetic:
Algorithms for fixed point and floating point addition, subtraction, multiplication and division operations .Hardware Implementation of arithmetic and logic operations, High performance arithmetic.
Instruction Set & Addressing: Memory Locations and Addresses, Machine addresses and sequencing , Various Addressing Modes, Instruction Formats ,Basic Machine Instructions. IA32 Petium example .

Module IV: Processor organization:
Introduction to CPU , Register Transfers, Execution of Instructions, Multiple Bus Organization, Hardwired Control, Micro programmed Control Memory Organization: Concept of Memory, RAM, ROM memories, memory hierarchy, Cache memories, virtual memory, secondary storage ,memory management requirements. : Introduction to I/O Organization , Direct memory access,

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buses, interface circuits standard I/O Interfaces.

Module V: Computer Network:
Basic Terminologies of computer network, LAN, WAN, MAN, PAN, Network Devices- Routers, HUB, Switches, Bridge ,Ethernet, etc ,Network topology, Basic OSI model and its applications

Reference BOOKS:
Computer Organization– CarlHamacher, ZvonkoVranesic,SafwatZaky ,fifthedition,McGrawHill.
Computer Architecture and Organization An Integrated Approach Miles Murdocca, Vincent Heuring, Second Edition, WileyIndia.
Computer Systems Architecture – M. Moris Mano, IIIrd Edition, Pearson.
Computer Organization and Architecture–William Stallings Sixth Edition,Pearson
.Computer- organization and Design- David A. Paterson and John L.Hennessy Elsevier.
Fundamentals or Computer Organization and Design,-SivaramaDandamudi Springer Int.Edition.
DigitalDesign–Third Edition ,M.Morris Mano, Pearson Education/PHI.
FundamentalsofLogicDesign,Roth,5th Edition,Thomson.

List of Experiment AI35 Lab

1. To study and verify the truth-table of logic gates.
2. Realization of a Boolean function.
3. Design and implementation using nand gate.
4. To study and verify adders and subtractors.
5. To study and verify binary to gray generator
6. To study and verify multiplexer and demultiplexer.
7. Realization of a boolean function using logisim.
8. To study and verify flip-flops.
9. To study and verify binary counters.

Course Outcomes:
At the end of the course the students will be able to:

CO1	Understand basic structure of computers and data representation, number base conversion, binary codes etc
CO2	Design develops and test different combinational, sequential circuits and their role in the digital system design
CO3	Solve and implement different arithmetic and logical operations. Interpret different Instruction set and addressing modes.
CO4	Analyze execution of instructions by CPU and understand concept of memories and Bus organization
CO5	Analyze interrupts and data transfer through I/O Interfaces.

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Bachelor of Technology (B.Tech.) IV Semester (Artificial Intelligence & Data Science)

COURSE CONTENTS w. e. f. July 2023

Subject Code	Subject Name & Title	Maximum Marks Allocated						Hours/ Weeks			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI 43	Data Base Management System	70	20	10	30	20	150	3	-	2	4

Module I: Introduction:

General introduction to database systems, DBMS Concepts and architecture, Data models- Hierarchical, Network and Relational, Three-schema architecture of a database, Data independence- Physical and Logical data independence. Challenges in building a DBMS, Various components of a DBMS.

Module II: Entity Relationship Model:

Conceptual data modeling - motivation, Entities, Entity types, Various types of attributes, Relationships, Relationship types, E/R diagram notations, Keys: Super key, Candidate key, Primary Key, Alternate key and Foreign key. Extended ER features: Specialization, Generalization, Aggregation, Examples.

Module III: Relational Data Model:

Concept of relations, Schema-instance distinction, Keys, referential integrity and foreign keys; Relational Algebra: Selection, Projection, Cross product, Various types of joins, Division, Example queries; Converting the database specification in E/R notation to the relational schema; SQL: Introduction, Data definition in SQL, Table, key and foreign key definitions, Update behaviors, Querying in SQL, Basic select-from- where block and its semantics, Nested queries, Aggregation functions group by and having clauses.

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Module IV: Functional Dependencies and Normal forms:
Importance of a good schema design, Problems encountered with bad schema designs, Motivation for normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, Closure of a set of FD's, Minimal covers; Definitions of 1NF, 2NF, 3NF and BCNF, Decompositions and desirable properties of them; Multi-valued dependencies and 4NF, Join dependencies and definition of 5NF.

Module V: Transaction Processing and Recovery Concepts:
Concepts of transaction processing, ACID properties, Testing for Serializability of schedules, conflict & view serializable schedule, recoverability; Concurrency Control: Locking based protocols for CC; Deadlock handling; Recovery from transaction failures: Log based recovery, Checkpoints.

Reference Books:

1. AviSilberschatz, Henry F. Korth, S. Sudarsan, Database System Concepts.
2. Elmasi, R. and Navathe, S.B., "Fundamentals of Database Systems", Pearson Education.
3. Date, C. J., "Introduction to Database Systems", Pearson Education.
4. Ramakrishnan, R. and Gekhre, J., "Database Management Systems", McGraw-Hill.
5. Vipin C Desai, "An Introduction to Database Systems", Galgotia.

List of Experiment (AI 43 Lab)

1. Implementation of DDl. Commands of SQL with suitable examples-Create table , Alter table, Drop table
2. Implementation of DML commands of SQL , with suitable examples- Insert, update, Delete.
3. Implementation of different types of function with suitable example- Number function , Aggregate function, character function, Conversion function, Date function.
4. Implementation of different types of operations in Sql- Arithmetic operation , Logical operators, Comparison operator, Special operator , Set operation
5. Implementation of different types of join- inner join , Outer join, Natural join etc
6. Study and implementation of- Group By & Having clause, Order By clause , Indexing
7. Study and implementation of – Sub queries , Views.
8. Study and implementation of different types of constraints.
9. Study and implementation of Database Backup & Recovery commands . Study & Implementation of RollBack, Commit, Save point.
10. Creating Database / Table Space. Managing Users , Create User , Delete User , Managing roles: Grant , Revoke.
11. Study and implementation of PL / SQL.
12. Study and implementation of SQL Triggers.

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Bachelor of Technology (B.Tech.) IV Semester (Artificial Intelligence & Data Science)

COURSE CONTENTS w. e. f. July 2023

Subject Code	Subject Name & Title	Maximum Marks Allocated						Hours/ Weeks			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI 44	Operating System	70	20	10	30	20	150	3	-	2	4

MODULE-I Introduction to Operating System:

Architecture, Goals & Structures of Operating System, Basic functions, Interaction of O. S. & hardware architecture, System calls, Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real -time O.S., Basics of Network Operating System, Server Operating System and Real Time Operating System.

MODULE-II Process Management:

Process Concept, Process states, Process control, Threads, Uni-processor Scheduling: Types of scheduling: Preemptive, Non preemptive, Scheduling algorithms: FCFS, SJF, RR, Priority, Thread Scheduling, Real Time Scheduling. System calls like ps, fork, join, exec family, wait. I/O Devices, Organization of I/O functions, Operating System Design issues.

MODULE-III Concurrency control:

Concurrency: Principles of Concurrency, Mutual Exclusion: S/W approaches, H/W Support, Semaphores, pipes, Message Passing, signals, Monitors, Classical Problems of Synchronization: Readers-Writers, Producer Consumer, and Dining Philosopher problem. Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, System calls like signal, kill.

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MODULE-IV Memory Management:

Memory Management requirements, Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Fragmentation, Swapping, and Paging. Segmentation, Demand paging, Virtual Memory: Concepts, management of VM, Page Replacement Policies (FIFO, LRU, Optimal, Other Strategies), Thrashing., I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), RAID, Disk Cache.

MODULE-V Inter Process Communication and Multi-Processors:

Basic Concepts of Concurrency, Cooperating process, Advantage of Cooperating process, Bounded- Buffer ,Shared-Memory Solution, Inter-process Communication (IPC), Basic Concepts of Inter- Communication and Synchronization, Multi-Processor Based and Virtualization Concepts, Virtual machines; supporting multiple operating systems simultaneously on a single hardware platform; running one, operating system on top of another. Reducing the software Engineering effort of developing operating systems for new hardware architectures.True or pure virtualization.Para virtualization; optimizing performance of virtualization system; hypervisor call interface and process.

Reference Books:

1. Silberschatz, A., Galvin, P.B. and Gagne, G., "Operating System Concepts", John Wiley (2004) 7th ed.
2. W. Stallings, "Operating Systems Internals and Design Principles", Prentice Hall (2009) 6th ed.
3. Andrew S. Tanenbaum, "Operating Systems: Design and Implementation", Pearson (2006)
4. Andrew S. Tanenbaum, Modern Operating Systems, Pearson 4th edition (2014)
5. Dhamdhere, D.M., "Operating Systems: A Concept Based Approach", McGraw Hill (2008) 2nd ed.

List of Experiment (AI 44 Lab)

1. FCFS CPU scheduling algorithm.
2. SJF CPU scheduling algorithm.
3. Priority CPU scheduling algorithm.
4. Round Robin CPU scheduling algorithm.
5. Classical inter process communication problem (Producer Consumer).
6. Classical inter process communication problem (Reader Writer).
7. Classical inter process communication problem (Dining Philosophers)
8. FIFO page replacement algorithm..
9. LRU page replacement algorithm..
10. LFU page replacement algorithm..
11. Optimal page replacement algorithm.

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AI 42	Introduction to AI & ML	70	20	10	30	20	150	3	-	2	4

Module I: Introduction to AI and State Space Search:
Meaning and definition of artificial intelligence, Study and comparison of breadth first search , depth first search Techniques, hill Climbing, Best first Search. A* algorithm, AO* algorithms etc., and various types of control strategies.

Representation of Knowledge: Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, comparison of propositional and predicate logic, Resolution, refutation, deduction, theorem proving,inferencing, monotonic and no monotonic reasoning.

Module II: Knowledge Inference & Reasoning:
Probabilistic reasoning, Baye's theorem, semantic networks scripts schemas, frames, conceptual dependency, fuzzy logic, forward and backward reasoning.

Game Playing:Game playing techniques like minimax procedure, alpha-beta cut-offs etc, planning, Study of the block world problem in robotics

Module III: Introduction to Machine Learning:
Basic Concepts, Understand and Formalize the Learning Problem, Model and Parameters, Training, Validation and Test Data. Metrics for Evaluation of Model

Performance: Accuracy, Precision, Recall, Confusion Matrix, Bias Variance tradeoffs, Overfitting and Under fitting. Types of Learning.

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Module IV: Supervised Learning:
Classification, Linear Regression, Linear Regression of One Variable using Gradient Descent Algorithm, Linear Regressions of Multiple Variables using Gradient Descent Algorithm. Logistic Regression. Decision Trees, Ensemble Learning – Boosting – Bagging, Naive Bayes Classifier, k-Nearest Neighbors Classifier, Support Vector Machine.

Module V: Unsupervised Learning:
Hierarchical Clustering, k-Means Clustering, Mixture Models, Density-Based Spatial Clustering of Applications with Noise (DBSCAN), Ordering Points to Identify the Clustering Structure (OPTICS) Introduction to Neural Network: Perceptron, Basic Neural Network Structure, Forward Propagation, Cost Functions, Error Backpropagation Algorithm, Training by Gradient Descent.

Reference Books:

1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill.
2. Nelsson N.J., Principles of Artificial Intelligence, Springer Verlag, Berlin.
3. Deepak Khemani "Artificial Intelligence", Tata McGraw Hill Education.
4. Dan W. Patterson, "Introduction to AI and ES", Pearson Education..
5. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", CRC Press.
6. Chapman and Hall, " Machine Learning and Pattern Recognition Series", CRC Press.
7. Tom M Mitchell, "Machine Learning", McGraw Hill Education.
8. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data",
Cambridge University Press.
9. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", Wiley.
10. EthemAlpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)" , MIT Press.
11. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press.

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List of experiments for AI and ML(AI 42) Lab

1. Write a program to implement BFS and DFS search strategies.
2. Write a program to implement A* algorithm and AO* algorithm.
3. Write a program to implement Min Max procedure.
4. Write a program to implement Linear regression .use appropriate dataset for training and testing. Compare the performance of your program of Linear regression with that of sklearn's implementation.
5. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
6. Write a program to implement Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong prediction . Compare the performance of your implementation.with that of sklearn's implementation.
7. Write a program to implement the naïve Bayesian classifier for a sampling training data set stored as a CSV file. Compute the accuracy, precision and recall of the classifier, considering few test data sets.
8. Write a program to implement K- means clustering algorithm. Use appropriate data set for training and testing. Compare the performance of your Implementation with that of sklearn's implementation.
9. Write a program to compare the result of DBSCAN and OPTICS clustering algorithms : Use appropriate Dataset to demonstrate the clusters identified by these algorithms. You can use Python ML library classes of DBSCAN and OPTICS.
10. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

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AI45	Microprocessor & Microcontroller	70	20	10	-	-	100	3	1	-	4

Module I: Vonnewmann model-

CPU, Memory, I/O, System Bus, Memory address register, Memory data register, program Counter, Accumulator, Instruction register, Micro operations, Register Transfer Language, Instruction Fetch, decode and execution, Instruction formats. Control Unit Organization: Hardwired control Unit, Micro programmed Control Unit, Control Memory, Address Sequencing, Micro instruction formats, Micro program sequencer, Microprogramming. Memory organization: RAM, ROM, Memory maps, Cache memory, Cache mapping, Associative memory, Virtual memory. Memory management hardware.

Module II: Introduction to 8085

Fundamentals of Architecture of 8085, pin configurations, machine cycles and bus timings, Instruction classification and data formats, addressing modes, Data transfer operations, Arithmetic operations, Logic operations, Branch operations. Interrupts; 8085 interrupt process, multiple interrupt and priorities, vectored interrupts, Writing Assembly Language programs.

Module III: Interfacing

Memory interfacing, Interfacing I/O devices, Memory mapped I/O, Interfacing of 8085 with RAM and ROM, 8279 programmable Keyboard/Display interface, 8255A programmable Peripheral interface, Interfacing keyboard and seven-segment display and other applications using 8255A, 8254 , 8259A, Direct Memory Access (DMA), 8257 DMA Controller. Basic concept of serial I/O, Standards in serial I/O; RS 232C standard, 8085-serial I/O lines, 8251

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USART, interfacing scanned multiplexed displays and Liquid Crystal Displays, Interfacing a matrix keyboard. All Application based learning.

Module IV: Intel 8086 microprocessor:
Introduction to 16-bit microprocessor, 8086 architecture, pin functions.Basics of Register organization, Instruction Format; Addressing modes of 8086, Minimum and Maximum mode configuration, memory interfacing with 8086 in minimum and maximum mode. Interrupts, Instruction set of 8086; Data Transfer Instruction, Arithmetic Instructions, Branching and Looping Instructions, Flag Manipulation and machine control Instructions, Logical, Shift and Rotate Instructions, String Instructions, Assembler Directives and Operators; Assembly language Programming of microprocessor 8086.Advanced generations of processors.

Module V: Microcontroller:
Introduction to micro controller 8051, its architecture, Signal descriptions, Register set, Operational features; Program status word (PSW), memory and I/O addressing by 8051, I/O configuration, Counters and Timers, Interrupts and stack of 8051, Addressing modes and instruction set of 8051.

Reference Books:
1. Microprocessor architecture, Programming and Applications with the 8085 by Ramesh S.Gaonkar
2. Morris Mano, "Computer System Architecture" (PHI).
3. William Stalling, "Computer Organization and Architecture" (PHI).
4. BB Brey, "The Intel Microprocessors, Architecture, Programming and Interfacing" (PHI)
5. KM Bhurchandi and AK Ray, "Advanced Microprocessors and Peripherals" (Me-Graw Hill

Course Outcomes: After completion of course the students will be able to:

CO1:	Understand the fundamental concepts of computer system architecture
CO2:	Learn the operation and programming of 8085 microprocessor.
CO3:	Illustrate how the different peripherals are interfaced with microprocessor
CO4:	Analyze the architecture and working of 8086 microprocessor.
CO5:	Analyze of the working of 8051 microcontroller.

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		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
BT-51	Professional Ethics	70	20	10	-	-	100	3	1	-	4

Module I. HUMAN VALUES:
Morals , values and Ethics-Integrity-Work Ethics-Service Learning-Civics virtue-respect for others- Living peacefully - Caring – Sharing - Honestly – Courage - Valuing time- Cooperation - Commitment- Empathy - Self Confidence – Character – Spirituality - Introduction to Yoga and meditation for professional excellence and stress management.

Module II: ENGINEERING ETHICS:
Sensors of Engineering Ethics- Variety of moral Issues- Types of Inquiry – Moral dilemmas- Moral autonomy- Kohiberg's theory – Gilligan's theory – Consensus and Controversy – Models of Professional roles – Theories about right action – self interest – Customs and Religion- Uses of Ethical Theories.

Module III : ENGINEERING AND SOCIAL EXPERIMENTATION:
Engineering as Experimentation – Engineering as responsible Experimenters – Codes of Ethics – A balanced Outlook on Law.

Module IV: SAFETY,RESPONSIBILITIES AND RIGHT:
Safety and Risk – Assessment of Safety and Risk – Risk Benefit analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentially – Conflict of interest –

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Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Module V: GLOBAL ISSUES:

Multinational Corporations – Environment Ethics – Computer Ethics – Weapons Development – Engineering as Managers – Consulting Engineers – Engineering as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate social Responsibility.

References Books:

1. MikeW.Martin and Roland Schinzinger, "Ethics in Engineering" Tata Mc-Graw Hill New Delhi,2003.
2.Govindaranjan M, Natarajan S, Senthil Kumar V.S, "Engineering Ethics", Prentice Hall of India, New Delhi,2004.
3.Charies B. Feddermann, "Engineering Ethics" Pearson Prentics Hall, New Jersey 2004
4.Charies E. Herris Michael S. Pritchard and Michael J. Rabins "Engineering Ethics – Concepts and cases" Learning, 2009.
5.John R Boatright, "Ethics and the conduct of Business" , Pearson Education New Delhi 2003.
6.Edumund G Seebauer and Robert L Barry, "Fundamental of Ethics for Scientists and Engineers", Oxford University Press, Oxford 2001.
7.Laura P. Hartman and joe Desjardins, "Buisness Ethics: Decision Making for Personal Intigrity and Social Responsibility" McGraw Hill Education India Pvt Ltd, New Delhi 2013.
8.World Community Service Centre, "Value Education",Vethathiri publication, Erode 2011.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society .At the end of the course the student will be able to

CO1	Understand Human Values
CO2	Apply Engineering Ethics.
CO3	Apply Engineering as Social expectation.
CO4	Assess Safety and Risks.
CO5	Deep Perception of Global Issues.

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Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
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AI51A	Probability and Random Process	70	20	10	-	-	100	3	1	-	4

Module-I: Probability Axioms of probability conditional
Probability Bay's theorem discrete and continuous random variables, Moments, Moment generating functions Binomial, Poisson Geometric, uniform, Exponential and neural distribution, Counting (permutation and combinations), probability axioms, Sample space, events, independent events, mutually exclusive events, Bernoulli Distribution.

Module-II: Two-dimensional Random. Variables Joint distributions, Marginal and conditional distributions Covariance correlation and linear regression, Transformation of random variables, central limit theorem (for independence and identically distributed random variables)

Module-III: Random Processes
Classification stationary process Markov process, Markov chain Poisson process, Random telegraph process. Correlation and spectral densities-Autocorrelation functions , cross correlation functions and properties, power spectral density, cross spectral density properties.

Module-IV: Linear system with Random Inputs
Linear time invariant system, system transfer function, linear systems with random inputs, auto correlation and cross correlation function of input and output. System stability.

Module-V: Statistics
Conditional expectation and variance, mean, median, mode and standard deviation,t-distribution, chi-squared distributions, cumulative distribution function, Conditional PDF, confidence interval, z-test, t-test, chi-squared test.

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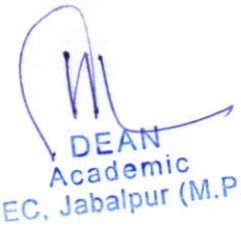
Reference Books:

1. Probability and Random Processes By S. Palaniammal, Prentice Hall, 2011
2. Probability theory and Random Processes By K. Mergu CBS Publisher.

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Basic understanding of probabilities and various type of distributions.
CO2	Understanding of conditional & point probability, various, stationary process, markov process.
CO3	Developing concept of spectral density and system transfer function



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AI51B	Theory of Computation	70	20	10	-	-	100	3	1	-	4

Module-I Introduction of Automata Theory

Examples of automata machines, Finite Automata as a language acceptor and translator, Types of Finite Automata: Non Deterministic Finite Automata (NDFA), Deterministic finite automata machines, Equivalence of NDFA and DFA, minimization of automata machines, 2 way DFA. Moore mealy machines , composite machine, Conversion from Mealy to Moore and vice versa.

Module-II: Regular Expressions and Languages:

Arden's theorem.Finite Automata and Regular Expressions, From DFA's to Regular Expressions, Converting DFA's to Regular Expressions. Properties of Regular Languages, The Pumping Lemma for Regular Languages, Applications of the Pumping Lemma Closure Properties of Regular Languages, Decision Properties of Regular Language.

Module -III: Grammars:

Types of grammar, context sensitive grammar, and context free grammar, regular grammar. Derivation trees, ambiguity in grammar, simplification of context free grammar, conversion of grammar to automata machine and vice versa, Chomsky hierarchy of grammar, Eliminating null and unit productions. Chomsky normal form and Greibach normal form.

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Module-IV: **Push** down **Automata:**
example of PDA, deterministic and non-deterministic PDA, conversion of PDA into context free grammar and vice versa, CFG equivalent to PDA, Petri net model.

Module-V: Turing Machine
Techniques for construction. Universal Turing machine Multi-tape , multi-head and multidimensional Turing machine, N-P complete problems. Decidability and Recursively Enumerable Languages, decidability, decidable & undecidable languages , Halting problem of Turing machine & the post correspondence problem.

Reference Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory Languages and Computation", Pearson Education, India.

2. K. L. P Mishra, N. Chandrashekaran "Theory of Computer Science-Automata Languages and Computation", Prentice Hall of India.

3. Harry R. Lewis & Christos H. Papadimitriou,,"Element of the Theory computation ", Pearson.

4. Cohen, D.I. and Cohen, D.I., "Introduction to computer theory", Wiley.

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Illustrate conceptual knowledge of switching and finite automata theory & languages.
CO2	Develop concept of abstract models of computing such as NFA, DFA, PDA. Turing machine and to check their power to recognize the languages
CO3	Interpret rigorously formal mathematical methods to prove properties of languages, grammars and automata.
CO4	Classify types of grammars, simplification and normal form and P. NP problems.

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AI51C	Information Theory And Coding	70	20	10	-	-	100	3	1	-	4

Module –I Source Coding:

A logarithmic measure of information, Average mutual information and entropy, Information measures for continuous random variables, Noiseless coding theorem, Coding for discrete memory-less sources, Discrete stationary sources, The Lampel-Ziv algorithm, Coding for analog sources, rate distortion function.

Module –II Channel Capacity and Coding:

The converse to the coding theorem, Channel models, Channel capacity, Achieving channel capacity with orthogonal Signals, Channel reliability functions, Random coding based on M-ary Binary-coded signals, Practical Communication systems in light of Shannon's equation.

Module –III The Noisy-channel coding theorem:

Linear Block codes, The generator matrix and the parity check matrix, Some specific linear block codes, Cyclic codes, Decoding of linear block codes, bounds on minimum distance of the linear block codes.

Module –IV Convolutional Codes:

Basic properties of the convolutional codes, The transfer function of a convolutional code, Optimum decoding of convolutional codes- The Viterbi algorithm, Distance properties of binary convolutional codes, Other decoding algorithms for convolutional codes, Practical considerations in the application of convolutional codes.

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Module –V Complex codes based on combination of simple codes:
Product codes, Concatenated codes, Turbo codes, The BCJR algorithm.
Coding for Bandwidth-constraint channels: Combined coding and modulation, Trellis coded modulation.

References Books :

1. Simon Haykins: Communication Systems, 4th Edition, John Wiley.
2. J. G. Proakis: Digital Communications, McGraw Hills
3. B.P. Lathi: Modern Analog and Digital Communication System, Oxford University Press
4. R. G. Gallager: Information Theory and Reliable Communication, John Wiley and Sons
5. A. J. Viterbi and J. K. Omura: Principles of Digital Communications and Coding, McGraw Hill Series.
6. U. Madhow: Fundamentals of Digital Communication, Cambridge University Press.

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

CO1	Understand various source coding algorithm.
CO2	Describe channel capacity.
CO3	Translate noise channel coding theorem.
CO4	Understand various types of the convolution codes.
CO5	Execute complex codes based on combination of simple codes.

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AI52	Deep Learning	70	20	10	30	20	150	3	-	2	4

Module- I

Basics of neural networks, perception algorithm feed forward and Back propagation Networks, ideaof computational units. McCulloch Pitts unit and threshold logic unit, Linear perception, perceptionlearning algorithm.

Module-II

Feed Forward network, multilayer Perception, Gradient descent, Back propagations Empirical riskminimization, regularization auto encoders.

Module-III

Convolutional networks, convolution separation, verity of basic convolution function, structured outputs, Data types, Le Net, AlexNet.

Module-IV

Recurrent Neural Networks Bidirectional RNNS deep recurrent N/W, Recursive Neural Network the long short time memory & other gated Recurrent Unit.

Module-V

Deep Generative models, Boltzmann Machines, Restricted Boltzmann machines, machines introduction to MCMC and cubbs seeping gradient N/W Deep Boltzmann machines. Deep Boltzmann machines, application of deep learning in speech recognition

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Reference Books:

(1) Deep learning MIT, Press 2016 By Ia Good fellow, Yoshna Brangio
(2) Fundamental of deep learning By Nikhil Budeima, O'Reilly Publication
(3) Make your own neural network By Tariq Pashid

Course outcomes: After completion of course, student will be able to:

CO1 Understand basic need of deep learning.
CO2 Knowledge of deep learning algorithm.
CO3 Understanding CNN RNN in real world application.
CO4 Applying Deep Learning in practical application.

List of Experiments (AI52Lab)

1. Implementation of different activation functions to train Neural Network. usingMatlab/Python.
2. Implementation of different learning Rules.
3. Implementation of Perception Networks
4. Implementation of adaline network for system Identification
5. Implementation of the Madaline networks
6. Pattern matching with different rules.
7. Project related to application of machine learning in health care
8. Project related to application of machine learning in business analytics.
9. Pin point implementation of application of deep learning in sports analytics.
10. Deep learning project in Time series analysis and fore casting.
11. Generate generic Python code for deep learning Networks ..
12. Create and Explore Data store for image classification using deep learning .

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		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI53	DATA SCIENCE	70	20	10	30	20	150	3	-	2	4

Module I: Introduction

Introduction to Data Science - Evolution of Data Science - Data Science Roles - Stages in a Data Science Project - Applications of Data science in various fields - Data Security Issues. Data Collection and Date Pre-Processing, Data Collection strategies - Data Pre-Processing overview - Data cleaning - Data integration and Transformation - Data Reduction - Data Discretization.

Module II: Exploratory Data Analytics

Descriptive statistics - Mean, Standard Deviation, Skewness and Kurtosis - Box plots - pivot Table - Heat Map - Correlation Statistics - ANOVA. Visual data AI algorithms for data analytics.

Module III: Model Development

Simple and Multiple Regression - Model Evaluation using visualization - Residual plot Distribution Plot - Polynomial Regression and pipelines – Measures for in-sample Evaluation - Prediction and Decision Making.

Module IV: Model Evaluation

Generalization Error – Out-of-sample Evaluation Metrics - Cross Validation - overfitting - under Fitting and Model Selection - Prediction by using Ridge Regression - Testing Multiple parameters by using Grid Search.

ModuleV: Introduction to Data Mining and Data Warehousing

Data types ,Introduction to Data Mining, Understand data: Mean, median, mode, standard deviation, correlation, variance, covariance, likelihood, data, nominal, ordinal, ratio, interval, factor, levels. Data warehousing Components, Building a Data warehouse, Data Warehouse Architecture, Data transformation such as normalization, discretization, sampling, compression; data warehouse modelling: schema for multidimensional data models, concept hierarchies, measures: categorization and computations.

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Reference Books:

l. Cathy O'Neil and Rachel Schutt , ..Doing Data Science", O'Reilly, 2015.
2. David Dietrich, Barry Heller, Beibei yang, ,,Data Science and Bii data Analytics,,, EMC 2O13
3. Raj, Pethuru, "Handbook of Research on cloud Infrastructures for Big Data Amlytics',, IGI Global.
4. Introduction to Data Science by Paul G. Allen School of Computer Science & Engineering, University of Washington.
5. JojoMoolayil, "Smarter Decisions: The intersection of loT and Data Science,,, PACKT, 2016.

COURSE OUTCOMES: At the end of this course, the students will be able to:

CO 1	Demonstrate proficiency with statistical analysis of data.
CO 2	Build and assess data-based models.
CO 3	Execute statistical analyses with professional statistical software.
CO 4	Demonstrate skill in data management.
CO 5	Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively.

List of Experiments:- AI53 Lab

1. Write R – Programming to plot various charts and graphs. You have to consider minimum two popular data sets and draw all the statistical observations.
2. Write a python Program to apply EDA on any two popular data sets and provided your analysis and interpretations. Use matplotlib library of python along with other libraries for the analysis and interpretation.
3. Write Python program to implement K-Means using inbuilt python Library. Also, write your own program to implement K-Means without using the inbuilt function. Compare and contrast the results.
4. Write a python program to implement a Spam Filter using Linear Regression and K-NN. Use a popular dataset.
5. Write a Python Program to Scrapping the Web using suitable API. Create a usable dataset for classification and clustering purpose.
6. Write a Python Program to implement Filter and Wrappers.
7. Write a Python Program to implement Decision Trees, Random Forests – The inbuilt functions should not be used for the implementation.
8. Write a python Program to implement Singular Value Decomposition and Principal Component Analysis. Use any popular data set.
9. Write a python Program to extract the friendship details of your face book account as Social network Graph and represent in various visual forms.
10. Write Python Program using Bokeh 2.1.1 realize the all the basic principles of data visualization.
11. Consider any popular dataset and present complex visualization principle using Bokeh 2.1.1.

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Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI54	Digital And Wireless Communication	70	20	10	30	20	150	3	-	2	4

Module-I: Analog & Digital Communication

Analog Modulation, Sampling Theorem, Digital Modulation, AM Modulation, FM Modulation, Phase Modulation, Demodulation techniques, PCM Basic, ADM, DM, DPCM, PPM, PAM quantization in PCM

Module-II: Communication System

Overview of communication and information theory, coding- Shannon fano and halffman, LZW coding, Communication protocols in brief, Decoders – Viterbi Decoder, Redundancy coder – decoder and advanced decoders in trends.

Module-III: Mobile Communication

Mobile communication, block diagram, protocols and channel .Introduction to mobile communication Block Diagram, Transmitter, Base Stations, Routers communication, protocols, channels, and multi path channels, path loss, Fading, etc.

Module-IV: Wireless Communication

Wireless communication, Advanced Modulator and Demodulators, Overview of TDMA, FDMA, CDMA, WCDMA and OFDMA. Different Generations of 3G/4G/5G/6G of wireless communication system and advancement in technology in mobile, radio and wireless Communication.

Module-V: Communication System & Standards

Advance Wireless System and Communication Standards Like MPEG – 4, MPEG -7, JPEG- 2000, All Audio, Speech coders, MP3, H.264, G.711, G.722, etc.

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Reference Books:

1. Fundamentals of Wireless Communication: David Tse and PramodViswanath
2. Principles of Mobile Communication : Gordon L. Stüber
3. WIRELESSCOMMUNICATIONS : AndreaGoldsmith
4. Wireless Communication Principles and Practice : T. S. Rappaport

Course outcomes:

After completion of course, student will be able to:

CO1	Understand basics concept of Digital modulation techniques
CO2	Comprehend statistical multipath channel modes and path loss.
CO3	Knowledge of capacity of various wireless channels.
CO4	Analyze the diversity in wireless channels.
CO5	Elaborate various wireless systems and standards, 4G, 5G

List of Experiment:-AI54 Lab

1. Verification of sampling theorem.

2. Generation and detection of PCM signals

3 Determine the response of of delta modulation

4. Analysis of responses of ASK

5 Analysis of responses of PSK

6. Experiment on time division multiplexing and other access techniques.

8. Study of 4G and 5G communication System

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Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours/ Week			Total Credits
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AI61A	Applications of AI	70	20	10	-	-	100	3	1	-	4

Module-I: AI and Humanity:
Introduction to human and artificial intelligence, Introduction to AI and Ethics, Understanding Artificial Intelligence: History, definitions, and applications, Ethical considerations in AI, development and deployment, Impact of AI on society and the need for ethical frameworks. AI and Social Implications, AI and workforce:, Reskilling and upskilling, Privacy, Data collection and surveillance, Individual rights and consent, Privacy-preserving AI..

Model-II: Applications of AI in Healthcare:
Overview of AI in healthcare: definitions, trends, and applications, Ethical considerations and challenges in AI adoption in healthcare, Introduction to healthcare data and AI technologies. machine learning algorithms used in healthcare, Supervised and unsupervised learning techniques for medical data analysis, Deep learning approaches for medical image analysis. Applications of natural language processing (NLP) in healthcare, Text mining and information extraction from clinical documents.AI applications in medical imaging for diagnosis and analysis, Genomic data analysis and personalized medicine, Ethical considerations and challenges in AI-enabled medical imaging and genomics.

Module-III: AI in Cyber Security
Basic Concept of cyber security, layers of security, vulnerability threat, harmful acts, Internet Governance-Challenges and Constraints, overview of attackers motives, active attacks, passive attacks, Software and hardware attacks, Methods of defence, Security Models, risk management, Cyber Threats, Application of AI algorithms in the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and case study of the algorithms required and implementations of AI in cyber security, etc.

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Module-IV: AI In Surveillance:

Introduction to surveillance, overview of computer vision problems, various purposes- including tracking and monitoring, intelligent video analytics, Video Content Analytics (VCA), Surveillance Video Anomaly Detection, Radio-Frequency Identification (RFID), Adaptive Kalman Filter, Gaussian mixture model, Auto encoders AE, Recurrent Neural Network (RNN), Monte- Carlo Condensation Filters based techniques of tracking.

Module-V: Application of AI in Agriculture:

Crop yield predictions and price forecasts, Intelligent spraying, Disease diagnose, Crop and soil monitoring, Solar Refrigerators, Lifecycle of agriculture, Challenges faced in Agriculture with traditional farming techniques and brainstorming solutions using AI algorithm.

Reference Books:

1"Artificial Intelligence in Healthcare" by Adam Bohr, Martin Homola, and FilipŽelezný (Oxford University Press)

2."Artificial Intelligence for Healthcare: Domain Adaptation, Transfer Learning, and Representation Learning" by Zachary C. Lipton, Alexandra Chouldechova, and Julian McAuley (MIT Press)

3"Machine Learning for Healthcare" by ZiadObermeyer, Ezekiel J. Emanuel, and Isaac S. Kohane (Oxford University Press)

4."Clinical Decision Support Systems: Theory and Practice" by Eta S. Berner and Andrew S. Bindman (McGraw-Hill) "The Cambridge Handbook of Artificial Intelligence" edited by Keith Frankish and William M.

5Ramsey

6."The Ethics of Artificial Intelligence" edited by Nick Bostrom and EliezerYudkowsky

7.The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies" by

8.ErikBrynjolfsson and Andrew McAfee

9Human Compatible: Artificial Intelligence and the Problem of Control" by Stuart Russell

10."Natural Language Processing in Healthcare" by Wendy W. Chapman, OzlemUzuner, and ÖzlemÇetinoğlu (MIT Press)

Course outcomes: After completion of course, student will be able to:

CO1	Identifying and understanding AI applications techniques.
CO2	AI applications and implementations in Healthcare
CO3	Concept of Cyber security and its applied AI algorithms.
CO4	Design all kind of surveillance and computer vision AI algorithms
CO5	Analyze Empathy and problem design for regular problems in agriculture

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AI61B	Optimization Methods in AI	70	20	10	-	-	100	3	1	-	4

Module I- Introduction to Optimization methods:
Need of optimization Methods, Classes of optimization problems, Problems solving using Graphs, Matrices, Optimization problems formulation in Machine Learning and Signal Processing.

Module II- Overview of applied modeling :
Basics of Linear Algebra and Calculus: Subspaces, Eigen Value, Decomposition, Singular Value Decomposition - Algorithms and Methods, PSD Matrices and Kernel Functions, Vector Calculus.

Module III- Linear and Integer Programming-
Introduction to linear programming, integer programming , related tricks , graphical methods of solving LP and IP .Solved problems on minimizing norms, max flow, solving IP using Branch & Bound and more examples on LP , IP formulations

Module VI Introduction to Optimization of Convex Function:
Introduction to Optimization, Convex Sets, Convex Functions, Lagrange Duality, Convex Optimization Algorithms, Second-order cone models, Semi-definite programming, Semi-infinite programming, Minimax, Sublinear algorithms, Interior Point Methods, Active set, Stochastic gradient, Coordinate descent, Cutting planes method, Applications to Image/Video/Multimedia Processing

Module V Optimization in Machine Learning:
Theory of Gradient Discent & Stochastic ,training a neural network, Newton Method for optimization, Pytorch – Tensor Flow Trainning a neural network & implementation.

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Reference Books:

1.Convex optimization by Stephen Boid
2. Optimization for machine learning by SuvritSra , MIT Press
3. Linear Algebra and Learning from Data, Gilbert Strang

Course outcomes:

After completion of course, student will be able to:

CO1	Identifying and understanding Al Optimizing techniques.
CO2	Develop mathematical modeling and applications.
CO3	Understand the design algorithms for linear systems
CO4	Learn Concept of Convex optimization and its application
CO5	Design optimization in Machine learning algorithms

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		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI61C	Information Retrieval	70	20	10	-	-	100	3	1	-	4

Module-I:INTRODUCTION:
Introduction. History of IR .Components of IR, Issues. Open source Search engine Frameworks. The impact of the web on IR, The role of artificial intelligence (AI) in IR, IR Versus, Web Search. Components of a Search engine, Characterizing the web.

Module-II: INFORMATION RETRIEVAL:
Boolean and vector space retrieval models. Term weighting.TF-IDF, weighting- cosine similarity, Preprocessing, Inverted indices, efficient processing with sparse vectors. Language Model based IR. Probabilistic IR, Latent Semantic Indexing - Relevance feedback and query expansion.

Module-III: WEB SEARCH ENGINE - INTRODUCTION AND CRAWLING:
Web search overview, web structure, paid placement, search engine optimization/ spam. Web size measurement, Web Search Architectures, crawling, meta-crawlers, Focused Crawling, web indexes, Near-duplicate detection, Index Compression, XML retrieval.

Module-IV: WEB SEARCH - LINK ANALYSIS AND SPECIALIZED SEARCH:
Link Analysis.hubs and authorities, Page Rank and HITS algorithms, Searching and Ranking, Relevance Scoring and ranking for Web, Similarity. Hadoop&Map Reduce Evaluation, Personalized search, Collaborative filtering and content-based recommendation of documents and products, "handling "invisible" Web. Snippet generation, Summarization, Question Answering.Cross- Lingual Retrieval.

Module-V: DOCUMENT TEXT MINING:
Information filtering, organization and relevance feedback.Text Mining.Text classification and clustering, Categorization algorithms: naive Bayes; decision trees; and nearest neighbor, Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

Reference Books:
1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press.
2. Ricardo Barza-Yates and BerthierRibeiro- Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2nd Edition. ACM Press Books,
3. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, Ist Edition Addison Wesley.
4. Mark Levene. An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley.

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Course outcomes:

After completion of course, student will be able to:

CO1	Apply information retrieval models.
CO2	Design Web Search Engine.
CO3	Use Link Analysis.
CO4	Apply document text mining techniques.
CO5	Apply document text mining techniques.

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		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work		L	T	P	
AI62 A	Economics & Social Issues	70	20	10	-	-	100	3	1	-	4

Module -I

Indian Economy on the eve of independence British Rule and its impact on economy, Population growth its pattern, genders rural urban literacy, Poverty and inequality agriculture and its productivity Green Revolution Industrial economy pattern, small scale industries

Module -II

Micro economics Theory of consumer behavior, Law of diminishing utility, demand and supply Demand curve elasticity of demand Theory of production, Theory of cast

Module -III

National income Measurement of national income Measurement of cost of living Consumption function investment function Economics fluctuations GDP, GVP

Module –IV

Concept of public and private goods public budget, optimum budget, plan budget, budget procedure of India Taxes in India.

Module-V

Indian economy policy. population policy anti-poverty programmes, NRECA Rishtto employment, MSME, growth, structure EXIM policies

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Reference Books

1.Mishra&PuriIndian Economics

2. Rana&VermaMacro economics

3. NavendraJadhav Monetary Policy

4. J. Ray Chellaih Trends and Issues in Indian Finance

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Understanding Indian Economy since independence
CO2	General information about micro Economics, Demand supply Losses
CO3	Compressive Knowledge about GDP and GNP, consumption
CO4	Compressive study of private public systems functioning and taxation systems
CO5	Knowledge about polices of Indian Economy and MSME

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		Theory			Practical		Total Marks				
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work		L	T	P	
AI62 B	Software Engineering	70	20	10	-	-	100	3	1	-	4

Module I: Introduction:
Phases in Software development, Software Development Life Cycle (SDLC), software development process models Software process models (Linear Sequential Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, and Rational Unified Process), Agileprocess.

Module II: Software Requirement specification (SRS):
Role of SRS, Requirements gathering and problem analysis, requirement specification, validation of SRS document. Use cases: Use case modelling, Use case diagram and use case documents/specifications.

Module III: Object-Oriented Modeling (using UML):
Analysis Modeling, Developing Class Diagram, Sequence Diagram, Class Collaboration Diagram, Activity Diagram, State Transition Diagram. System and Subsystem Design, Design goals, Design Patterns.

Module IV: Software Testing:
Unit testing, Integration testing, System testing, Regression testing, Black-box and White-box techniques, Static Techniques like code inspections, static analysis and dynamic analysis.

Module V: Software Project Management:
Software Project Planning, Cost Estimation, Scheduling, Risk Management, Quality Management, Software Change Management, Software Configuration Management, Re-engineering, Reverse Engineering, Project Plan

Reference books:

1. RS. Pressman,"Software Engineering: A Practitioner's Approach", McGraw-Hill.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning.
3. Sommerville,"Software Enginerring", Pearson Education.

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4. Grady Booch, RobartA. Maksimchuk, Michael W. Engle, BobbijYoung, Jim Conallen, and Kellia Houston, "Object Oriented Analysis &Design with Applications", Pearson Education India.
5. Pankaj Jalote. "An Integrated Approach to Software Engineering", Narosa.
6. Bernd Bruegge, Allen Dutoit: "Object-Oriented Software Engineering: Using UML, Patterns, and Java", Prentice Hall.
7. Blaha and Rumbaugh. "Object-Oriented Analysis and Modeling using UML",TMH.

Course Outcomes:

After successful completion of the course, the students will be able to:

CO 1	Explain concepts of software engineering such as SDLC and software process models, SRS, models (or Software Artefacts), software testing and software project management.
CO 2	Analyze SRS/problem specifications to extract relevant domain elements such as domain class, Class attributes, operations and relationships between classes.
CO 3	The use case models, analysis level class diagram and sequence diagrams for the given usecase.
CO 4	UML models such as Class Diagram, Sequence Diagram. Class Collaboration Diagram, Diagram, State Transition Diagram and test cases for a given software problem.

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		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI62C	Quantum Computing	70	20	10	-	-	100	3	1	-	4

Module-I: Introduction
Introduction to quantum computing, fundamental concepts ,Global perspectives, quantum Bits, Computation, quantum Algorithm, Quantum Information, Assignment on experimental quantum information processing.

Module-II Quantum Algorithms
Super dense coding, quantum teleportation ,applications of teleportation, probabilistic versus quantum algorithms, phase kick-back, the Deutsch Algorithm, simon.s algorithm. Problem solving assignment for algorithms,

Module-III: Quantum Computations
Quantum circuits, Algorithm ,circuit model of computation and simulation, quantum Fourier Transform and applications, search algorithm. Assignment and tutorials based on quantum fourier transform and quantum search algorithm.

Module-IV: Quantum Estimation
Quantum algorithm for Order-finding problem, Eigen value Estimation, finding discrete algorithm hidden subgroups, search algorithm amplitude estimation ,algorithms without knowing the success probability.

Module-V: Quantum Information Theory
Quantum states and accessible information, Data compression, classical information over Noisy quantum channels, quantum box model, error correction and fault tolerant computations. Quantum cryptography .Assignment for quantum compression and noisy channels, problem solving exercises.

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Reference Books-

1. V. Sahni, Quantum Computing, Tata Mcgra-Hill publication,2007
2. P. Kaye, R. Laflamme and M. Mosca, " An introduction to Quantum Computing", Oxford University press 1999.
3. Scott Aarnson, " Quantum Computing Since Democritus", Cambridge University press, 2013
4. Research papers review.

Course Outcomes:

After successful completion of the course, the students will be able to:

CO1	Knowledge of basics of Quantum Computing
CO2	Learn computation techniques and algorithms
CO3	AnalyzAnalyze and design the estimation and error correction algorithms

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI63	Compiler Design	70	20	10	30	20	150	3	-	2	4

Module-1: Introduction:
Compilers and Translators: The phases of the compiler - Lexical Analysis. Syntax Analysis, Intermediate Code Generation. Optimization, Code generation, Bookkeeping, Error handling.

Module-II: Lexical Analysis:
The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata: Regular expressions, NFA, DFA. Design of a lexical analyzer generator.

Module-III: SyntaxAnalysis:
The role of a parser, Context free grammars, writing a grammar, Top down Parsing: Recursive decent parser, Predictive parser. Bottom up Parsing: Handles. Viable prefixes, Operator precedence parsing. LR parsers: SLR, LALR, CLR. Parser generator (YACC).Error Recovery techniques for different parsers.**Syntax directed translation:** Syntax directed definitions, Synthesized and inherited attributes, Construction of syntax trees.

Module-IV:Run time environments:
Source language issues (Activation trees, Control stack, scope of declaration, binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies. Symbol tables: storage, data structures used.

Module-V: Intermediate code generation:
Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples). Code optimization and code generation: Introduction. Basic blocks & flow graphs, DAG, principle sources of optimization: loop optimization, eliminating induction variable, eliminating common sub-expression, loop unrolling, loop jamming etc. Peephole optimization, Issues in the design of code generator, a simple code generator, Register allocation &assignment.

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Reference Book:

1. Michael T. Simpson, Kent Backman, James E. "Corley, Hands-On Ethical Hacking and Network. Defense". Second Edition, CENGAGE Learning
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools!, Second Edition. Pearson Education
3. Randy Allen, Ken Kennedy, OptimizingCompilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers.
4. Steven S. Muchnick, Advanced Compiler Design and Implementationl, Morgan Kaufmann Publishers Elsevier Science, India, Indian Reprint.
5. Keith D Cooper and Linda Torczon, Engineering aCompiler, Morgan Kaufmann Publishers Elsevier Science, 2004.
6. V. Raghavan, Principles of Compiler Design, TataMcGraw Hill Education Publishers.

Course outcomes:

After completion of course, student will be able to:

CO1	Understand fundamentals of the compiler and identify the relationships among different phases of the complier
CO2	Understand the application of finite state machines, recursive descent, production rule parsing, and language semantics.
CO3	Analyze & implement required optimizations modules and apply for various optimization techniques for dataflow analysis.
CO4	Use modern tools and technologies for designing new compilers

List of Experiments AI63 Lab

1. Write a program to identify. Whether a given line is a comment or not.
2. Write a C program to recognize strings "a", a* b + ;abb
3. Write a C program to test whether a given identifier is valid or not
4. Write a c program to simulate lexical analyzer for validating operators.
5. Implement the lexical analyzer using 3 Lex, flex or other lexical analyzer generating tools.
6. Write a c programs for implementing the functionalities of predictive parser for the mini language.
7. Write a Program "C" program to implement LALR parsing
8. Write a program to check whether a string to the grammar or not.
9. Write a program to find the numbers of Whitespaces and new line characters.
10. Write a program to find loading terminal

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AI64	Internet of Things (I.O.T)	70	20	10	30	20	150	3	-	2	4

Module I: IoT Introduction and Fundamentals:
Deciphering the term IoT, Applications where IoT can be deployed, Benefits/challenges of deploying an IoT, IoT components: Sensors, front-end electronics (amplifiers, filtering, digitization), digital signal processing, data transmission, choice of channel (wired/wireless), back-end data analysis. Understanding packaging and power constraints for IoT implementation.

Module II: Signals, Sensors, Actuators, Interfaces:
Sensors: types, signal types, shape and strength, Sensor non-idealities: Sensitivity and offset drift, noise, minimum detectable signal, nonlinearity, Read-out circuits: Instrumentation-amplifier, SNR definition, noise-bandwidth-power trade off, Circuit component mismatch and mitigation techniques (calibration, chopping, auto zeroing etc.), Power/energy considerations, Basic signal processing (filtering, quantization, computation, storage).

Module III: Networking in IoT:
Review of Communication Networks, Challenges in Networking of IoT Nodes, range, bandwidth, Machine-to-Machine (M2M) and IoT Technology Fundamentals, Medium Access Control(MAC) Protocols for M2M Communications, Standards for the IoT, Basics of 5G Cellular Networks and 5G IoT Communications, Low-Power Wide Area Networks (LPWAN), Wireless communication for IoT: channel models, power budgets, data rates, IoT Security and Privacy, MQTT Protocol, Publisher and Subscriber Model.

Module IV: Cloud Computing in IoT
Cloud computing platform (open source) and local setup of such environment, embedded software relevant to microcontroller and IoT platforms (enterprise or consumer), user interfaces.

Module V: Data Analysis for IoT applications
Statistics relevant to large data, linear regression, Basics of clustering, classification.

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Reference BOOKS:

1. Introduction to IOT BySudip Mishra, Aandarup Mukherjee, Arijit Roy & Kamal Kant Hiran.
2. Coco Blue / Amazon / IOT Ahandson approach By ArshdeepBahga&Vijay Madisetti.
3. 21 IOT Experiments ByYashwankanedkar&ShrirangKorde, BPB Publication India.
4. IOT ByEr. Vk Jain, Khanna Publisher.

Course Outcomes:

Upon successful completion of course students will be able to:

CO1	Understand the fundamentals of Internet of things
CO2	Knowledge of interfacing of signal, sensors and actuators in Internet of Things
CO3	Interpret networking in Internet of things
CO4	Implement on Cloud computing in Internet of things
CO5	Analyze the data for various Internet of things applications

List of Experiment:-AI64 Lab

1. Sense the available Networks using arduino.
2. Measuring the distance using ultrasonic Sensor and make led Blink using arduino.
3. Detect the vibration of an object using arduino.
4. Connect with the available Wifi using arduino.
5. Sense a finger when it is placed On Board using arduino.
6. Temperature notification using auduino.
7. LDR to vary the light intensity of LED using Arduino.
8. Switch light on and off Based on the User using Respberry Pi.
9. Application of circuit design using Respberry Pi 3& 4.
10. Study & application of thermal camera & circuit design,
11. AI based audio control operations.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI65	Robotics Technology	70	20	10	30	20	150	3	-	2	4

Module I: Introduction:
Classification of Robots, Basic Robot Components, Manipulator End Effectors, Controller, Power Unit, Sensing Devices, Specification of Robot System, Accuracy Precision and Repeatability. Coordinate Systems: Cartesian Coordinates, Transformation Matrices, Reference Frame Transformations, Orientation, Inverse Transformations, and Graphs.

Module II: Robotic Sensing Devices:
Position, Velocity and Acceleration Sensors, Proximity and Range Sensors, Touch and Slip Sensors, Tectile Sensors, Force and Torque Sensors. Robotic Vision System: Imaging Components Picture Coding, Object Recognition, Training and Vision Systems, Review of Existing System.

Module III: Robotics Programming:
Methods of Robotics Programming, Types of Programming, Robotics Programming Language, Artificial Intelligence Programming. Robot Processing Applications and Algorithms like Dijkstra, Rapidly Exploring Random Tree (RRT),Bellman-Ford, Floyd- warshall algorithm , Conversational AI Algorithm , Human Robot programming ,Future Robotic Application and Related Technologies Development and Algorithms.

Module IV: Image Identification:
Lenses, Camera and Videocon Tube, Image aquasition, Image Processing, Grey scale and Binary Image Analysis, Image enhancement, Object identification, face recognition, The Image Transforms, Concept of Moving Image processing . Applications for Robot vision.

Module V: Control:
Basic Concepts in Control Systems, Digital Control for Positions. System Integration: Mechanism, Actuators and Sensors. Power Transmission Trajectory Planning &Control: Manipulator Equations of Motion Manipulator Control, The Measure of the Robot. Robot tracking techniques. Robot operations.

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Reference Books:

1. J.craig, "Introduction to Robotics" Addision Wesley.
2. Klafter, chemielwski and nagrin, "Robotics Engineering", Prenticehall.
3. Robert J. Schiling, "Fundamental of Robotics analysis and control", Pearson education.
4. K. S. Fu, R.c. Gonzalez, C.S.g lee, "Robotics" TMH.
5 Robotics Technology Khanna Publishers,2021.

Course outcomes:

After completion of course, student will be able to:

CO1	Define various fundamental concepts of robotics such as robot and its components, co-ordinate system, robotic sensing, image identification, 'vision system, control system, robot programming and applications.
CO2	Classify and compare various sensors, sensing devices, robot programming methods, transmission devices and control systems.
CO3	Experiment with programming samples, control rules and parameters with available hardware and software.
CO4	Evaluate mathematic and programming problems of various robotic concepts.

List of Experiment: (AI65Lab)

1. Demonstration of Cartesian / cylindrical/spherical robot.
2. Demonstration of articulated /SCARA robot
3. Design modeling and analysis of two different types of gripper
4. Study of Robotic system design.
5. Robot programming and simulation for pick place
6. Robot programming and simulation for color identification.
7 Robot programming & simulation for cutting and welding
8. Robot programming & Simulation for microprocess.

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI73	Big Data Analysis	70	20	10	30	20	150	3	-	2	4

Module-I Introduction to Big Data
Introduction: Big Data - Characteristics of Big Data - Big data management architecture - Examining Big Data Types - Big Data Technology Components - Big data analytics - Big data analytics examples - Web Data Overview - Web Data in Action.

UNIT- II Hadoop
Introduction: History of Hadoop - Hadoop Ecosystem - Analyzing data with Hadoop - Hadoop Distributed File System - Design - HDFS concepts - Hadoop filesystem - Data flow – Hadoop I / O - Data integrity - Serialization - Setting up a Hadoop cluster - Cluster specification - cluster setup and installation - YARN.

UNIT- III MapReduce
Introduction: Understanding MapReduce functions - Scaling out - Anatomy of a MapReduce Job Run - Failures - Shuffle and sort - MapReduce types and formats - features - counters - sorting - MapReduce Applications – Configuring and setting the environment - Unit test with MR unit - local test.

UNIT- IV Spark
Installing spark - Spark applications - Jobs - Stages and Tasks - Resilient Distributed databases - Anatomy of a Spark Job Run - Spark on YARN - SCALA: Introduction - Classes and objects - Basic types and operators - builtin control structures - functions and closures - inheritance.

UNIT- V NoSQL Databases
Introduction to NoSQL – MongoDB: Introduction - Data types - Creating - Updating and deleing documents - Querying - Introduction to indexing - Capped collections - Hbase: Concepts - Hbase Vs RDBMS - Creating records - Accessing data - Updating and deleting data - Modifying data - exporting and importing data. USE CASES: Call detail log analysis - Credit fraud alert - Weather forecast.

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Reference Books

1.David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, No SQL, and Graph", Morgan Kaufmann/Elsevier Publishers, 2013.
2.Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3.Kim H. Pries, Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers", CRC Press, 2015.
4.EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley Publishers, 2015.
5.Simon Walkowiak, "Big Data Analytics with R", PackT Publishers, 2016.

Course Outcomes

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

CO1	Understand the characteristics of big data and concepts of Hadoop ecosystem
CO2	Implement the fundamental concepts of programming for Big Data.
CO3	Apply Mapreduce programming model to process big data
CO4	Analyze Spark and its uses for big data processing
CO5	Design programs for big data applications using Hadoop components

Lab Work – AI 71Lab

All the Experiments and Programme as per syllabus would be assigned by the Subject Professor.

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		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI74	Digital Image Processing	70	20	10	30	20	150	3	-	2	4

Module-I Introduction
Fundamentals of Image Processing - Applications of Image Processing –Image acquisition Introduction to Image Formation - Sampling and Quantization - Binary Image -,Grey Image, Negative image-Image Matrix- Image formats,Three-Dimensional Imaging - Image file formats - Color and Color Imagery: Perception of Colors.

Module-II Image Transforms
Introduction and Applied solutions of different transforms- Fourier Transforms – Discrete Fourier Transform ,Discrete Cosine Transform, Walsh-transform, Slant, Hilbert, Hadmard, Hough transform , Karhaunen Loeve Transform, Haar Transform ,Discrete Wavelet Transform: and Extension to 2D Signals - Lifting Implementation of the Discrete Wavelet Transforms.

Module-III Image Enhancement and Restoration
Introduction - Distinction between image enhancement and restoration - Histogram-based Contrast Enhancement - Frequency Domain Methods of Image Enhancement - Noise Modelling - Image Restoration - Image Reconstruction. Enhancement: Median filtering, Low pass filtering, Averaging of multiple images, Edge detection - Edge linking via - Thresholding - Region based segmentation, Image sharpening by differentiation and high pass filtering. Restoration: Circulant matrices, Block circulantmatrices, Inverse filtering, Wiener filter.

Module- IV Image Compression
Need of Compression, Watershed algorithm - Use of motion in segmentation - Block diagrams Encoder-Decoder model - Types of redundancies - Lossy and Lossless compression. Different types of Image compression techniques and standards, CCITT, JPEG, JPEG2000, Video Compression Standards.

UNIT- V Recognition of Image Patterns
Introduction - Decision Theoretic Pattern Classification - LDA - Bayesian Decision Theory - Texture and Shape Analysis - Case study - Image mining and Content-Based Retrieval.

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Reference Books

1.Gonzalez, Woods, "Digital Image Processing", Third Edition (DIP/3e), Prentice Hall, 2008.
2.A.K.Jain Digital Image Processing
3.Tinku Acharya, Ajoy K. Ray, "Image Processing Principles and Applications", John Wiley & Sons Publishers, 2005.
4Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Second Edition, Gatesmark Publishing, 2009.
5.Maria Petrou, Costas Petrou, "Image Processing the Fundamentals", Second Edition, John-Wiley and Sons Publishers, 2010.

Course Outcomes

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

CO1	Understand Digital Image Processing, enhancement and restoration techniques .
CO2	Apply Different Image transforms for processing and conversion in different domain of images .
CO3	Apply image compression and segmentation Techniques, awareness of different Compression Standards.
CO4	Design and develop image processing techniques for Pattern recognition and Identification.

Lab Work – AI 74 Lab

All the Experiments and Programme as per syllabus would be assigned by the Subject Professor.

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		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI75	Statistical Data Analysis	70	20	10	30	20	150	3	-	2	4

Module-I Introduction:
Basics of Statistical Data Analysis,Types of Statistical Data Analysis, Clustering and its applications, All live data retrival based Applications.

Module- II Descriptive Data Analytics:
Introduction, descriptive vs predictive vs prescriptive data analytics. Clustering: definition, applications and examples, objective functions: Intracluster and Intercluster distance, clustering method taxonomy, hard clustering, soft clustering.

Module- III K-Means:
key points, procedure, stopping criteria, various distance matrices, distance calculation, examples, choosing an appropriate number of clusters, limitations, assumptions.

Module-IV Hierarchical Clustering:
Introduction and background, divisive method, agglomerative method, dendrogram, agglomerative clustering algorithm, linkage methods: single linkage, complete linkage, average linkage, Centroid distance, time complexity .

Module-V Density based clustering:
Introduction and background, Density-Based Spatial Clustering of Applications with Noise (DBSCAN), parameters: eps (ε), MinPt, Core point, Border point, Noise point, Directly density-reachable, Density-reachable , Density-connected, DBSCAN procedure, advantages, limitations. Assign applied problems.

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Reference Books:

1.An Introduction to Statistical Learning, Gareth James, Springer.
2.Paul L. Meyer, Addison-Wesley, Introductory Probability and Statistical Applications, 1966.

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

CO1	Understanding of Statistical analysis of Data
CO2	Implement different techniques for statiscally data analysis
CO3	Design different algorithm and techniques for all types of statistics and data analytics

Lab Work – AI 75 Lab

All the Experiments and Programme as per syllabus would be assigned by the Subject Professor.

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AI71A	AI-Natural Language Processing (NLP)	70	20	10	-	-	100	3	1	_	4

Module-I:Introduction
Introduction to NLP, stages of NLP ,Basic text processing, spelling correction, Language modelling Lexical Analysis –Regular expression and Automata for string matching - Words and Word Forms –In brief Morphology fundamentals - Morphological Diversity of Indian Languages - Morphology Paradigms - Finite State Machine / Transducers Based Morphology - Automatic Morphology Learning - Parts of Speech - N-gram Models - Hidden Markov Models.

Module-II: Speech Processing
Biology of Speech Processing - Place and Manner of Articulation - Word Boundary Detection - Argmax based computations - HMM and Speech Recognition - Text to Speech Synthesis - Rule based-Concatenative based approach. Concept of Speech compression techniques and standards.

Module-III: Parsing
Theories of Parsing - Parsing Algorithms – Earley Parser - CYK Parser - Probabilistic Parsing - CYK - Resolving attachment and structural ambiguity - Shallow Parsing - Dependency Parsing - Named Entity Recognition - Maximum Entropy Models - Conditional Random Fields.

Module- IV: Lexical Knowledge Networks
Meaning: Lexical Knowledge Networks - Wordnet Theory - Indian Language Wordnets and Multilingual Dictionaries - Semantic Roles - Word Sense Disambiguation - WSD and Multilinguality- Metaphors - Coreference and Anaphora Resolution.

Module- V: Applications: Sentiment Analysis –Openion mining- Text Entailment - Machine Translation - Question Answering System - Information Retrieval - Information Extraction - Cross Lingual Information Retrieval (CLIR).All types of algorithm used for NLP. Assignment for designing of solutions of Industry based problems.

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Reference Books

1.Jurafsky Daniel, Martin James, "Speech and Language Processing", Second Edition, Tenth Impression, Pearson Education, 2018.
2.Christopher Manning, Schutze Heinrich, "Foundations of Statistical Natural Language Processing", MIT Press, 1999.
3.Allen James, "Natural Language Understanding", Second Edition, Benjamin Cumming, 1995.
Charniack Eugene, "Statistical Language Learning", MIT Press, 1993.

Course Outcomes

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

CO1	Justify the various steps necessary for processing natural language
CO2	Suggest appropriate lexical and parsing techniques for a given natural language
CO3	Apply appropriate statistical models for a given natural language application
CO4	Modify existing algorithms to suit any natural language for processing
CO5	Suggest appropriate pre-processing steps essential for the various applications involving natural language processing and all applications

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AI71B	Block Chain Technique	70	20	10	-	-	100	3	1	_	4

Module-I Introduction-
Overview of Block chain, Public Ledgers, Bit coin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Crypto currency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain; Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic crypto currency.

Module-II Understanding Block chain with Crypto currency:
Bit coin and Block chain: Creation Of coins, Payments and double spending, Bit coin Scripts, Bit coin P2P Network, Transaction In Bit coin Network, Block Mining, Block propagation and block relay. Working with Consensus in Bit coin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, Hash Cash PoW, Bit coin PoW, Attackson PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

Module-III Understanding Block chain for Enterprises: Permissioned Block chain: Permissioned model and use cases, Design issues for Permissioned block chains, Execute contracts, State machine replication, Overview of Consensus models for permissioned block chain Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems.

Module-IV Enterprise application of Block chain:
Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, and Identity on Block chain.

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Module-V Block chain application development:
Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, writing smart contract using Hyperledger Fabric, writing smart contract using Ethereum, Overview of Ripple and Corda.

References Books:

1. Melanie Swan, "Block Chain: Blueprint for a New Economy", O'Reilly, 2015
2. Josh Thompsons, "Block Chain: The Block Chain for Beginners- Guide to Blockchain Technology and Leveraging Block Chain Programming"
3. Daniel Drescher, "Block Chain Basics", Apress; 1stedition, 2017
4. Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi.
5.Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization
And Smart Contracts Explained", Packt Publishing
6. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing
7. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer", Import, 2018.

Course Outcome-

CO1	Understanding of Blockchain and Crypto currency.
CO2	Knowledge of Block chain for enterprise and its ethics.
CO3	Design technique and application of Block chain.

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AI71C	Simulation & Modelling	70	20	10	-	-	100	3	1	_	4

Module –I Introduction:
System, model and simulation,Discrete and continuous systems ,Model of a system,Types of models, Steps in simulation study, Model development life cycle, Advantage and disadvantage of simulation, Limitations of the simulation techniques,Areas of application. Introduction to Software Reliability, Review of Probability, Statistics, Description of Specific Models, Principles used in Modeling, System models and role of simulation. Entities, Attributes, States and Activities,

Module-II Random Variables:
Discrete Random variable, Probability mass function, Cumulative Distribution function, Continuous Random variable, Probability Density function, Exponential Distribution, Statistical tools and techniques- generation of pseudo random numbers, Random variant generation for uniform, Poisson and normal distributions.

Module -III Stochastic processes:
Introduction, Classification of Stochastic processes, Renewal process, independent process, Poisson process, Stationary process, Markov Process: Introduction to Discrete Parameter Markov Chains and Continuous Parameter Markov Chains, Birth-death process. Markov models. Introductory ideas of Simulation of inventory and queuing systems - single and multi-server queues.

Module -IV Simulation Languages and Mathematical models:
Continuous system simulation languages, discrete event simulation languages, merits of simulation languages, Exponential Growth and decay models, System dynamics diagrams, Static physical model, Dynamic physical model,static mathematical models, Dynamic mathematical models,Verification and validation of simulation models - input /output validation using a Turing test, Face validity, Sensitivity Analysis.

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Module-V Introductory ideas of the following:

Sampling, Estimation, Parameter Estimation, Maximum likelihood estimation, Confidence intervals, Hypothesis testing, Performance measures and their estimation: run length of a static and dynamic stochastic simulation.

Reference Books:

1.Narsingh, Deo, "System Simulation with Digital Computers", PHI.
2.Gordon, Geoferey, "System Simulation", 2nd Edition, Prentice Hall India.
3A.M. Law and W.D. Kelton: Simulation and Modeling and analysis.
4.R. Y. Rubinstein, B. Melamed: Modern Simulation and Modeling
5.S. Shakya: Lab Manual on Simulation and modeling
6.Kishore Trivedi, "Probability and Statistics with Reliability, Queuing, and Computer Science
Applications", John Wiley and Sons.
7. Law, Kelton, "Simulation Modeling and Analysis" Tata Mc-Graw Hill.
8.D.S. Hira, "System.

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AI72A	Cloud Computing	70	20	10	-	-	100	3	1	_	4

Module- I Introduction
Evolution: Clustering - Grid computing – Virtualization – Basic concepts - Benefits and Risks - Roles and Boundaries - Characteristics - XaaS based service offerings - Basic Deployment models.

Module- II Enabling Technologies
Networks: ISPs - Connectionless Packet Switching - Router-based Interconnectivity - Technical and Business Considerations - Data Center: Standardization and Modularity - Automation - Remote Operation - High Availability - Hardware Virtualization: Hardware Independence - Server Consolidation - Resource Replication - OS and hardware based Virtualization - Web Technology - Multitenant Technology - Service Technology.

Module- III Computing Mechanisms
Infrastructure: Logical Network Perimeter - Virtual Server - Storage Device - Usage Monitor - Resource Replication - Specialized: Automated Scaling Listener - Load Balancer - Monitors - Failover System - Hypervisor - Resource Cluster - Multi-Device Broker - State Management Database - Management: Resource - SLA - Billing - Remote Administration - Security.

Module- IV Cloud Providers & Software Platforms
Globally available public clouds (Microsoft Azure - Amazon Web Services - Google Cloud Platform): Overview and Comparison - Instances - Images - Networking and Security - Storage - Monitoring and Automation Introduction to Open-source softwares: Eucalyptus - OpenNebula - OpenStack - Apache CloudStack.

Module- V Programming Models & Advances
Introduction to MapReduce - Apache Spark - TensorFlow - Intercloud: Architecture - Resource Provisioning - Billing - Security - Mobile Cloud Computing: Resource Allocation - Security - Business Aspects - Application - Future Scope - Introduction to Edge and Fog Computing.

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Reference Books

1.Barrie Sosinsky, "Cloud Computing Bible", John Wiley & Sons, 2010.

2.Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise 3.Perspective on Risks and Compliance", O'Reilly, 2009.

4.James Turnbull, "The Docker Book: Containerization is the New Virtualization", E-Book, 2015.

5.Kai Hwang, Geoffrey C. Fox, and Jack J. Dongarra, "Distributed and Cloud Computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier, 2012.

Course Outcomes :

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

CO1	Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state oftheart cloud computing .
CO2	Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud
CO3	Adopt suitable computing mechanisms for establishing a cloud environment .
CO4	Design the appropriate cloud computing solutions and recommendations according to the applications used and knowledge on recent advances and implementation of programming modes in cloud computing

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AI72B	Network Management	70	20	10	-	-	100	3	1	_	4

Module-I: Introduction to Network Managements:
Network Management Framework, Network Based Managements, Evolution of Network Management: SGMP, CMIP, SNMP. Network Implementation and Management Strategies, Network Management Categories: Performance Management, Fault Management, Configuration Management, Security Managements, Accounting Managements. Network Management Configuration: Centralized Configuration, Di stributed Configuration. Selected Management Strategy.

Module-II: Management Information Base (MIB):
MIB, Structure of Management Information, NMS Presentation of the SMI, NMS Meter-ware Network view. Remote Monitoring (RMON), RMON Group.Desktop Management: Desktop Management Interface (DMI), DMI Architecture, DMI Browser, DMV/SNMP Mapping, Desktop SNMP Extension Agents. Setting up LAN Access, SNMP Configuration.

Module-III: OSI Layering:
OSI Layering-TCP/IP Layering, Protocols & Standards, Internet standards, Internet administration, Internet Addresses, Internet protocol: introduction, IP header, IP routing, Subnet addressing, subnet mask, special case of IP addresses, Comparative Study of IPV4 & IPV6, port numbers Address Resolution Protocol, ARP packet format, Proxy ARP, ARP command, ARP Example, Reverse Address Resolution Protocol (RARP): Introduction, RARP Packet format, RARP Examples, RARP server design.

Module-IV Delivery and Routing:
Delivery and Routing of IP Packets, Routing Methods, Static versus Dynamic Routing, Routing table. And Routing Module, Classless Addressing: CIDR. Internet Protocol (IP), Datagram, Fragmentation, Options, IP Package. Interior and Exterior Routing, Routing information protocol (RIP), Open shortest path first protocol (OSPF). BGP, GGP. Private Networks. Virtual Private Network (VPN), Network Address Translation (NAT).

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Module-V: Internet Control Message Protocols (ICMP):
Types of message, message format. error reporting, query, checksum, ICMP Package. IGMP, IGMP Message and its operation, IGMP package.Transmission control protocol, Process-to-Process Communication. TCP Services Flow Control, TCP Timers. TCP Operation, TCP Package. Application layers protocols Telnet Protocol. File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP). X-Window system protocol, Remote procedure call, and Network file system.

Reference Books:
1. Forouzan. TCP/IP Protocol Suite 4th edition, TMH
2. J.RichardBurkey. Netrvork Management Concept and Practice. PHI
3. Stevens,'I'CP/IP Illustrated Volume-I, Pearson
4. Tittel:TCP/IP, Cenage Learning
5. [-iyless Black. TCP,IP and related protocols, McGrarv Hill.
6. DougJrals E. Comer, Internetr+'orking with TCP/IP Vol. I, Principles" Protocols, and Architecture, Prentice
Hall,India.

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

CO1	Explain and demonstrate Network Management Architecture, Routing & Protocols used for Network Management.
CO2	Select Routing methods and Protocols for Network Based Management & Construct Computer Network.
CO3	Compare Routing Strategies, Networks Configuration and various protocols
CO4	Select network Management Protocols Maintain the network by performing routine maintenance tasks.

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AI72C	Cyber Security	70	20	10	-	-	100	3	1	_	4

Module-I: Introduction to Cyber security:
Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and webtechnology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept ofcyber security, Issues and challenges of cyber security.

Module-II: Cyber-crime and Cyber law:
Classification of cyber-crimes, CommonCyber-crimes- cyber-crime targeting computers and mobiles, cyber-crime againstwomen and children, financial frauds, social engineering attacks, malware andransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi,Reporting of cyber-crimes, Remedial and mitigation measures, Legal perspectiveof cyber-crime, IT Act 2000 and its amendments, Cyber-crime and offences,Organisations dealing with Cyber-crime and Cyber security in India, Case studies.

Module-III: Social Media Overview and Security:
Introduction to Social networks. Types of social media, social media platforms, social media monitoring, Hashtag, Viral content, Social media marketing, social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of social media, Case studies.

Module -IV: E-Commerce and Digital Payments:
Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commercethreats, E-Commerce security best practices, Introduction to digital payments,Components of digital payment and stake holders, Modes of digital payments-BankingCards, Unified Payment Interface (UPI), e-Wallets, Unstructured SupplementaryService Data (USSD), Aadhar enabled payments, Digital payments relatedcommon frauds and preventive measures. RBI guidelines on digital payments andcustomer protection in unauthorised banking transactions. Relevant provisions of Payment Settlement Act,2007.

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Module- V: Digital Devices Security, Tools and Technologies for Cyber Security:
End Point device and Mobile phone security, Password policy, Security patchmanagement, Data backup, Downloading and management of third-party software,Device security policy, Cyber Security best practices, Significance of host firewall andAnt-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration ofbasic security policy and permissions.

Reference Books:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition2010.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and LegalPerspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (FirstEdition, 2011)
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities byHenry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13thNovember, 2001)
4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition,Wiley India Pvt. Ltd.
7. Fundamentals of Network Security by E. Maiwald, McGraw Hill.

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COURSE CONTENTS **w. e. f. July 2023**

Subject Code	Subject Name & Title	Maximum Marks Allocated						Hours/ Weeks			Total Credits
		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI81A	Financial Engineering	70	20	10	-	-	100	3	1	_	4

Module- I Introduction:
Quantitative Finance- Scope- The Functions of the Financial System- Market Organization and Structure.

Module- II Numerical methods for finance:
Solving systems of linear equations- Solving non-linear equations- Curve fitting Interpolation- Numerical Integration-Finite Difference Methods for Partial Differential Equations.

Module -III Optimization in finance:
Linear Programming- Non-linear programming- Quadratic programming- Dynamic Programming.

Module- IVFinancial time series analysis:
Linear Time Series Analysis- Nonlinear Models, Multivariate Time Series Analysis.

Module-V Financial reporting and analysis:
Financial Reporting Standards- Income Statements and Balance Sheet- Cash Flow Statements- Financial Analysis Techniques- Inventories- Long Lived Assets-Income Taxes-Applications.

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Refrences Books:

1. Joerg Kienitz, Daniel Wetterau, "Financial Modelling: Theory, Implementation and Practice with MATLAB Source", John Wiley & Sons
2. Gerard Cornuejols et al., Optimization Methods in Finance, Cambridge University press.
3. Paolo Brandimarte, "Numerical Methods in Finance and Economics ", John Wiley & Sons.

Course Outcomes:

At the end of the course the students will be able to:

CO1	• Use Numerical methods to solve practical problems finance
CO2	• Apply suitable optimization techniques in financial optimization problems
CO3	• Choose an appropriate time series model for a given set of data
CO4	• Describe the tools and techniques used in financial reporting and analysis

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AI81B	Dev Ops & MLOPs	70	20	10	-	-	100	3	1	–	4

Module- I Introduction: Agile principles–
Improve the quality of data- Analytics insights- AI models

Module- II DevOps: DevOps Process and Lifecycle-
Development – Testing- Configuration Management-Integration and Deployment-Monitoring of the software- DevOps tools ,

Module-III DataOps:
Establish DataOps (Prepare for operation- Optimize for operation) - Iterate DataOps (Know your data, Trust your data, Use your data) - Improve DataOps

Module- IV MLOPs:
Introduction to Machine Learning in Production- Machine Learning Data Lifecycle in Production- Machine Learning Modeling Pipelines in Production- Deploying Machine Learning Models in Production.

Module-V Applications:
Application of DevOps, DataOps and MLOPs- Challenges of DevOps, DataOps and MLOPs- Tools in DevOps, DataOps and MLOPs

References Book:
DataOps, MLOps and DevOps: Outperform Analytics and Software Development with Expert Practices on Process Optimization and Automation. BPB Publications (16 June 2022).

Course Outcomes:
At the end of the course the students will be able to:

CO1	• Understand the benefits of DevOps over other software development processes
CO2	• Get an overview of different DevOps Tools
CO3	• Understand how to enable the organization's business, development and operations to continuously design, deliver and validate new data demands
CO4	• Design an ML production system end
CO5	end: project scoping, data needs, modeling strategies, and deployment requirement.

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		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI81C	Advanced AI Algorithms-Gen-AI	70	20	10	-	-	100	3	1	_	4

Module-I Introduction And Generative Text:
Introduction to Generative AI,Prompt, Elements of a Prompt, Designing Prompt, Example prompts for various use cases,Introduction to AI Chatbots, Working of AI Chatbots, Popular AI Chatbots,, For example like ChatGPT and its working, Use cases of ChatGPT for various users.

Module- II Generative Image, Video and Codes:
Role of AI in Image Generation, Popular AI tools for Image Generation. Midjourney for Image Generation,working of midjourney, Advantages and disadvantages of Midjourney, Use cases of Midjourney. AI Tools in Video Making, Working of AI Video Makers, Benefits of AI Video Makers, Popular AI Video Makers, Introduction to Synthesia, Features of Synthesia, Compatibilty of Synthesia, Pros and Cons of Synthesia. Role of AI Tools in Programming, Copilot by Github, Advantages and Drawbacks of Copilot, Auto filling Repetitive Code using Copilot, Running Tests using Copilot, Navigating Unfamiliar Territory with Copilot, Creating an Application Entirely With Copilot. All live examples on computer vision.

Module- III OpenAI APIs:
Understanding OpenAI APIs, OpenAI playground, creating API keys, Authentication, making requests build chatbots, integration with OpenAI API keys.

Module-IV Neural Network, Transformer and LLM:
Applied problems From simple perceptron to multi-layer perceptron and its training, Introducing deep learning and architectures such as CNN, RNN, GAN and transformers, Detailed description of transformer architecture, use cases and various models for natural language proocessing, Training LLM: Training, fine tuning, evaluation and feedback through reinforcement learning.

Module –V Generative Adversarial Networks (GAN):
Detailed description of GAN architecture, its training and variants and industrial applications, standards and ethics for AI applications.

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Reference Books

Generative AI with LangChain: Build Large Language Model (LLM) Apps with Python, ChatGPT and other LLMs, Ben Auffarth, 2023
Generative AI in Practice, Barnard Marr, 2024
Generative AI with Python, Raghav Bali, 2021
Generative AI in Higher Education, Cecilla Ka Yuk Chan, 2024

Course Outcomes: At the end of the course the students will be able to:

CO1	Understand Recent trends of AI and about Generative AI
CO2	Implement all Algorithms for GenAI
CO3	Design &Application Of Gen AI solutions for Industrial applications

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AI82A	Computer Vision	70	20	10	-	-	100	3	1	–	4

Module-I BASICS OF COMPUTER VISION
Introduction-Image Formation-Image Representation-Linear Filtering-Image in frequency domain- Image Sampling-Edge Detection-Feature detection - SIFT and its variants- Image Segmentation-Feature matching

Module- II MOTION ANALYSIS
Background Subtraction and Modeling-Optical Flow- KLT- Spatio-Temporal Analysis-Dynamic Stereo- Motion parameter estimation

Module- III ARCHITECTURES FOR COMPUTER VISION
CNN Architectures – Convolution – Pooling Layers – Back propagation in CNN-Transfer Learning -RNN,LSTM,GRU, Encoder/Decoder Architectures – Autoencoders –Variational Autoencoders – Adversarial Generative Networks – Self Attention Mechanism

Module-IV MODELS FOR COMPUTER VISION
Object Classification-VGGNET, RESNET, ALEXNET, DENSENET, EFFICIENT NET, MOBILENET,
INCEPTION V3, Object Detection-R-CNN, F-RCN, SSD, Retinanet, YOLO, CornerNet, Image Segmentation- UNet, SegNet, Mask-RCNN, Attention Models-Transformers

Module-V APPLICATIONS AND RECENT TRENDS IN COMPUTER VISION
Applications- Image Editing, Inpainting, Superresolution, 3D Object Generation, Security, Surveillance-Object Tracking-Automatic Image Captioning.
Recent Trends- Zero-shot, One-shot, Few-shot Learning-Self-supervised Learning and Reinforcement Learning in Vision

Reference Books:

1.Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", 2016.
2.Richard Szeliski, Computer Vision: Algorithms and Applications, 2010.
3.Simon Prince, Computer Vision: Models, Learning, and Inference, 2012.
4.Yoshua Bengio, Learning Deep Architectures for AI, 2009.
5.Michael Nielsen, Neural Networks and Deep Learning, 2016.

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6.David Forsyth, Jean Ponce, Computer Vision: A Modern Approach, 2002.

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

CO1	Implement AI based fundamental image processing techniques required for computer vision
CO2	Employ the motion analysis techniques for solving real life problem
CO3	Apply the deep learning architectures to various problems
CO4	Create their own advanced deep learning models Develop applications of computer vision using deep learning techniques

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		Theory			Practical		Total Marks	L	T	P	
		End Sem	Mid Sem Exam	Quiz/ Assignment	End Sem	Lab Work					
AI82B	Bio Informatics	70	20	10	-	-	100	3	1	–	4

Modulet-I Introduction:
Introduction to bioinformatics, objectives of bioinformatics, Basic chemistry of nucleic acids, structure of DNA & RNA, Genes, structure of bacterial chromosome, cloning methodology, Data maintenance and Integrity Tasks.

Unit-II Bioinformatics Databases & Image Processing:
Types of databases, Nucleotide sequence databases, Protein sequence databases, Protein structure databases, Normalization, Data cleaning and transformation, Protein folding, protein function, protein purification and characterization, Introduction to Java clients, CORBA, Using MYSQL, Feature Extraction.

Unit-III Sequence Alignment and database searching:
Introduction to sequence analysis, Models for sequence analysis, Methods of optimal alignment, Tools for sequence alignment, Dynamics Programming, Heuristic Methods, Multiple sequences Alignment

Unit-IV Gene Finding and Expression:
Cracking the Genome, Biological decoder ring, finding genes through mathematics & learning, Genes prediction tools, Gene Mapping, Application of Mapping, Modes of Gene Expression data, mining the Gene Expression Data.

Unit –V Proteomics & Problem solving in Bioinformatics:
Proteome analysis, tools for proteome analysis, Genetic networks, Network properties and analysis, complete pathway simulation: E-cell, Genomic analysis for DNA & Protein sequences, Strategies and options for similarity search, flowcharts for protein structure prediction.

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Recommended Books:

1. Gopal & Jones, BIOINFORMATICS with fundamentals of Genomics &Proteomics, TMH Pub
2. Rastogi, Bioinformatics –Concepts, skills & Applications, CBS Pub
3. Claverie, Bio informatics, Wiley pub
4. Stekel, Micrarray Bio Informatics, Cambridge

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

CO1	Understanding of Bio Informatics
CO2	Creating Bioinformatics data retreaval and techniques
CO3	Applying different tecniques for bioinformatics and problem solving
CO4	Design new solutions to different case study.

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AI82C	Design Thinking	70	20	10	-	-	100	3	1	_	4

Module- I Design Thinking –
Introduction - What - How - Why - Design Process - Four Questions - Ten Tools - Identify an Opportunity - Scope your opportunity - Draft your design brief.

Module-II Visualizations
Three visualizations - Visualization basics - Journey mapping - Value Chain analysis - Mind mapping.

Module- III Design Criteria
Design thinking brainstorming - Concepts development - develop concepts - napkin pitches.

Module-IV Assumption testing –
Rapid Prototyping - Surface Key assumptions - make prototypes.

Module- V Customer co-creation–
learning launch - Feedback from stake holders - Design the on-ramp - Case study.

Reference Books
1.Jeanne Liedtka, Tim Ogilvie, Rachel Brozenske, "The Designing for Growth Field Book: A Step-by Step Project Guide", New York: Columbia University Press, 2014.
2.Jeanne Liedtka, Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", New York: Columbia University Press, 2011.

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

CO1	Convert real-life problems into methodical problems
CO2	Apply various visualization principles for problem and solution representation
CO3	Design solutions by applying an integrated approach to design thinking
CO4	Justify and prototype solutions to problems
CO5	Understanding customer feedback and design new model with case study.

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