NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department of Artificial Intelligence and Data Science

2021 Scheme Curriculum Handbook

3rd and 4th Semesters

Vision

To produce effective and capable engineers, scientists and professionals in Artificial Intelligence and Data Science who can meet the demands of society, industry and universities for decades to come by continually improving teaching and research standards of the department.

Mission

The Dept. of Artificial Intelligence and Data Science Engineering is committed to

- Provide high-quality education to the students to fulfil the requirements of industry and R&D establishments.
- Constantly strive to improve teaching-learning methods to deliver good academic programs.
- Respond to the fast evolving scientific and technological challenges in a highly competitive world.
- Inculcate ethics, integrity, honesty, credibility, social and environmental consciousness

PEOs:

- Graduates will have the ability to Analyze, Develop and Apply Innovative ideas to solve real-world problems using Artificial Intelligence and Data Science techniques.
- Pursue higher studies to carry out research and development in the area of Artificial Intelligence and Data Science.
- Engage in lifelong learning, communicate effectively and exhibit leadership skills and demonstrate sensitivity towards professional ethics.

PSO 1: Apply solutions based on Computer Programming and Artificial Intelligence to societal and technological problems

PSO2: Create innovative solutions , processes, methodologies and products to enable organizations and automated systems to make data-driven decisions

Program Outcomes:

PO-1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. .
PO-2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO-3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO-4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO-5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO-6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO-7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO-9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO-11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO-12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Semester 3:

Department: *Mathematics*	***Course Type:*** *Basic Science*
Course Title*:* Engineering Mathematics III (*Integral Transforms, Linear Algebra and Numerical Methods)*	***Course Code:*** *21DS31*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Description

The course aims at imparting knowledge of Fourier analysis, Integral transforms, numerical methods, basics of linear algebra relevant to the field of Computer Science, Information Science and Artificial Intelligence

Pre-requistes:

Integration, differentiation, Taylor series, matrices

Cos	Course Outcome Description	Blooms Level
1	To apply numerical methods for fitting data, find appropriate functions, differentiate and integrate the same	L3
2	To use the concept of numerical methods to solve differential equations	L3
3	To analyze situations arising in Engineering Problems using concepts of Linear Algebra	L3
4	To apply the concepts of Fourier analysis ,integral transforms and optimization to Engineering Problems	L3
5	To analyze situations arising in Engineering Problems using the concept of matrices, orthogonality and vectorspaces	L3

The course objectives are:

To understand the periodic and harmonic phenomena and to be able to model them using Fourier series and use integral transforms such as Laplace and Fourier transforms,

To understand the advantages, limitations and applications of different numerical techniques.

To explore the concepts and applications of Linear algebra.

UNIT – I **8 HOURS**

Linear Algebra-I

Vector spaces- definition, examples, Linear combinations, subspaces, linear dependence, basis and dimension, linear mapping, linear operator, Kernel and Image of a Linear mapping, matrix representation of linear operator, change of basis.

Self Study: Row Space and Column space, Rank and nullity theorem

UNIT – II **8 HOURS**

Linear Algebra-II

Inner product space, Orthogonal Sets and Bases, Gram Schmidt Orthogonalization process Polynomial of matrices, Characteristic polynomial, diagonalization, Eigenvalues and Eigen vectors, diagonalization, Characteristic and minimal polynomial, Singular value decomposition

Self-Study:Block matrices and Canonical form.

UNIT - III **8 HOURS**

Numerical Methods-I

Interpolation: Newton's divided difference formulae, Lagrange's formula, Cubic spline.

Least square fitting of Fourier series (Harmonic Analysis).

Numerical Differentiation: Newton's forward and backward formulae, Lagrange's formula.

Numerical Integration**:** Trapezoidal, Simpson's1/3rd and 3/8th, Gaussian Quadrature method.

Quadratic spline, Weddle's rule for numerical integration.

UNIT – IV **8 HOURS**

Numerical Methods-II

Numerical solution of ordinary differential equations: Taylor's series method, Runge-Kutta 4th order method - First order and second order Ordinary differential equations, Milne's predictor corrector method. Finite difference method for Boundary value problems

Correlation, Karl Pearson's coefficient, Regression lines

Continuous Optimization: Gradient Descent, Lagrange multipliers

Numerical solution of Laplace Equation, Rank correlation

UNIT – V **7 HOURS**

Fourier analysis and Integral Transforms

Fourier series: Euler's formulae, Dirichlet's conditions for Fourier series expansion, Even and odd function.

Fourier Transforms: Complex Fourier transforms, Cosine and Sine transforms, Inverse

Fourier transforms.
Laplace Transforms: Definition, Transforms of standard functions, Laplace transforms of periodic functions, Inverse Laplace transforms
Self-Study: Fourier half range series, solutions of 1st and 2nd order ODE using Laplace transforms.

Text Books:

1. Linear Algebra, Seymore Lipschutz and Marc Lipson, 3rd edition, Tata McGrawhill, 2005
2. Numerical Methods for Scientific and Engg. Computation, M K Jain, S R K Iyengar, R K Jain, 6th edition, New Age, 2012
3. Advanced Engineering Mathematics, Erwyn Kreyzig, 9th edition, Wiley, 2011

Reference Books:

1. Linear Algebra for everyone, Gilbert strang, 2020
2. Fourier Series, Transforms and Boundary Value Problems, J R Hanna, J H Rowland, 2nd edition, Dover, 2008
3. Numerical Algorithms, E V Krishnamurthy, S K Sen, East West press,2007

Teaching Methods:

- Black Board Teaching.
- Power point presentation
- Tutorials

Assessment Methods:

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Quiz/ assignment based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of all the 3 will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03	02	03	1								**02**	**02**	**03**
CO2	03	02	03	1					02	01		**02**	**02**	**03**
CO3	03	02	03	1					02	01		**02**	**02**	**03**
CO4	03	02	03	1					02	01		**02**	**02**	**03**
CO5	03	02	03	1								**02**	**02**	**03**

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Semester: 3 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Core*
Course Title*:* Programming using Python	***Course Code:*** *21DS32*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

No programming knowledge is assumed, successful completion of first year course on programming is desirable..

Course Outcomes:

Cos	Course Outcome Description	Blooms Level
1	Describe Python and Libraries with Applications to Data Science	L1
2	Develop Python programs using control statements and functions	L3
3	Develop Python programs using features of Lists, tuples, Dictionaries and Sets with simple applications to Data Science	L3
4	Use Object-oriented features of NumPy, Exceptions and File handling in Python Programs performing Unit Testing.	L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Motivation of concepts using Practical Examples.
- Course Project/Assignment.

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Rubrics for Course Project/Assignment (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03			2	2	2	2	1			1		**03**	**03**
CO2	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**
CO3	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**
CO4	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**

Course Content

UNIT – I **6 HOURS**

Introduction to Computers and Python:
Object Technology basics, Overview of Python, Python standard library, Data Science libraries, Cloud and the Internet of Things and BigData. Introduction to Python Programming: Variables and Assignment statements. Arithmetic. Single, double and triple-quoted strings. Getting Input, Decision making, Objects and Dynamic Typing, Basic Descriptive Statistics. Control Statements.

UNIT – II **10 HOURS**

Functions, Sequences, Lists and Tuples, Dictionaries and Sets: Functions: Various features and concepts used in developing functions in programming languages and specifically, Python. Lists and Tuples: Unpacking sequences, Sequence slicing, Sorting lists, searching sequences, Simulating Stacks with Lists, List Comprehensions, Generator Expressions, Filter, Map and Reduce, Two dimensional lists, Simple Python programs for Simulations and Static Visualizations. Dictionaries, Sets and Dynamic Visualizations.

UNIT **8 HOURS**

Arrays, Strings, Files and Exceptions: Array-oriented Programming with NumPy, Strings: A Deeper Look, Files and Exceptions. Introduction to Data Science: pandas Series and DataFrames, Regular expressions and data munging, Working with CSV files.

UNIT – IV **8 HOURS**

Object-oriented Programming: Classes, Inheritance, Polymorphism, Operator Overloading, Exceptions, Unit Testing, Namespaces and Scopes, Data Science example program on Time Series and Simple Regression.

UNIT – V **7 HOURS**

Data Analysis using Python:
Cleaning and Preparing the Data, Identify and Handle Missing Values, Data Formatting,Data Normalization Sets, Descriptive Statistics, Basics of Grouping, ANOVA, Correlation,Simple and Multiple Linear Regression, Model Evaluation Using Visualization,R-squared and MSE for In-Sample Evaluation

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Text Book:
Python for Programmers by Paul Deitel and Harvey Deitel ,2020, Pearson India.

Websites:
https://www.python.org

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Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Core*
Course Title*:* Programming using Python Lab	***Course Code:*** *21DSL38*
L-T-P:0*-0-2*	***Credits:****01*
Total Contact Hours: 30 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Cos	Course Outcome Description	Blooms Level
1	Describe Python and Libraries with Applications to Data Science	L1
2	Develop Python programs using control statements and functions	L3
3	Develop Python programs using features of Lists, tuples, Dictionaries and Sets with simple applications to Data Science	L3
4	Use Object-oriented features of NumPy, Exceptions and File handling in Python Programs performing Unit Testing.	L3

Assessment:

CIE(Experiments, Record, Viva Voce: 20 marks; Lab Test: 30 marks); SEE: 50 marks

Sl No	**Programs for Laboratory**	**CO**
1.	Design, Develop and Implement Python Programs for the following: a) Input a number , compute and print factorial of the number. b) Print Fibonacci sequence upto the first k elements, input k. c) Enter Python code at the Python shell prompt to illustrate that a Python list is mutable whereas tuples and strings are not. d) Count and print the number of occurrences of a sub string in a string.	**1**
2.	Develop functions to perform the following: 1. Perform sparse matrix addition using an appropriate Python data type 2. Perform addition of two polynomials 3. Search for an element in a list 4. A function that confirms Birthday Paradox.	**2**

3.	Write Python code for the following: 1. Given examples of slicing 2. Checking if a list of parentheses is well-formed 3. Given examples of list comprehensions and generator expressions 4. Given examples of Filter, Map and Reduce 5. Perform multiplication operation on two matrices and display the result.	3
4.	1.Develop Simple Python programs for Simulations and Static Visualizations. 2. 2. Develop simple Python programs for Dynamic Visualizations.	2
5.	1.Develop programs for given Array-oriented problems with NumPy 2.Develop given programs for string manipulation.	2
6.	1.Design and implement Python programs that handle exceptions for the given problem. 2. Use Pandas Series and DataFrame in given data science exercise. 3.Use Regular expressions in given data science exercise. 4. Apply data munging in the given data science application. 5. Read from CSV file and process as per the given data science exercise.	**4**
7.	Design and develop Python classes for the given exercise. Develop methods. Design , develop and run Unit tests.	**5**
8.	1.Design, Develop and Implement a Python class hierarchy using inheritance for the given exercise. Use Polymorphism where applicable. Unit test the class. 2.Develop a Python program for time series and regression.	**5**
9.	Design, develop and test Python programs for the given data science exercise involving Cleaning and Preparing the Data, Identify and Handle Missing Values, Data Formatting,Data Normalization Sets.	**6**
10	Design, develop and test Python programs for the given data science exercise involving Descriptive Statistics, ANOVA, Correlation,Simple and Multiple Linear Regression, Model Evaluation Using Visualization,R-squared and MSE for In-Sample Evaluation.	**6**

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03			2	2	2	2	1			1		**03**	**03**
CO2	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**
CO3	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**
CO4	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**

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Semester: 3 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Core*
Course Title*: Computer Organization and Architecture*	***Course Code:*** *21DS33*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

i. Fundamentals of Computers.
ii. Programming.

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Describe the fundamentals of Boolean algebra, gates and combinatorial circuits	L2
2	Understand the internal functional units of a processor to execute instructions and mechanism for generating control signals	L2
3	Analyse internal organization of memory chip and the impact of cache on processor performance	L4
4	Illustrate the approaches involved in achieving communication between Processor and I/O devices	L2
5	Apply Booth algorithm for performing signed integer multiplication, restoring and non-restoring methods for integer division	L3
6	Understand the classic five stage pipeline and its role in improving the processor performance	L2

Teaching Methodology:

i. Black board teaching
ii. Motivation of Concepts using relevant Examples

Assessment Methods:

i. Aptitude test (GATE syllabus) for10 Marks.
ii. Assignment for 10 marks.
iii. Three MSEs for 30 Marks each will be conducted and the Average of all three will be considered.
iv. Semester End Examination for 100 Marks will be conducted and reduced for 50 Marks.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03												**1**	**03**
CO2	03	02	03						02	02		**02**	**1**	**03**
CO3	03	02	03						02	02		**02**	**1**	**03**
CO4	03	02	03						02	02		**02**	**1**	**03**
CO5	03	02	03						02	02		**02**	**1**	**03**
C06	03	02	03						02	02		**02**	**1**	**03**
	03	02	03						02	02		**02**	**1**	**03**

COURSE CONTENT

UNIT – I Boolean Algebra, Gates, Overview of Combinatorial Circuits and Sequential Circuits, their role in computer organization	**6 hours**
UNIT – II	**8 hours**
Basic Structure of Computers: Computer Types, Functional Units, Basic Operations & Concepts, Performance: Processor clock, Basic Performance Equation, clock rate, Performance measurement. **Machine Instructions and Programs**: Memory Locations and Addresses, Memory Operations, Instructions and instruction sequencing: Register Transfer Notation, Assembly Language Notation, Instruction Types, Instruction Execution and straight line sequencing, branching, condition codes, Addressing modes.	
UNIT – III	**8hours**
Basic processing unit: Some Fundamental Concepts: Laws, Register Transfers, Performing an Arithmetic or Logic Operation, Fetching a word from Memory, Storing a word in memory; Execution of a complete Instruction: Branch Instructions; Multiple Bus Organization, Hardwired Control: A Complete Processor; Micro programmed Control: Microinstructions;	
UNIT – IV	**8hours**
The Memory System: Some basic concepts, Semiconductor RAM Memories: Internal organization of Memory chips, static memories, Asynchronous DRAMS, synchronous DRAMS, Read-Only Memories, Speed size and cost, Cache memories: Mapping functions, Replacement Algorithms, Performance considerations: Interleaving, Hit rate and Miss Penalty, Caches on the processor chips, other enhancements.	
UNIT – V	**4 hours**
I/O Organization: Access of I/O devices, Interrupts, Direct Memory Access,Buses,I/O interfaces - Serial port, Parallel port	

UNIT – VI	5hours
Fundamentals of Computer Design: Defining Computer Architecture -Instruction Set Architecture **Pipelining:** Basic and Intermediate Concepts: What Is Pipelining?, The Basics of a RISC Instruction Set, A Simple Implementation of a RISC Instruction Set, The Classic Five-Stage Pipeline for a RISC Processor, The Major Hurdle of Pipelining—Pipeline Hazards.	

Text books:

1.ComputerOrganization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 5th Edition, TMH

2. Computer architecture: A quantitative approach, John L. Hennessy and David. A. Patterson, 4th edition, Elsevier

Reference books:

1. Computer Organization & Architecture, William Stallings, 7thEdition, PHI, 2006.

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Semester: 3 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Core*
Course Title*:* Artificial Intelligence	***Course Code:*** *21DS34*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

i. A course on Programming.

Course Outcomes:

Cos	Course Outcome Description	Blooms Level
1	Describe the evolution of artificial intelligence along with applications	L1
2	Apply the principles of search strategies to relevant problems	L3
3	Describe and apply the principles and steps of Game Playing Algorithms	L1, L3
4	To design algorithms to find optimal paths and apply concepts of A* algorithm in developing applications	L3
5	To describe the usage of Prolog in realization of Knowledge base for querying	L1

Teaching Methodology:

- Black board Teaching
- PowerPoint Presentation

Assessment Methods:

i. Aptitude test for10 Marks.

ii. Assignment for 10 marks.
iii. Three MSEs for 30 Marks each will be conducted and the Average of all three will be considered.
iv. Semester End Examination for 100 Marks will be conducted and reduced for 50 Marks.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03			2	2	2	2				1			**03**
CO2	03	02	03	2	2	2	2		02	02	1	**02**	**02**	**03**
CO3	03	02	03	2	2	2	2		02	02	1	**02**	**02**	**03**
CO4	03	02	03	2	2	2	2		02	02	1	**02**	**02**	**03**
CO5	03	02	03	2	2	2	2		02	02	1	**02**	**02**	**03**
	03	02	03	2	2	2	2		02	02	1	**02**	**02**	**03**

Course Content

UNIT – I	**3hours**
Introduction: History, Can Machines think? Turing Test, Winogard Schema Challenge, Language, Philosophy, Mind, Reasoning, Computation, The Chess Saga, Intelligent Agents	
UNIT – II	**10hours**
Search strategies: State Space Search: Depth First Search, Breadth First Search, Depth First Iterative Deepening , Heuristic Search: Best First Search, Hill Climbing, Solution Space, Travelling Salesman Problem, Escaping Local Optima, Stochastic Local Search, Population based methods, Genetic Algorithms, SAT, TSP, Emergent Systems, Ant Colony Optimization	
UNIT – III	**10hours**
Finding Optimal Paths: Branch&Bound, A*, Admissibility of A*, Informed Heuristic Functions, Space Saving Versions of A*:Weighted A*, Iterative Deepening A*, Recursive Best First Search, Monotone Condition, Sequence Alignment, Divide and Conquer Beam Stack Search	

UNIT – IV	**9 hours**
Game Playing: Game Theory, Board Games and Game Trees, Algorithm MiniMax, AlphaBeta and SSS*, Automated Planning: Domain Independent Planning, Blocks World, Forward&Backward Search, Goal Stack Planning, Plan Space Planning, Problem Decomposition: Means Ends Analysis, Algorithm Graphplan, Algorithm AO*	
UNIT – V	**7hours**
Rule Based Expert Systems, Knowledge, Reasoning and Planning, First order logic, Knowledge base using Prolog, Concepts of Uncertainty and Knowledge Reasoning	

Text Book:

1. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education(India) 2013.
2. Russell, S. J., and Norvig, P., 2022, Artificial Intelligence: A Modern Approach, 4th edn., Prentice Hall.

Websites:

https://towardsdatascience.com/ai-search-algorithms-every-data-scientist-should-know-ed0968a43a7a

Popular Search Algorithms in AI - BLOCKGENI

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Semester: 3 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Core*
Course Title*: Data Structures*	***Course Code:*** *21DSG35*
L-T-P:3*-0-2*	***Credits:****04*
Total Contact Hours: 39 theory & 26 lab	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

Computer concepts and C programming

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the fundamentals of Linear and Non-linear data structures.	L2
2	Apply stack operations for given problems	L3
3	Develop solutions for the given problem using recursion	L3
4	Apply Queue operations to solve the real-world problem	L3
5	Apply linked list concepts for solving the given problem	L3
6	Construct binary trees and perform tree traversals	L3

Teaching Methodology:

I. Black board teaching
II. PowerPoint presentation
III. GATE Aptitude training during tutorial hours

Assessment Methods:

I. Aptitude test (GATE syllabus) for 10 Marks.
II. Programming Assignment for 10 Marks
III. Three MSEs for 30 Marks each will be conducted and the Average of all three will be considered.
IV. Semester End Examination for 100 Marks will be conducted and reduced for 50 Marks.
V. LAB: CIE(Record, Experiments, Viva Voce:20 marks; Lab Test: 30 marks); SEE:50 marks

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03			1	2						1		**03**	**03**
CO2	03	02	03	1	2				02	02	1	**02**	**03**	**03**
CO3	03	02	03	1	2				02	02	1	**02**	**03**	**03**
CO4	03	02	03	1	2				02	02	1	**02**	**03**	**03**
CO5	03	02	03	1	2				02	02	1	**02**	**03**	**03**
C06	03	02	03	1	2				02	02	1	**02**	**03**	**03**
	03	02	03	1	2				02	02	1	**02**	**03**	**03**

COURSE CONTENT

UNIT – I	**8 hrs**
Introduction: Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations, Dynamic Memory Allocation Functions, dynamically allocated arrays, Representation of 2D Arrays in Memory, Pointers to 2D arrays (Matrix addition, subtraction, multiplication), Multidimensional Arrays, Polynomials and Sparse Matrices.	
UNIT – II	**10 hrs**
Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. **Recursion** -Recursive definition and process, Factorial function, Fibonacci Sequence, Binary search, Tower of Hanoi.	
UNIT – III	**10 hrs**
Queues: Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues. Multiple Stacks and Queues. Programming Examples.	
UNIT – IV	**12 hrs**
Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. **Linked list operations:** Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples	
UNIT – V	**12 hrs**
Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees,	

Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples. Overview of Hashing functions and Tables with applications.

Text Books:

1. Ellis Horowitz and Sartaj Sahani, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

Reference Books:

1. Data Structure using C, Aaron M. Tanenbaum, YedidyahLangsam& Moshe J. Augenstein, Pearson Education/PHI, 2006
2. The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Prentice Hall Software Series, 2nd Edition
3. Data Structures a Pseudocode approach with C,Richard F.Gilberg and Behrouz A .Forouzan, Thomson,2005.
4. Data Structures & Program Design in C, Robert Kruse & Bruce Leung, Pearson.

Sl No	**Programs for Lab**	**CO**
1.	Design, Develop and Implement a menu driven Program in C for the following operations using pointer to 2D arrays e) Read two matrices of order m * n f) Display the elements of the matrices g) Perform addition operation on two matrices and display the sum. h) Perform subtraction operation on two matrices and display the result. i) Perform multiplication operation on two matrices and display the result.	**1**
2.	Design and implement a stack (Array implementation/ Linked list implementation) and demonstrate its working with necessary inputs. Display the appropriate messages in case of exceptions	**2**
3.	Develop a program to demonstrate concept of recursion (Factorial / Binary Search / Fibonacci /Towers of Hanoi)	3
4.	Design and implement an algorithm for conversion of an expression from infix to postfix and infix to prefix form. Demonstrate its working with suitable inputs	2
5.	Design and implement an algorithm to evaluate an postfix and prefix arithmetic expression and demonstrate its working with suitable examples	2
6.	Design and implement a given type of (ordinary queue, circular queue) queue in C (array implementation/ Linked list implementation). And demonstrate its working with suitable inputs. Display appropriate messages in case of exceptions.	**4**

7.	Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Programme, Sem, PhNo. a) Create a SLL to store details of N Students by using both front insertion and rear insertion. b) Display the details of all the students and count the number of students whose details is stored in the list. c) Demonstrate deletion of student details from both front and rear end of SLL. d) Demonstrate Insertion and deletion of student details at specified position of SLL. (Note: Only few of the operations can be asked in exam)	**5**
8.	Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Basic, DA, Income tax(IT). a) Create a DLL to store details of N Employees by using both front insertion and rear insertion. b) Display the details of all the Employees from (both front to back and back to front) and count the number of employees whose details is stored in the list . c) Demonstrate deletion of employee details from both front and rear end of DLL. d) Demonstrate Insertion and deletion of Employee details at specified position of DLL e) Calculate and display the net and gross salary of each employee whose details is stored in the DLL. (gross_sal = Basic + DA) (net_sal = gross_sal - IT) (Note: Only few of the operations can be asked in exam)	**5**
9.	Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers . a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in Inorder, Preorder and PostOrder c. Search the BST for a given element (KEY) and report the appropriate message d. Exit	**6**
10	Design and implement binary tree and demonstrate its working	**6**

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Elective*
Course Title*: Statistics using R*	***Course Code:*** *21DSE37*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

- Self-contained (but desirable to have understanding of Calculus)

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	To apply concepts of probability such as Axioms of Probability, Association Rule Mining and Baye's Theorem	L3
2	To apply and visualize, using R, concepts of Random variables, distributions such as Binomial, Normal, Poisson, Geometric, Uniform , Exponential, Chi-Square, Student's t-distribution and F-distribution	L3
3	To apply the concepts of sampling, Central Limit Theorem, Maximum Likelihood Estimation and Confidence Intervals	L3
4	To use Hypothesis Testing	L3
5	To apply ANOVA and correlation analysis	L3

Teaching Methodology:

- Black board teaching
- Power Point presentations
- Handson Sessions

Assessment Methods:

- Course Project -20 Marks
- Three internals, 30 Marks each will be conducted and the Average of best of all three will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03	03	03	02	03	02	02						**02**	**03**
CO2	03	03	03	02	03	02	02		01	02	01	**02**	**02**	**03**
CO3	03	03	03	02	03	02	02		01	02	01	**02**	**02**	**03**
CO4	03	03	03	02	03	02	02		01	02	01	**02**	**02**	**03**
CO5	03	03	03	02	03	02	02		01	02	01	**02**	**02**	**03**
	03	03	03	02	03	02	02		01	02	01	**02**	**02**	**03**

COURSE CONTENT **7 hours**

UNIT – I

Overview of Probability Concepts, Random experiment, Sample Space, Event, Probability Estimation, Axioms of Probability, Association Rule Mining as an application, Baye's Theorem.
Overview of Programming using R.

UNIT – II **14 hours**

Concepts and features of programming using R to visualize applications of probability distributions. Random Variables, Probability Density Function, Binomial Distribution, Geometric Distribution, Poisson Distribution, Parameters of Continuous Distributions, Uniform Distribution, Exponential Distribution, Normal Distribution. Chi-Square Distribution, Student's t-Distribution, F-Distribution.

UNIT – III **9 hours**

Sampling and Estimation, Random Sampling, Stratified Sampling, Cluster Sampling, Bootstrap aggregating, Non-probability Sampling, Sampling distribution, Central Limit Theorem, Sampling Size Estimation for the Mean of the Population, Estimation of Population Parameters, Method of Moments, Estimation of Parameters, Maximum Likelihood Estimation, Confidence Intervals. Examples and demonstrations using R.

UNIT – IV **9 hours**

Introduction Hypothesis Testing, Setting up a Hypothesis Test, One-Tailed and Two-Tailed Test, Type I Error, Type II Error, z-Test, t-Test, Paired Sample t-Test, Comparing Two Populations, Two Sample z-Test for Proportions, Effect Size: Cohen's D, Hypothesis Test for Equality of Population Variances, Non-parametric Tests, Analysis of Variance, Correlation Analysis. Examples and demonstrations using R.

TEXT BOOKS:

1. Business Analytics: The Science of Data-driven Decision Making, Dinesh Kumar, 2017, Wiley India, Pvt. Ltd.
2. Probability&Statistics for Engineers & Scientists, Ninth Edition, Ronald E. Walpole,Raymond H.Myers, Sharon L.Meyers, Keying Ye. 2012, Pearson.

WEBSITES:

1. Probability and Statistics with Examples using R (isibang.ac.in)

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Elective*
Course Title*: Web Technologies*	***Course Code:*** *21DSE37*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

- A Programming course

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Design web pages using HTML mark-up language for the given Scenarios.	L3
2	Describe the fundamental concepts of XML	L1
3	Apply the concepts of Cascading Style Sheets for designing the web pages.	L3
4	Demonstrate the use of JavaScript to develop the dynamic user interface.	L3
5	Implement server-side scripting using PHP	L3

Teaching Methodology:

- Black board teaching
- Power Point presentations
- Handson Sessions

Assessment Methods:

- Course Project -20 Marks
- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03												**02**	**03**
CO2	03	02	03						02	02		**02**	**02**	**03**
CO3	03	02	03						02	02		**02**	**02**	**03**
CO4	03	02	03						02	02		**02**	**02**	**03**
CO5	03	02	03						02	02		**02**	**02**	**03**
	03	02	03						02	02		**02**	**02**	**03**

COURSE CONTENT UNIT – I 7 hours

Internet and web technologies, structuring an HTML document, Exploring Editors and Browsers Supported by HTML5, Creating and saving an HTML document, Validating and Viewing an HTML document, Understanding HTML elements, Describing data types, Formatting text with HTML elements, Arranging text, Exploring the hyperlinks and URL, Creating tables.

UNIT – II **7 hours**

HTML Continued - Inserting images in a web page, Exploring colours, working with forms, Exploring audio and video formats, Describing the multimedia elements, Defining a multimedia file using the EMBED element.

Introduction to XML: Working with basics of XML – Exploring XML, Comparing XML with HTML, Advantages and disadvantages of XML, Structure of XML document

UNIT – III **8 hours**

CSS – Overview of CSS, Background and colour gradient in CSS, font and text styles, Creating Boxes and Columns in CSS, Displaying, Positioning and Floating an element, List styles, Table layouts.

UNIT – IV **9 hours**

Exploring the features of Javascript, Using Javascript in an HTML Document, Programming fundamentals of Javascript, Javascript functions, events, image maps and animations, Objects in Javascript, Working with Browser objects, Working with Document Object, Document Object Model.

UNIT – V **8 hours**

Introduction to PHP: Origins and uses of PHP, Overview of PHP, General syntactic characters, Primitives operations and expressions, output, control statements, Arrays, Functions, Pattern matching, Form handling, Cookies, Session Tracking.

TEXT BOOKS:

1. HTML5 Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and Jquery Black Book, dreamtech PRESS, ISBN:978-93-5119-907-6, 2019
2. Programming the World Wide Web- Robert W. Sebesta, 7thEdition, Pearson Education, 2014.

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Elective*
Course Title*: Software Engineering*	***Course Code:*** *21DSE37*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Prerequisites:

- A course on programming

COs	Course Outcome Description	Blooms Level
1	Describe the phases of software engineering life cycle	L1
2	Specify requirements for a chosen case study by applying principles of requirements engineering and best practices	L3
3	Create Architecture and detailed design for the chosen case study by applying best practices in architecture and design	L3
4	Develop software for the chosen case study by using appropriate coding guidelines and running unit, integration and system tests	L5
5	Implement changes and bug-fixes to the software of the case study pointing out opportunities for refactoring code besides ensuring correctness	L3

Teaching Methodology:

- Black board teaching
- Power Point presentations
- Handson Sessions

Assessment Methods:

- Course Project -20 Marks
- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03				02			2					**02**	**03**
CO2	03	01	03		02			2	02	02		**02**	**02**	**03**
CO3	03	01	03		02			2	02	02		**02**	**02**	**03**
CO4	03	01	03		02			2	02	02		**02**	**02**	**03**
CO5	03	01	03		02			2	02	02		**02**	**02**	**03**
	03	01	03		02			2	02	02		**02**	**02**	**03**

Course Content:

UNIT – I	8 hours
Software Development Life Cycle: History of Software Engineering. Software Development Life Cycle. Process Models. Sample case studies for illustration. Classification of software qualities. Quality requirements.	
UNIT – II	8 hours
Requirements Specification: User Requirement Specifications. Products and Requirements. Use Cases. Sample Case studies for illustration. Development Cost Estimation methods. Principles of Requirements Engineering. Product Line , common and varying requirements. The uses of specifications, specification qualities, verification of specifications, Building and using specifications in practice.	
UNIT – III	8 hours
Architecture and Design: Separation of concerns, Modularity, Abstraction, Anticipation of change, Generality and incrementality. Case studies illustrating software engineering principles. Software Design activity and its objectives. Modularization techniques. Handling anomalies. Object-oriented design. architecture and components.	
UNIT – IV	8 hours
Implementation and Validation: Alpha, Beta and Revenue Release milestones. Coding guideline standards. Development of code in conformance with coding guidelines. Case studies. White-box and Black-box testing methods. Unit , integration and system testing.	
UNIT – V	7 hours
Making Changes to Software: Importance of software process models. Dealing with Legacy software. Organizing the Process. Organizing Artifacts. Configuration Management Standards.	

Text Books:

5. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli. Fundamentals of Software Engineering, 2nd edition, 2003, Prentice-Hall of India.
6. Roger Pressman, Bruce Maxim. Software Engineering A Practitioner's Approach. Ninth Edition, 2019. Mc-Graw Hill Education.

Semester: 3 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Elective*
Course Title*: Software Engineering*	***Course Code:*** *21DSE37*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Elective*
Course Title*: Internship-I*	***Course Code:*** *21DSI39*
L-T-P:	***Credits:****02*
Total Contact Hours:	***Duration of SEE:****as required for presentation/Viva Voce*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Outcomes:

1. Students gain practical experience in software design, development and testing
2. Students learn how to work in teams and integrate their work
3. Students learn about technical report writing
4. Students learn how to present OR explain their work to others
5. Students learn about best practices or right usage of programming constructs

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03	03	2	2	03	2	2	2	3	2	3	**3**	**03**	**03**
CO2	02	02	02	2	02	2	2	2	03	02	3	**02**	**02**	**02**
CO3	03	03	02	02	02	02	2	2	03	03	2	**02**	**02**	**02**
CO4	02	02	02	02	02	02	02	2	03	03	02	**02**	**02**	**02**
CO5	02	02	03	2	03	2	1	1	03	03	3	**03**	**03**	**03**
	2.4	2.4	2.2	2	2.4	2	1.8	1.8	03	2.6	2.6	**2.4**	**02**	**03**

Assessment:

Students need to submit a report on project work carried out (50% weightage) and present or undergo a Viva Voce (50% weightage).

Course Content:

Students perform projects of their choice or assigned ones that shall have specified course outcomes. Typically, students develop software and co-ordinate with a small team learning project management issues in addition to resolving technical challenges.

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Semester 4:

Department: Mathematics	***Course Type: Basic Science***
***Course Title**: Engineering Mathematics IV (Probability and Discrete mathematics)*	***Course Code: 21DS41***
L-T-P : 3-0-0	***Credits: 3***
Total Contact Hours: 39	***Duration of SEE: 3.00hrs***
***SEE Marks**: 100*	***CIE Marks: 50***

COURSE DESCRIPTION

The course gives a broad view of Probability theory, Random Process, Discrete mathematical structures and Graph theory.

PREREQUISITES

Concepts of Combinations, Permutation and Set theory

COURSE OBJECTIVES

To Impart the knowledge and ability to apply basic concepts of Probability, random process, discrete mathematics and graph theory to engineering problems

COURSE CONTENTS

UNIT - I — 08 Hours

Probability and Random Variables

Probability: Definition, Axioms of probability, Addition rule, Conditional Probability, Multiplication rule.

Random variable -: Probability distribution- discrete and continuous, probability density function, cumulative density function, mean and variance, expectation.

Joint distribution - discrete joint probability distribution, marginal distribution, expectation, covariance, rank correlation.

Binomial, Poisson distribution, Gaussian distribution

Baye's Theorem, continuous Joint distribution

UNIT - II — 08 Hours

Probability and sampling Distribution

Probability Distribution: Normal distribution, exponential distribution and uniform distribution.

Sampling and Testing of hypothesis: Introduction, Sampling with and without replacement, Sampling distribution of means and sample variance. Unbiased estimate, confidence intervals for mean, statistical hypothesis, testing of hypothesis of large samples, one tailed and two tailed test, Significance level.

Markov Process: Definition, transition probability matrix, regular stochastic matrix, n – step transitional probabilities, stationary distribution

Self-Study: Poisson's Process, States of Markov process.

.

UNIT - III 08 Hours

Discrete Mathematical structures

Mathematical Logic: Propositional Logic, logical operators, compound propositions - truth values, truth tables, Propositional Equivalences.

Functions: Definition, surjective, injective and bijective functions, Inverse function and composition of functions.

Relations: Definition, Properties, Equivalence, matrix representation, digraphs, partial order -Hasse diagram- Maximal and minimal elements, LUB and GLB.

Self-Study: Rules of Inference.

UNIT - IV 08 Hours

Graph Theory-I

Graph Terminologies, circuits, cycles and connected graphs hand shaking theorem, Degree sequence, path and trail in graphs, Graph isomorphism, Adjacency and Incidence matrices, Euler and Hamiltonian graphs, Shortest path problems-Dijkstra's algorithm for undirected graphs.

Applications such as Job Assignments, Travelling Salesman problem

UNIT - V 07 Hours

Graph Theory-II

Trees- Properties, spanning trees, minimum spanning trees- Prim's and Kruskal's algorithm.

Planar graphs, Problems on Euler's formula, Graph coloring – vertex coloring.

Self-Study: Three house and Three utilities problem, Scheduling Problems using Graph coloring,

TEXT BOOKS

1. Fundamentals of Statistics, S C Gupta, 6th edition, Himalaya Pub., 2007
2. Discrete Mathematics and its applications, Kenneth Rosen, 7th edition, Tata McGrawHill, 2011

REFERENCE BOOKS

1. Introduction to Graph theory, Gary Chartrand, Tata McGrawHill, 2006
2. Probablility and Statistics, M R Spiegel, JJ Schiller, R A Srinivasan, 3rd edition, Mc GrawHill, 2019

TEACHING METHODS

- Black Board Teaching.
- Power point presentation
- Tutorial

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Quiz/ assignment based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of all the 3 will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

1. The concepts of Mathematical logic, functions and relations can be applied to Engineering. Problems
2. The concepts of graph theory can be used to model and solve problems
3. The concepts of Graph theory can be applied to Engineering Problems
4. The basic concepts of Probability, random variables, distributions and Sampling can be used for problem solving
5. The testing of hypothesis and distributions can be applied to engineering problems

Mapping of CO-PO:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	2	1	2	2		1	2		2	1	2
CO2	3	2	2	2	1	2	2		1	2		2	1	2
CO3	3	2	2	2	1	2	2		1	2		2	1	2
CO4	3	3	2	2	1	2	2		1	2		2	1	2
CO5	3	2	2	2	1	2	2		1	2		2	1	2
C06	3	2	2	2	1	2	2		1	2		2	1	2
	3	2.2	2	2	1	2	2		1	2		2	1	2

Department: *Artificial Intelligence & Data Science*	***Course Type: Core***
Course Title*: Data Mining*	***Course Code:*** *21DS42*
L-T-P:*3-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Prerequisites

- Data Mining shall be a self-contained course, mathematical preliminaries such as probability theory are helpful.

Course Outcomes:

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

Cos	Course Outcome Description	Blooms Level
1	Describe methods for data cleaning	L1
2	Explain methods of frequent pattern mining	L2
3	Apply techniques for classification of data	L3
4	Analyse given data using classification and clustering algorithms	L4
5	Synthesise and solve data mining problems of practical importance using theoretical analysis and software tools	L3

Teaching Methodology

- Black board, Power Point
- Assignment
- Case Study

Assessment Methods:

- Three MSEs of 30 marks of each. The average of all three performances will be considered to award 30 marks.
- Rubrics to evaluate Case Study 10Marks
- Rubrics for evaluating assignment 10 Marks.
- SEE for 100 marks will be evaluated for50 marks.

Course Outcome to Programme Outcome Mapping

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO2	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO3	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO4	3	3	2	2	3	2	2	1	1	2	2	2	2	2
CO5	3	2	3	2	3	2	2	1	1	2	2	2	2	2
C06	3	2	3	2	3	2	2	1	1	2	2	2	2	2
	3	2.2	2.8	2	3	2	2	1	1	2	2	2	2	2

COURSE CONTENT

Unit 1(Introduction to Data mining): Data mining, kinds of data mining, patterns, technologies. Getting to know your data. Description of data, data visualization, measuring the similarity and dissimilarity. Data Pre-processing: An overview of data pre-processing, data cleaning, integration, reduction, transformation and discretization. (8 Hours)

Unit 2 (Mining Frequent Patterns): Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods, Market Basket Analysis, Data Warehousing and Online Analytical Processing, Data Cube Technology (8 Hours)

Unit 3 (Classification): Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy. (8 Hours)

Unit 4 (Clustering): Basic Concepts and Methods, Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods and Evaluation of Clustering. (8 Hours)

Unit 5 (Outlier and data mining Applications): Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches, Clustering-Based Approaches, Classification-Based Approaches, Mining Contextual and Collective Outliers.

Case studies from text mining, recommender systems, image and video processing, data warehousing. Data Mining Trends and Research Frontiers: Data Mining Applications, Graph Mining and Social Network Analysis.

(7 Hours)

Text books

Jiawei Han, Kamber Jian Pei Simon (2019), Data Mining Concepts and Techniques, Third Edition. Morgan Kaufmann Publishers

References:

Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining ,

Pearson,2016.

Websites:

Data mining - Wikipedia

Semester: 4 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type: Core***
Course Title*: Database Management Systems*	***Course Code:*** *21DS43*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisite:

- Students should have knowledge of data structures.

Course Outcomes:

Students will be able to:

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Cos	Course Outcome Description	Blooms Level
1	Describe the concepts, design and applications of database systems	L1
2	Explain the principles of data modelling, querying, SQL programming techniques of database systems.	L2
3	Design and implement queries using query languages for a given database system.	L3
4	Analyse given schema and use appropriate normalization techniques for relational databases.	L4
5	Explain the principles of storage, transactions and optimization of database systems	L2
6	Design and implement an efficient database system and interface it with a given application	L3

Teaching Methodology:

- Black board teaching
- Power Point presentations
- Hands on Sessions

Assessment Methods:

- Course Project /Assignment-20 Marks
- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	3	2	2	1			2	2	3	3
2	2	2	2	2	3	2	2	1	2	2	2	2	3	3
3	2	2	2	2	3	2	2	1	2	2	2	2	3	3
4	2	2	2	2	3	2	2	1	2	2	2	2	3	3
5	2	2	2	2	3	2	2	1	2	2	2	2	3	3
6	2	2	2	2	3	2	2	1	2	2	2	2	3	3
	2	2	2	2	3	2	2	1	2	2	2	2	3	3

Course Content:

Unit 1 (Introduction to Database Systems and Entity Relationship Model): Purpose of database systems, characteristics of database approaches, history of database applications, classification of DBMS, database users, architectures for DBMS, recent database applications, data models, schemas, data independence, database design and implementation process.

E-R diagrams, entities, attributes, relationships, roles and constraints, Enhanced Entity-Relationship (EER) diagrams, sub classes and super classes, specialization and generalization.

11 HOURS

Unit 2 (Relational Data models and Query Languages): Relational schema, relational model constraints, keys, relational database design, relational algebra, relational calculus.

SQL- data definition and data types, query formulation, constraints in SQL, basic queries in SQL, complex queries in SQL, QBE, query processing, database programming - techniques and issues, embedded SQL, using JDBC, database stored procedures.

8 hours

Unit 3 (Normalization) : Functional dependency, normal forms, decomposition of a schema, multivalued dependencies, join dependencies, dependency preservation, inclusion dependencies.

6 hours

Unit 4 (File Structures)

Basic file structure, RAID technology, hashing techniques, indexing structures, types of single level ordered indexes, multi-level indexes, B+ trees

7 hours

Unit 5 (Transaction Processing)

Transaction processing systems, transaction states, ACID properties, characterizing schedules, recoverability and serializability of schedules, concurrency control, locking techniques, time stamp ordering, database recovery techniques, shadow pages, ARIES recovery algorithm, database security and authorization.

7 hours

Text Book:

1. Elmasri, R., and Navathe, S.B., 2017, Fundamentals of Database Systems, 7th ed., Pearson Education.

Websites:

Database - Wikipedia

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Semester: 4 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type: Core***
Course Title*: Design and Analysis of Algorithms*	***Course Code:*** *21DS44*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods which are useful in practice. The computational problems for sorting, searching, Divide and Conquer, dynamic programming and greedy algorithms, graph algorithms string matching, Backtracking, Branch and Bound, NP completeness are discussed.

Pre-requisites:

- Self-contained , however, desirable for student to have successfully completed first year programming course and have knowledge of mathematical preliminaries such as probability theory.

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Describe Algorithmic problem solving approaches , important problem Types and Analysis of Algorithm efficiency	L1
2	Design various algorithms for Search, and Sort including Depth First and Breadth First approaches	L3
3	Design algorithms using Divide and Conquer approach, Transform and Conquer and Dynamic Programming	L3
4	Design algorithms using Greedy technique, iterative improvement,	L3
5	Analyse with respect to space time tradeoffs	L4

Teaching Methodology:

- Black board teaching
- Power Point presentations
- Hands on Sessions

Assessment Methods:

- Course Project/Assignment -20 Marks
- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	2	3	1	2	1			1	3	3	3
2	3	2	2	2	3	1	2	1	2	2	1	3	3	3
3	3	2	2	2	3	1	2	1	2	2	1	3	3	3
4	3	2	2	2	3	1	2	1	2	2	1	3	3	3
5	3	2	2	2	3	1	2	1	2	2	1	3	3	3
	3	2	2	2	3	1	2	1	2	2	1	3	3	3

COURSE CONTENT UNIT – I	8 hours
Fundamentals of Algorithmic Problem Solving, Algorithm Design techniques, Design an Algorithm and Data Structures, Analyzing an Algorithm, Coding an Algorithm, Important Problem Types, Fundamental data structures. Analysis Framework. Asymptotic notations and basic efficiency classes.	
UNIT – II	**9 hours**
Bruteforce and exhaustive search, Selection Sort and Bubble Sort, Sequential Search and Brute-force String matching, Closest Pair and Convex-Hull problems by Brute force, Exhaustive Search, Depth-first search and Breadth-first search.	
UNIT – III	**8 hours**
Decrease-and Conquer, Insertion Sort, Topological Sorting, Algorithms for generating Combinatorial Objects, Decrease by a constant factor algorithms, Variable size decrease algorithms,	
UNIT – IV	**7 hours**
Divide and Conquer, Mergesort, Quicksort, Binary Tree Traversals, Multiplication of large integers, Strassen's matrix multiplication, closest-pair and Convex-Hull problems by Divide and Conquer.	
UNIT – V	**7 hours**
Transform and conquer, Gaussian elimination, Balanced search trees, Hashing, B-Trees, Dynamic Programming, Greedy Algorithms. Overview of P,NP,NP-Complete Problems.	

TEXT BOOKS:

3. Anany Levitin: Introduction to the Design and Analysis of Algorithms, Pearson 3rd edition 2017.

Reference BOOKS:

1.Introduction to Algorithms, Eastern Economy Edition, Feb 2010, Thomas H.Cormen, Charles E.Leiserson, Ronals L.Rivest and Clifford Stein

Semester: 4 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type: Core***
Course Title: AI Case Studies using Python	***Course Code:*** *21DSG45*
L-T-P:3*-0-2*	***Credits:****04*
Total Contact Hours: 39 *hours theory & 26 Hours Lab*	***Duration of SEE:****04 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Outcomes:
Students will be able to:

Sl. No.	Course Outcome Description	Blooms Level
1	To apply rich features of Python in Machine Learning and Data Science Applications	L3
2	To develop simple Python programs for Natural Language Processing, Twitter data based sentiment analysis understanding basic necessary concepts	L3
3	To develop simple programs based on Time series and linear regression	L3
4	To develop simple programs for classification, clustering and regression understanding basic necessary concepts	L3
5	To explain NoSQL databases and use MongoDB.	L2

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Programming Assignments

Assessment Methods:

- Theory:Rubrics to evaluate Course Project for 20 Marks
- Theory:Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Theory:Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.
- Lab: CIE(Experiments, Viva Voce, Record: 20 marks; Lab Test: 30 marks); SEE:50 marks

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3	3	3	2	2	1		2	2	3	3	2
CO 2	3	2	3	3	3	2	2	1	2	2	2	3	3	2
CO 3	3	2	3	3	3	2	2	1	2	2	2	3	3	2
CO 4	3	2	3	3	3	2	2	1	2	2	2	3	3	2
CO 5	3	2	3	3	3	2	2	1	2	2	2	3	3	2

COURSE CONTENT

Unit1(Python for Data Science): Sample usage of numpy, scipy and Pandas. Introduction to Data Science, Basic Descriptive Statistics, Measures of central tendency, Measures of dispersion, Simulation and Static Visualization, Dynamic Visualizations, Pandas series and data frames, Pandas regular expressions and data munging, Working with CSV files, Time Series and Simple Linear regression.

8 hours

Unit2(Simple program for NLP and Data Mining Twitter): TextBlob, Visualizing word frequencies with bar charts and word clouds, Readability Assessment with Textatistic, Named entity recognition with spaCy, Other NLP libraries and Tools,

7 hours

Unit 3(Machine Learning and Data Mining for Twitter)

Machine Learning and Deep learning Natural Language Applications, Natural Language Datasets. Overview of the Twitter APIs and their usage as in, for example, creating a Twitter account, Authentication, Searching recent Tweets. Tweet Sentiment Analysis.

8 hours

Unit4(Programs for Classification, Regression and Clustering): Introduction to Machine learning , Scikit-Learn, Program development for Classification with k-Nearest Neighbours, Time Series and Simple Linear Regression, Multiple Linear Regression, Unsupervised Machine Learning, Deep Learning Applications, Keras, Neural Networks, Tensors.

9 hours

Unit5(Big Data: Hadoop, NoSQL): Overview of Relational Databases and SQL, Overview of NOSQL and NewSQL Big-Data Databases, MongoDB JSON Document Database, Hadoop. IoT and Publish-Subscribe Model.

7 hours

Laboratory Exercises:

Text Book:

Python for Programmers by Paul Deitel and Harvey Deitel ,2020, Pearson India.

Laboratory:

7. Exercises to work with CSV files using Python
8. Exercises to work with concepts of Time series and Linear Regression
9. Exercises with TextBlob and NLP applications
10. Exercises on Data Mining Twitter
11. Exercises in Machine Learning(classification, regression and clustering)
    - Classification with k-Nearest Neighbours
    - Dimensionality Reduction
    - K-Means clustering
12. Deep learning applications
13. Deep Learning Applications
14. Exercises with BigData databases
15. Exercises with BigData databases
16. Exercises with Data Science libraries NumPy, Pandas, SciPy, NLTK, TexBlob, Tweepy, Matplotlib, Seaborn, Folium

Department: *Artificial Intelligence & Data Science*	***Course Type:*** ***Core***
Course Title*: Database Management Systems Lab*	***Course Code:*** *21DSL48*
L-T-P:0*-0-2*	***Credits:****03*
Total Contact Hours: 30 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

At the end of the course, a student shall be able to:

Sl. No.	Course Outcome Description	Blooms Level
1	Describe the components of database systems	L1
2	Explain the principles of database design and implementation	L2
3	Design a database system for a given application	L3
4	Implement a database using DBMS and interface it with an application	L3
5	Test and validate the developed database system	L3

Course Content of Database Management Systems Lab course:

Exercises in the specified problems shown below will be performed by students.

- Analyze and perform data modeling for a given application
- Convert the data model into a relational model
- Use DDL and DML commands in SQL queries
- Develop SQL commands to create and maintain database structure
- Interface application to the developed database system
- Multidimensional data modelling

Assessment:

CIE(Experiments, Record, Viva Voce: 20 marks; Lab Test: 30 marks); SEE: 50 marks

Course Outcome to Programme Outcome Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3	3	3	2	2	1		2	2	3	3	2
CO 2	3	2	3	3	3	2	2	1	2	2	2	3	3	2
CO 3	3	2	3	3	3	2	2	1	2	2	2	3	3	2
CO 4	3	2	3	3	3	2	2	1	2	2	2	3	3	2
CO 5	3	2	3	3	3	2	2	1	2	2	2	3	3	2

Semester: 4 **Year: 2022-23**

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Semester: 4 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type: Elective***
Course Title: *Object-oriented* Programming using Java	***Course Code:*** *21DSE47*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

No programming knowledge is assumed, successful completion of first year course on programming is desirable..

Course Outcomes:

Cos	Course Outcome Description	Blooms Level
1	Describe main features of Object-oriented programming and associate them with features of Java	L1
2	Develop Java programs using features of classes, methods and control structures of Java	L3
3	Develop Java programs involving classes , inheritance and polymorphism using exception handling where necessary	L3
4	Use advanced features of Java such as generics, functional programming and threads	L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.
- Course Project.

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Rubrics for Course Project (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	02	02	02	2	3	2	2	1	01	02	02	**02**	**03**	**03**
CO2	02	02	02	2	3	2	2	1	02	02	02	**02**	**03**	**03**
CO3	02	02	02	2	3	2	2	1	02	02	02	**02**	**03**	**03**
CO4	02	02	02	2	3	2	2	1	02	02	02	**02**	**03**	**03**

Course Content

Unit1(Internet and Java):

Object Technology basics, Overview of Java, Operating Systems on which Java implementations are available, Java Development Environment, Internet and World Wide Web, Software Technologies. (4 Hours)

Unit2(Control Structures, Operators, Arrays in Java): Decision making, Relational operators, Instance variables, constructors, primitive types, Reference types, A simple GUI, Control Statements, Assignment and operators, logical operators, Methods, parameters, call stack, Method overloading, Arrays and Array Lists. (10 Hours)

Unit3(Object-oriented Programming): Controlling Access to Members of objects, this Reference, Overloaded Constructors, Default and No-Argument Constructors, Set and Get methods, Composition, enum types, Garbage collection, static Class Members, final Instance Variables, Package Access, Superclasses and subclasses. Protected members, constructors in subclasses, Class Object, Composition vs Inheritance. Polymorphism and Interfaces, Abstract Classes and Methods.Case study using polymorphism. (12 Hours)

Unit4(Advanced features of Java and Unit Testing): Classes, Inheritance, Polymorphism, Operator Overloading, Exceptions, Unit Testing, Namespaces and Scopes, Overview of Generic Collections, Lambdas and Streams. Java Threads. (9 Hours)

Unit 5(Accessing Databases with JDBC):

Setting Up a database, connecting to and querying a database. (4 Hours)

Texbook:

Java How to Program Early Objects 11th edition, Paul Deitel and Harvey Deitel, March 2022.

Website:

https://plugins.jetbrains.com/plugin/14014-spotbug

Department: *Artificial Intelligence & Data Science*	***Course Type: Elective***
Course Title*: Software Design Patterns*	***Course Code:*** *21DSE47*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

Successful completion of first year course on programming and knowledge of object-oriented programming is desirable.

COs	Course Learning Outcomes	BL
1	To describe the purpose of design patterns in software development and data science applications	L2
2	To use relevant structural patterns in application development	L3
3	To use behavioural patterns in software development	L3
4	To apply patterns relevant for data science	L3
5		

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.
- Course Project.

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Rubrics for Course Project (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

COURSE CONTENT UNIT – I	8 hours
Motivation for using design patterns, Overview of design patterns, structural and behavioural patterns	
UNIT – II	**9 hours**
Structural Patterns : Creational Patterns with examples, Adapter and Decorator Patterns, Bridge and Façade Patterns, Model-View Controller and Proxy Patterns.	
UNIT – III	**10 hours**
Behavioural Patterns: Chain of Responsibility, Command and Observer Patterns, State and other behavioural patterns with examples and discussion on applications.	
UNIT – IV	**12 hours**
Data Science Patterns: Map Reduce Patterns and other patterns relevant for data science applications with examples.	

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	02	02	02	01	03	01	02	01	02	02	02	**02**	**03**	**03**
CO2	02	02	03	01	03	01	02	01	02	02	02	**02**	**03**	**03**
CO3	02	02	03	01	03	01	02	01	02	02	02	**02**	**03**	**03**
CO4	02	02	03	01	03	01	02	01	02	02	02	**02**	**03**	**03**

Textbooks:

Mastering Python Design Patterns, 2nd edition, Kamon Ayeva and Sakis Kesampalis, 2018, Packt Publishing.

References:

Design Patterns: Elements of Reusable Object-oriented Software , Erich Gamma, John Vlissides, Ralph Johnson, Richard helm, Addison-Wesley,

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: *Artificial Intelligence & Data Science*	***Course Type: Ability Enhancement***
Course Title: Cloud Computing and Distributed Systems	***Course Code:*** *21DSE47*
L-T-P:2*-0-0*	***Credits:****02*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

Successful completion of the course on data structures.

Course Outcomes:

COs	Course Learning Outcomes	BL
1	To discuss basic concepts of operating systems and network concepts necessary for distributed systems	L2
2	To discuss clouds, virtualization and virtual machine	L2
3	To apply Leader Election Algorithm and classical distributed algorithms in Cloud and Distributed Systems	L3
4	To discuss Consensus, Paxos and Recovery in clouds	L2
5	To discuss concepts of cloud storage and implement cloud applications	L2, L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.
- Course Project.

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Rubrics for Course Project (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

COURSE CONTENT UNIT – I	8 hours
Overview of Operating System and Network Concpets; Introduction to clouds, virtualization and virtual machine; Features of Clouds; Data-intensive computing; Hypervisor; Types of virtualization; Hotspot mitigation for Virtual Machine migration	
UNIT – II	**9 hours**
Network Virtualization and Geo-distributed clouds; Server Virtualization, Software Defined Network; Geo-distributed Cloud Data Centres; Leader Election in Cloud, Distributed Systems.	

UNIT – III	**10 hours**
Classical Distributed Algorithms; Time and Clock Synchronization in Cloud Data Centres; Global State and Snapshot Recording Algorithms; Distributed Mutual Exclusion;	
UNIT – IV	**12 hours**
Consensus, Paxos and Recovery in Clouds;Cloud Storage; Key Value Stores/NoSQL; P2P Systems and their use; Cloud Applications; Map Reduce, Spark and Apache Kafka	

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2	2	2	3	2	2	1	1	2	2	2	2	2
CO2	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO3	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO4	3	2	2	2	3	2	2	1	1	2	2	2	2	2
CO5	3	2	3	2	3	2	2	1	1	2	2	2	2	2
	3	2	2.6	2	3	2	2	1	1	2	2	2	2	2

Text Books:

1. Distributed and Cloud Computing From Parallel Processing to the Internet of Things- Kai Hwang, Jack Dongarra, Geoffrey Fox

2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011

References:

1.Distributed Algorithms-Nancy Lynch
2.Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
3.Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: *Artificial Intelligence & Data Science*	***Course Type: Ability Enhancement***
Course Title: Business Analytics	***Course Code:*** *21DSA49*
L-T-P:2*-0-0*	***Credits:****02*
Total Contact Hours: 26 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Outcomes:

Cos	Course Learning Outcomes	BL
1	To understand the concepts of Business Analytics as the science of data-driven decision making	L2
2	To apply concepts of descriptive analytics	L3
3	To understand the concepts of Stochastic Models and use them in predictive analytics	L2
4	To apply concepts of predictive analytics	L3
5	To apply concepts of prescriptive analytics	L3

Course Content:

UNIT I Overview_: Overview of Business Analytics, Motivation and Examples.Web and Social Media Analytics, Framework and challenges in data-driven decision making (1 hour)
UNIT II Descriptive Analytics: Data types and Scales, Types of data measurement scales, Population and Sample, Measures of Central Tendency, Percentile, Decile and Quartile, Measures of Variation, Skewness and Kurtosis, Data Visualization (2 hours)

UNIT III Predictive Analytics: Simple Linear Regression, Multiple Linear Regression, Logistic Regression, Decision Tree Learning and Forecasting Techniques (12 hours)

UNIT IV Prescriptive Analytics: Linear Programming, Integer Programming and Goal Programming (6 hours)

UNIT V Stochastic Models: Stochastic Process, Compound Poisson Process, Markov Chains, Using Markov Chains in Predictive Analytics (5 hours)

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.

Assessment Methods:

- Two internals, 30 Marks each will be conducted and the Average of two will be taken.
- Course Seminar (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO – PO Mapping:

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO2	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO3	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO4	3	3	2	2	3	2	2	1	1	2	2	2	2	2
CO5	3	2	3	2	3	2	2	1	1	2	2	2	2	2
	3	2.2	2.8	2	3	2	2	1	1	2	2	2	2	2

Text Book:

Business Analytics: The Science of Data-driven Decision Making , U Dinesh Kumar, Wiley, 2017.

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: *Artificial Intelligence & Data Science*	***Course Type: Ability Enhancement***
Course Title*: SQL for Data Science*	***Course Code:*** *21DSA49*
L-T-P:2*-0-0*	***Credits:****02*
Total Contact Hours: 26 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Outcomes:

Cos	Course Learning Outcomes	BL
1	To discuss concepts of Data Life Cycle and Relational Data	L2
2	To apply concepts of data cleaning and pre-processing using SQL	L3
3	To use various features of SQL for addressing requirements of data life cycle	L2
4	To apply concepts of data analysis and implement them using SQL queries	L3

Course Content:

Unit1: Data Life Cycle; Sequence of stages from data acquisition to archiving; Data Loading, Cleaning and pre-processing Relational Databases ; Usage of MySQL and Postgres (8 hours)

Unit2: SQL queries, implementation of data analysis tasks such as data exploration, cleaning and Transformation; implementation of sample analyses; Lab exercises/demonstrations (8 hours)

Unit 3: Additional SQL features for Data Analysis ; implementation of sample analyses; Practical demonstrations; addressing various requirements of Data Life Cycle using SQL (8 hours)

Unit 4: Using SQL from with R and Python (2 Hours)

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.

Assessment Methods:

- Two internals, 30 Marks each will be conducted and the Average of two will be taken.
- Course Seminar (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	2	3	2	2	1	1	2	2	2	2	2
CO2	3	2	2	2	3	2	2	1	1	2	2	2	2	2
CO3	3	2	2	2	3	2	2	1	1	2	2	2	2	2
CO4	3	2	2	2	3	2	2	1	1	2	2	2	2	2
	3	2	2	2	3	2	2	1	1	2	2	2	2	2

Text Book:

Antonio Badia, SQL for Data Science: Data Cleaning, Wrangling and Analytics with Relational Databases, Springer, 2020.

Department: *Artificial Intelligence & Data Science*	***Course Type: Ability Enhancement***
Course Title*: Habits for Highly Effective People*	***Course Code:*** *21DSA49*
L-T-P:2*-0-0*	***Credits:****02*
Total Contact Hours: 26 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Outcomes:

COs	Course Learning Outcomes	BL
1	To apply and practise relevant habits to enhance individual professional performance	L3
2	To apply relevant habits to promote teamwork	L3
3	To develop innovative solutions as a part of a team	L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.

Assessment Methods:

- Two internals, 30 Marks each will be conducted and the Average of two will be taken.
- Course Seminar (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Content:

Unit 1:

Habits 1 & 2**:** Be Proactive; Begin with the end in mind (8 Hours)

Unit 2:

Habits 3 & 4: Put First Things First; Think win-win (8 Hours)

Unit 3:

Habits 5,6 & 7: Seek First to Understand then to be Understood; (10 Hours)
Synergize;
Sharpen the Saw

Course Outcomes:

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	1	1	1	1	1	1	1	3	3	3	3	3	2	2
CO2	1	1	1	1	1	1	1	3	3	3	3	3	2	2
CO3	1	1	1	1	1	1	1	3	3	3	3	3	2	2
	1	1	1	1	1	1	1	3	3	3	3	3	2	2

Text Book:

Stephen Covey, The 7 Habits of Highly Effective People, Simon & Schuster; 12th edition (1 January 2019)..