GLOBAL ACADEMY OF TECHNOLOGY

(Autonomous institution affiliated to VTU, Belagavi.
Accredited by NAAC with 'A' grade,
NBA Accredited CS, E&C, E&E, MECH and IS branches)Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098.

Department of Artificial Intelligence and Data Science

2022 BATCH

3RD TO 8TH SEMESTER SCHEME & SYLLABUS

Head of the Department 24/10/24
Dept. of Artificial Intelligence & Data Science
Global Academy of Technology
Bengaluru - 560 098.

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

B.E. in Artificial Intelligence and Data Science
Scheme of UG Autonomous Program – 2022 batch

III SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22MAT31A	Discrete Mathematics – I	BS	MAT	2	2	0	50	50	100	3
2	22ADS32	Data Structures using C	IPC	Respective Department	3	1	2	50	50	100	4
3	22ADS33	Data Base Management System	IPC		3	1	2	50	50	100	4
4	22ADS34	Foundations of Data Science	PC		2	2	0	50	50	100	3
5	22ADS35	Python for Data Science	ETC		3	0	0	50	50	100	3
6	22ADS36	Operating System	AEC		3	0	0	50	50	100	3
							Total	300	300	600	20

H.M. Rajashekhar Swamy
Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

B.E. in Artificial Intelligence and Data Science
Scheme of UG Autonomous Program – 2022 batch

IV SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hou			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	22MAT41A	Probability and Linear Algebra	BS	MAT	2	2	0	50	50	100	3
2	22ADS42	Design & Analysis of Algorithms	IPC	Respective Department	3	1	2	50	50	100	4
3	22ADS43	Machine Learning-I	IPC		3	1	2	50	50	100	4
4	22ADS44	Soft computing techniques	PC		2	2	0	50	50	100	3
5	22ADS45	Image Processing	ETC		2	2	0	50	50	100	3
6	22ADS46	Programming in Java	AEC		2	0	2	50	50	100	3
							Total	300	300	600	20

H.P. Rajeshekaraswamy
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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER – III

DISCRETE MATHEMATICS – I

(Common for CSE/ISE/AI&DS /AI&ML)

Course Code:	**22MAT31A**	**CIE Marks:**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks:**	**50**
No. of Credits:	**03**	**Examination Hours:**	**03**

Course Objectives: To enable students to apply the knowledge of Mathematics in fields of computer science and allied branches by making them to learn:

1	Counting Principles
2	Mathematical Logic and Set Theory
3	Well ordering principle and Properties of Integers.
4	Probability and Random Variables

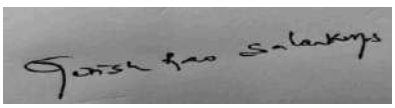
Sl. No	Course Learning Objectives (CLO)
1	To understand the concept of pointers and, allocate and deallocate memory dynamically to pointers.
2	To understand working principle of different types of data structures
3	To identify and apply the appropriate data structure to solve a given problem.
4	To develop applications using data structure algorithms.

Module 1	No. of Hours	RBT Level
The Rules of Sum and Product, The Pigeon-hole Principle, Permutations, Combinations, The Binomial Theorem, Combinations with Repetition.	**08**	**L3**
Module 2		
Sets and Subsets, Set operations and Laws of Set Theory. Counting and Venn Diagrams. Probability, Conditional probability and Bayes Theorem.	**08**	**L3**
Module 3		
Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implications: Rules of Inference. Quantifiers, Definitions, and the Proofs of Theorems.	**08**	**L3**
Module 4		
The Well-Ordering Principle, Mathematical Induction, Recursive Definitions, The division algorithm, Euclidian algorithm, Fundamental theorem of arithmetic.	**08**	**L3**
Module 5		
Random Variable, Binomial, Poisson, Exponential and Normal distributions. Joint distributions, Expectation and Covariance.	**08**	**L3**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Use computational techniques essential for the study of mathematical logic, set operations, counting principles and properties of integers.
CO2	Solve problems associated with random variables using probability distributions



CO / PO Mapping													
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1									3		
CO2	3	2	1									3		
Average	3	2	1									3		

High-3: Medium-2: Low-1

Text Books:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education. 2020.
2. T Veerarajan, Probability, Statistics and Random Processes for Engineers, Tata McGraw Hill, 3rd Edition, 2008

Reference Books:

1. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007
2. Richard H Williams, Probability, Statistics and Random Processes for Engineers, Cengage Learning, 1st Edition, 2003

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

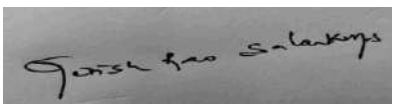
Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER – III

DATA STRUCTURES USING C

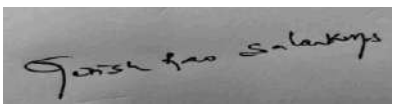
Semester:	**03**	**CIE Marks:**	**50**
Course Code:	**22ADS32**	**SEE Marks:**	**50**
Hours/Week (L: T: P):	**3:1:2**	**Duration of SEE (hours):**	**03**
Type of Course:	**IPC**	**Credits:**	**04**

Prerequisites (if any): C programming language.

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To understand the concept of pointers and, allocate and deallocate memory dynamically to pointers.
2	To understand working principle of different types of data structures
3	To identify and apply the appropriate data structure to solve a given problem.
4	To develop applications using data structure algorithms.

Module 1	No. of Hours	RBT Level
Introduction: Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations **Sorting:** Insertion Sort, Radix sort, Address Calculation Sort. **Dynamic Memory Allocation:** Introduction, Dynamic Memory Allocation, Allocating a Block of Memory: malloc, Allocating a Multiple Blocks of Memory: calloc, Releasing the Used Space: Free, Altering the size of Block: realloc.	**10**	**L2**
Module 2		
The Stack: Definition and Examples— Primitive operations, examples **Representing Stacks in C**: Implementing the POP operation, testing for exceptional conditions, implementing the PUSH operation An Example: Infix, Postfix, and Prefix – Basic definitions and examples **Stack Applications** – Recursive Definition and Processes, Tower of Hanoi, conversion of infix to prefix and postfix, Evaluating a postfix expression	**10**	**L2**
Module 3		
Queues: The Queue and its Sequential Representation: C Implementation of Queues, primitive operations on Queue, Array Implementation of a Priority Queue, circular Queue, Priority Queue, double ended queue	**10**	**L2**
Module 4		
Linked Lists: Introduction and definition, representation of linked list in memory, primitive operations on linked list, Linked Implementation of Stacks, getnode and free node Operations, Linked Implementation of Queues **Other list structures** - Circular lists and it's primitive operations, Doubly linked lists and it's primitive operations, Applications of linked lists: Addition of long positive integers, addition of Polynomials.**Hashing:** Hash tables, Hash function, Overflow handling: Open Addressing, Chaining.	**10**	**L2**
Module 5		
Binary Trees: Introduction and definition, Node Representation of Binary Trees, Internal and External Nodes, Implicit Array Representation of Binary Trees, Primitive operations on Binary Tree, Threaded binary tree, Binary search tree and its primitive operations, General Expressions as Trees, evaluating an expression tree, constructing a Tree.	**10**	**L2**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Explain different types of data structures along with couple of sorting techniques.
CO2	Explain and implement the operational aspects of stacks in problem solving.
CO3	Explain and implement the operational aspects of queues in problem solving.
CO4	Explain and implement operations on linked lists and demonstrate their applications
CO5	Explain and implement various operations on trees

CO / PO Mapping													
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3		2				2	1		2	3	
CO2	3	3	3		2				3	1		2	3	
CO3	3	3	3		2				2	1		2	3	
CO4	3	3	3		2				2	1	2	2	3	
CO5	3	3	3		2				2	1	2	2	3	
Average	3	3	3		2				2	1	2	2	3	

High-3: Medium-2: Low-1

Text Books:

1. Fundamentals of Data Structures in C, Ellis Horowitz, Sartaz Sahni, Anderson, Freed, Second edition, University press, 2008, Reprinted 2016, **ISBN:**978-81-7371-605-8
2. Data Structures with C, Seymour Lipschutz, Schaum's Outlines, McGraw Hill, Special Indian Edition, Thirteenth Reprint 2015. **ISBN:**978-0-07-070198-4

Reference Books:

1. Data Structures using C, Aaron Tanenbaum, Yedidyah Langsam and Moshe Augenstein, Pearson, Thirteenth Impression, 2014. **ISBN:**978-81-317-0229-1
2. Data Structures A Pseudo code approach with C, Richard F. Gilberg and Behrouz A. Forouzan, Thomson, 2005. **ISBN:**978-81-315-0314-0
3. Data Structures & Program Design in C, Robert Kruse & Bruce Leung, Pearson Education, 2007.
4. Data Structures using C, Reema Thareja, Second edition, Oxford University press, 2104

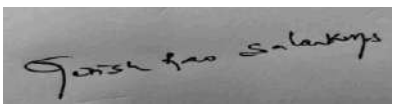
E-Books / Web References:

1. Notes on Data Structures and Programming Techniques (CPSC 223, Spring 2021) http://www.cs.yale.edu/homes/aspnes/classes/223/notes.pdf
2. Fundamental Data Structures

   https://en.wikipedia.org/wiki/Book:Fundamental_Data_Structures
3. Algorithms and Data Structures http://www.inr.ac.ru/~info21/ADen/

MOOCs:

1. https://www.coursera.org/specializations/data-structures-algorithms
2. https://www.edx.org/course/introduction-to-data-structures



Prog. No.	Lab Programs	No. of Hours/ RBT levels
1	Develop a menu driven program to implement primitive operations of stack - a) Push b) Pop c) Display. The program should print appropriate messages for stack overflow, stack underflow	**02 L3**
2	Write a program to demonstrate: a) Tower of Hanoi problem and b) Ackermann's function	**02 L3**
3	Develop a program to convert INFIX notation to POSTFIX	**02 L3**
4	Develop a program for evaluation of POSTFIX notation.	**02 L3**
5	Develop a menu driven program for QUEUE that performs following primitive operations: insert, delete and display	**02 L3**
6	Develop a menu driven program for CIRCULAR QUEUE that performs following primitive operations: insert, delete and display	**02 L3**
7	Develop a menu driven program to perform primitive operations on single linked list	**02 L3**
8	Develop a program to reverse a single linked list	**02 L3**
9	Develop a program to traverse a tree using in-order, pre-order and post-order.	**02 L3**
10	Develop a program to perform insertion, deletion and traversal of a binary search tree	**02 L3**

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.

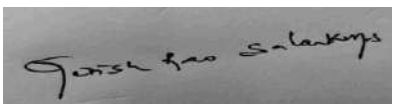
Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Laboratory	**20**	
SEE	Semester End examination	**100**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –III

DATABASE MANAGEMENT SYSTEM

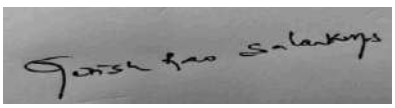
Semester:	**03**	**CIE Marks**	**50**
Course Code:	**22ADS33**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:1:2**	**Duration of SEE (hours):**	**03**
Type of Course	**IPC**	**Credits**	**04**

Prerequisites (if any): NA

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Explain the concept of databases, database management systems, database structures, and how they work.
2	Make use of Entity-Relationship modeling for creating simple databases from teal-world scenarios.
3	Write structured query language (SQL) statements.
4	Normalize a database using Normalization Rules.
5	Describe database design concepts and algorithms.

Module 1	No. of Hours	RBT Level
Databases and Database Users - Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications, Data base System Applications, Purpose of Database Systems, View of Data – Data Abstraction, Instances and Schemas. **Database System Concepts and Architecture -** Data Models, Database Languages–DDL, DML, database Access for applications Programs, Transaction Management, Data Storage and Querying, – data base Users and Administrator, data base System Structure, History of Data base Systems. **Data Modeling Using the Entity – Relationship (ER) Model** - Using High-Level Conceptual Data Models for Database Design, A Sample Database Application, Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database, ER Diagrams, Naming Conventions, and Design Issues, Example of Other Notation: UML Class Diagrams, Relationship Types of Degree Higher than Two, Another Example: A UNIVERSITY Database **The Relational Data Model and Relational Database Constraints** - Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations.	**10**	**L3**
Module 2		
The Relational Algebra and Relational Calculus - Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations, Examples of Queries in Relational Algebra, The Tuple Relational Calculus, The Domain Relational Calculus. **Relational Database Design by ER- and EER-to-Relational Mapping** - Relational Database Design Using ER-to-Relational Mapping, Mapping EER Model Constructs to Relations. **Basic SQL -** SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL, Additional Features of SQL.	**10**	**L3**



More SQL: Complex Queries, Triggers, Views, and Schema Modification - More Complex SQL Retrieval Queries, Specifying Constraints as Assertions and Actions as Triggers, Views (Virtual Tables) in SQL, Schema Change Statements in SQL.		
Module 3		
Basics of Functional Dependencies and Normalization for Relational Databases - Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. **Relational Database Design Algorithms and Further Dependencies -** Further Topics in Functional Dependencies: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, About Nulls, Dangling Tuples, and Alternative Relational Designs, Further Discussion of Multivalued Dependencies and 4NF, Other Dependencies and Normal Forms.	**10**	**L3**
Module 4		
Overview of Transaction Management - The ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control, Performance of Locking, Transaction Support in SQL, Introduction to Crash Recovery. **Concurrency Control -** 2PL, Serializability, and Recoverability, Introduction to Lock Management, Lock Conversions, Dealing With Deadlocks, Specialized Locking Techniques, ConClurency Control without Locking. **Crash Recovery -** Introduction to ARIES, The Log, Other Recovery-Related Structures, The Write-Ahead Log Protocol, Checkpointing, Recovering from a System Crash, Media Recovery, Other Approaches and Interaction with Concurrency Control.	**10**	**L3**
Module 5		
Disk Storage, Basic File Structures, Hashing, and Modern Storage Architectures: Introduction, Secondary Storage Devices, Buffering of Blocks, Placing File Records on Disk, Operations on Files, Files of Unordered Records (Heap Files),Files of Ordered Records (Sorted Files), Hashing Techniques, Other Primary File Organizations, Parallelizing Disk Access Using RAID Technology, Modern Storage Architectures.	**10**	**L3**

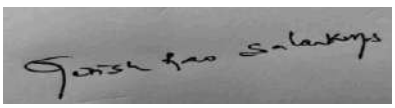
Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Identify and Apply the concept of databases, database management systems, ER modeling for designing simple databases.
CO2	Solve database queries using relational algebra.
CO3	Write database queries using Structured Query Language (SQL).
CO4	Design and develop databases from the real world by applying the concepts of Normalization.
CO5	Apply Transaction Processing and Recovery techniques, basic database storage structures and access techniques on real world application.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3		2					2		2	3	
CO2	3	3	3		2		2			2		2	3	
CO3	3	3	3		2		2			2		2	3	
CO4	3	3	3		2		2			2		2	3	
CO5	3	3	3		2		2			2		2	3	
Average	3	3	3		2		2			2		2	3	

High-3: Medium-2: Low-1



Text Books:

1. Fundamentals of Database Systems by Ramez Elmasri and Shamkant B. Navathe, Pearson, 7th Edition, 2017.
2. Database management systems by Ramakrishnan, and Gehrke, McGraw Hill, 3rd Edition, 2014.

Reference Books:

1. Database System Concepts, by Silberschatz, Korth and Sudharshan, Mc-GrawHill, 6th Edition, 2013
2. Database Principles Fundamentals of Design, Implementation and Management by Coronel, Morris, and Rob, Cengage Learning, 2012.

E-Books / Web References:

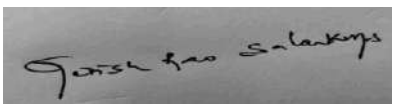
1. An introduction to Database systems by Bipin Desai
2. https://www.digitaldoughnut.com/articles/2020/june-2020/fundamentals-of-master-data-management-in-nutshell

MOOCs:

1. https://www.coursera.org/learn/database-management
2. https://onlinecourses.nptel.ac.in/noc19_cs46/preview

<table>
<tr><th>Prog. No.</th><th>Lab Programs</th><th>No. of Hours/ RBT levels</th></tr>
<tr><td>1</td><td>Creation of Tables:
1.Create a table called Employee with the following structure.
<table><tr><th>Name</th><th>Type</th></tr><tr><td>Empno</td><td>Number</td></tr><tr><td>Ename</td><td>Varchar2(20)</td></tr><tr><td>Job</td><td>Varchar2(20)</td></tr><tr><td>Mgr</td><td>Number</td></tr><tr><td>Sal</td><td>Number</td></tr></table>a. Add a column commission with domain to the Employee table.
b. Insert any five records into the table.
c. Update the column details of job
d. Rename the column of Employ table using alter command.
e. Delete the employee whose empno is19.

2. Create a table called reserves table
<table><tr><th>Name</th><th>Type</th></tr><tr><td>Boat id</td><td>Integer</td></tr><tr><td>Sid</td><td>Integer</td></tr><tr><td>Day</td><td>Integer</td></tr></table>a. Insert values into the reserves table.
b. Add column time to the reserves table.
c. Alter the column day data type to date.
d. Drop the column time in the table.
e. Delete the row of the table with some condition</td><td>02
L3</td></tr>
<tr><td>2</td><td>Queries using DDL and DML.
1.
a. Create a user and grant all permissions to the user.
b. Insert the any three records in the employee table and use rollback. Check the result.
c. Add primary key constraint and not null constraint to the employee table.
d. Insert null values to the employee table and verify the result.
2.
a. Create a user and grant all permissions to the user.
b. Update the table reserves and use save point and rollback.
c. Add constraint primary key, foreign key and not null to the reserves table Delete constraint not null to the table column.</td><td>02
L3</td></tr>
</table>

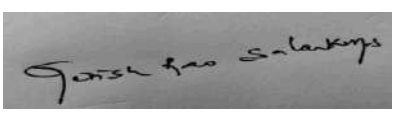


<table>
<tr><td>3</td><td>Queries using aggregate functions.
1.
a. By using the group by clause, display the enames who belongs to deptno 10 along with average salary.
b. Display lowest paid employee details under each department.
c. Display number of employees working in each department and their department number.
d. Using built in functions, display number of employees working in each department and their department name from dept table. Insert deptname to dept table and insert deptname for each row, do the required thing specified above.
e. List all employees which start with either B or C.
f. Display only these ename of employees where the maximum salary is greater than or equal to 5000.

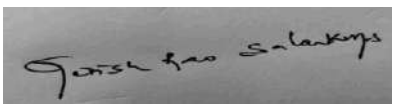
2.
a. List the Vendors who have delivered products within 6 months from order date.
b. Display the Vendor details who have supplied both Assembled and Subparts.
c. Display the Sub parts by grouping the Vendor type (Local or Non-Local).
d. Display the Vendor details in ascending order.
e. Display the Sub part which costs more than any of the Assembled parts.
f. Display the second maximum cost Assembled part.</td><td>02
L3</td></tr>
<tr><td>4</td><td>Programs on Pl/Sql
1. a. Write a PL/SQL program to swap two numbers.
b. Write a PL/SQL program to find the largest of three numbers.

2. a. Write a PL/SQL program to find the total and average of 6 subjects and display the grade.
b. Write a PL/SQL program to find the sum of digits in a given number.</td><td>02
L3</td></tr>
<tr><td>5</td><td>Functions
1. Write a function to accept employee number as parameter and return Basic +HRA together as single column.
2. Accept year as parameter and write a Function to return the total net salary spent for a given year.</td><td>02
L3</td></tr>
<tr><td>6</td><td>Triggers
1. Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old values and new values:

CUSTOMERS table:
<table><tr><td>ID</td><td>NAME</td><td>AGE</td><td>ADDRESS</td><td>SALARY</td></tr><tr><td>1</td><td>Alive</td><td>24</td><td>Khammam</td><td>2000</td></tr><tr><td>2</td><td>Bob</td><td>27</td><td>Kadapa</td><td>3000</td></tr><tr><td>3</td><td>Cantri</td><td>25</td><td>Guntur</td><td>4000</td></tr><tr><td>4</td><td>Dena</td><td>28</td><td>Bangalore</td><td>5000</td></tr><tr><td>5</td><td>Eeshwar</td><td>27</td><td>Mysore</td><td>6000</td></tr><tr><td>6</td><td>Farooq</td><td>28</td><td>Belagavi</td><td>7000</td></tr></table></td><td>02
L3</td></tr>
<tr><td>7</td><td>Procedures
1. Write the PL/SQL programs to create the procedure for factorial of given number.
2. Write the PL/SQL programs to create the procedure to find sum of N natural number.</td><td>02
L3</td></tr>
<tr><td>8</td><td>Cursors
1. Write a PL/SQL block that will display the employee details along with salary using cursors.
2. To write a Cursor to display the list of employees who are working as a managers or Analyst.</td><td>02
L3</td></tr>
</table>



9	**Case Study: Book Publishing Company** A publishing company produces scientific books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing one or more publications. A publication covers essentially one of the specialist subjects and is normally written by a single author. When writing a particular book, each author works with on editor, but may submit another work for publication to be supervised by other editors. To improve their competitiveness, the company tries to employ a variety of authors, more than one author being a specialist in a particular subject for the above case study, do the following: 1. Analyze the data required. 2. Normalize the attributes. Create the logical data model using E-R diagrams.	**02** **L3**
10	**Case Study: General Hospital** A General Hospital consists of a number of specialized wards (such as Maternity, Pediatric, Oncology, etc). Each ward hosts a number of patients, who were admitted on the recommendation of their own GP and confirmed by a consultant employed by the Hospital. On admission, the personal details of every patient are recorded. A separate register is to be held to store the information of the tests undertaken and the results of a prescribed treatment. A number of tests may be conducted for each patient. Each patient is assigned to one leading consultant but may be examined by another doctor, if required. Doctors are specialists in some branch of medicine and may be leading consultants for a number of patients, not necessarily from the same ward. For the above case study, do the following. 1. Analyze the data required. 2. Normalize the attributes. Create the logical data model using E-R diagrams.	**02** **L3**
11	**Case Study: Car Rental Company** A database is to be designed for a car rental company. The information required includes a description of cars, subcontractors (i.e. garages), company expenditures, company revenues and customers. Cars are to be described by such data as: make, model, year of production, engine size, fuel type, number of passengers, registration number, purchase price, purchase date, rent price and insurance details. It is the company policy not to keep any car for a period exceeding one year. All major repairs and maintenance are done by subcontractors (i.e. franchised garages), with whom CRC has long-term agreements. Therefore, the data about garages to be kept in the database includes garage names, addresses, range of services and the like. Some garages require payments immediately after a repair has been made; with others CRC has made arrangements for credit facilities. Company expenditures are to be registered for all outgoings connected with purchases, repairs, maintenance, insurance etc. claims must be kept of file. CRC maintains a reasonably stable client base. For this privileged category of customers special credit card facilities are provided. These customers may also book in advance a particular car. These reservations can be made for any period of time up to one month. Casual customers must pay adeposit for an estimated time of rental, unless they wish to pay by credit card. All major credit cards are accepted. Personal details such as name, address, telephonenumber, driving license, number about each customer are kept in the database.For the above case study, do the following: 1. Analyze the data required. 2. Normalize the attributes. Create the logical data model using E-R diagrams.	**02** **L3**



12	**Case Study: Student Progress Monitoring System** A database is to be designed for a college to monitor students' progress throughout their course of study. The students are reading for a degree (such as BA, BA (Hons) M.Sc., etc) within the framework of the modular system. The college provides a number of modules, each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from. A module is coordinated by a module leader who shares teaching duties with one or more lecturers. A lecturer may teach (and be a module leader for) more than one module. Students are free to choose any module they wish but the following rules must be observed: Some modules require pre- requisites modules and some degree programmes have compulsory modules. The database is also to contain some information about students including their numbers, names, addresses, degrees they read for, and their past performance i.e. modules taken and examination results. For the above case study, do the following: 1. Analyze the data required. 2. Normalize the attributes. 3. Create the logical data model i.e., ER diagrams. 4. Comprehend the data given in the case study by creating respective tables with primary keys and foreign keys wherever required. 5. Insert values into the tables created (Be vigilant about Master- Slave tables). 6. Display the Students who have taken M.Sc course. 7. Display the Module code and Number of Modules taught by each Lecturer. 8. Retrieve the Lecturer names who are not Module Leaders. 9. Display the Department name which offers ―English module.‖ 10. Retrieve the Prerequisite Courses offered by every Department (with Department names).	**02** **L3**

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.

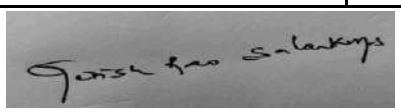
Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER – III

FOUNDATIONS OF DATA SCIENCE

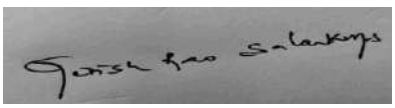
Semester:	**03**	**CIE Marks:**	**50**
Course Code:	**22ADS34**	**SEE Marks:**	**50**
Hours/Week (L:T:P):	**2:2:0**	**Duration of SEE (hours):**	**03**
Type of Course:	**PC**	**Credits:**	**03**

Prerequisites (if any): Basics of Probability

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To understand the problems solvable with data science
2	Ability to solve problems from a statistical perspective.
3	To build the skills to create data analytical pipelines
4	To bring the familiarity with the data science ecosystem and the various tools needed to continue developing as a data scientist.

Module 1	No. of Hours	RBT Level
Introduction to Data Science: Evolution of Data Science, Data Science Roles,Lifecycle of Data Science, Representation of Data Science as a Venn Diagram, Technologies revolving around Data Science. **Types of Data:** Structured and Unstructured Data, Quantitative and Qualitative Data,Four Levels of data (Nominal, Ordinal, Interval, Ratio Level). **Data Pre-processing:** Asking interesting question, Obtaining of data, Exploration of data, Modeling of data, Communication and visualization.	**08**	**L2**
Module 2		
Data Mining: What is Data Mining? Types of Data Mining, Challenges of implementation in Data Mining, Advantages and Disadvantages, Applications of DataMining. **Overview of Basic Data Mining Tasks:** Classification, Regression, Time Series Analysis, Prediction, Clustering, Sequence Discovery.	**08**	**L3**
Module 3		
Basics of Statistics: Introduction to Statistics, Terminologies in Statistics, Measures ofcenter, variance and relative standing, Normalization of data using the z-score, Empirical rule, Categories in Statistics (Descriptive and Inferential Statistics). **Descriptive Statistics:** Data Objects and Attribute, Basic Statistical Description of Data (Measuring the Central Tendency of Data, Measuring the Dispersion of Data, Graphical Displays), Data Visualization Techniques, Measuring Data Similarity and Dissimilarity.	**08**	**L3**
Module 4		
Inferential Statistics: Overview of Probability Distributions (Bernoulli, Binomial, Poisson, Chi-square, t-tail), Joint distribution of the Sample Mean and Sample Variance, Confidence Intervals, Bayesian Analysis of samples from Normal Distribution, Fisher Estimator, Central Limit Theorem.	**08**	**L3**
Module 5		
Hypothesis Testing: Testing simple hypotheses, Uniform tests, Two-sided alternatives, t-Test, F-Distribution, Bayes Test Procedures, Case studies based onHypothesis Testing.	**08**	**L3**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand the basics of data science, data mining techniques.
CO2	Apply the advanced mining concepts.
CO3	Interpret the basic statistical description of data.
CO4	Implement Data sampling Techniques.
CO5	Apply the data mining concepts on the real data.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3		2			2		2		2	3	
CO2	3	3	3		2			2		2		2	3	
CO3	3	3	3		2			2		2		2	3	
CO4	3	3	3		2			2		2		2	3	
CO5	3	3	3		2			2		2		2	3	
Average	3	3	3		2			2		2		2	3	

High-3: Medium-2: Low-1

Text Books:

1. Principles of Data Science by Sinan Ozdemir, Sunil Kakade, Packt Publishing Limited,2nd Edition, 2018
2. Probability and Statistics, by Morris H Degroot, Mark J Schervish, Pearson, 4th Edition, 2012.

Reference Books:

1. Data Mining Concepts and Techniques by Jiawei Han and Micheine Kamber, Morgan Kaufmann, 3rd Edition, 2011.
2. Machine Learning:A probabilistic perspective, by Murphy, KevinP, MIT Press, 2012.

E-Books / Web References:

1. **Learn Data Science : Open content for self-directed learning in Data Science :** http://learnds.com/
2. **Foundations of Data Science:** https://www.cs.cornell.edu/jeh/book.pdf

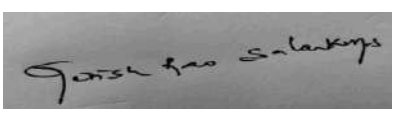
MOOCs:

1. **Introduction to Mathematical Thinking:** https://www.coursera.org/learn/mathematical-thinking
2. **IBM Data Science Professional Certificate:** https://www.coursera.org/professional-certificates/ibm-data-science

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouragedto use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/partial reproduction of research work/ oral presentation of research work/ group activity/ developing



a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

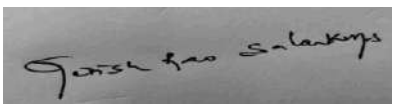
Typical evaluation pattern for regular courses is shown in Table 1:

Table 1: CIE Evaluation		
Components	**Marks**	**Total**
CIE TEST 1	40	50
CIE TEST 2	40	
CIE TEST 3	40	
Quiz 1 / AAT	05	
Quiz 2 / AAT	05	

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respective Board of Studies and can be given here.

Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –III

PYTHON FOR DATA SCIENCE

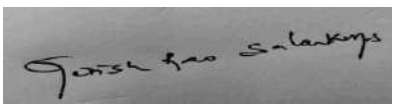
Semester:	**03**	**CIE Marks:**	**50**
Course Code:	**22ADS35**	**SEE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course:	**ETC**	**Credits:**	**03**

Prerequisites (if any): Programming with Python.

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To build a strong foundation to understand advanced python packages for data science.
2	To understand daily tasks that data scientists tackle.
3	To gain skills needed to implement machine learning, AI, and predictive analytics algorithms.
4	To understand the access to a wide variety of data analysis and data science libraries.
5	To meet industry demand for experts with Python skills.

Module 1	No. of Hours	RBT Level
NumPy Basics: Arrays and Vectorized Computation **Basics of Numpy Arrays:** NumPy Array Attributes **The NumPy nd array:** A Multidimensional Array Object, Creating nd arrays, Data Types for nd arrays, Arithmetic with NumPy Arrays, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Transposing Arrays and Swapping Axes, Reshaping of Arrays, Aggregations, Universal Functions: Fast Element-Wise Array Functions, Array-Oriented Programming with Arrays, Expressing Conditional Logic as Array Operations, Mathematical and Statistical Methods, Methods for Boolean Arrays, Sorting, Unique and Other Set Logic, File Input and Output with Arrays, Linear Algebra, Pseudorandom Number Generation, Example: Random Walks.	**08**	**L2**
Module 2		
Pandas: Installing and using Pandas, Introducing Pandas Objects, Operating on data in pandas. **Introduction to pandas Data Structures:** Series, DataFrame, Index Objects **Essential Functionality:** Reindexing, Dropping Entries from an Axis, Indexing, Selection, and Filtering, Integer Indexes, Arithmetic and Data Alignment, Function Application and Mapping, Sorting and Ranking, Axis Indexes with Duplicate Labels. **Combining Datasets:** Concat, Append, Merge and Join. Working with Time Series.	**08**	**L2**
Module 3		
Plotting and Visualization: A Brief matplotlib API Primer: Figures and Subplots, Charts using plot(), pie chart, violin plot, scatter plot, histogram, bar chart, area plot, Quiver plot, Mesh grid, contour plot, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, matplotlib Configuration. **Plotting with pandas and seaborn:** Three-Dimensional Plotting in Matplotlib, Python Visualization Tools for categorical Variables and Continuous Variables.	**08**	**L2**



Module 4		
Data Cleaning and Preparation: Handling Missing Data, Filtering Out Missing Data, Filling in Missing Data, Data Transformation, Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Renaming Axis Indexes, Discretization and Binning, Detecting and Filtering Outliers, Computing Indicator/Dummy Variables. **Data Wrangling:** Join, Combine, and Reshape: Combining and Merging Datasets, Database-Style Data Frame Joins, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap, Reshaping and Pivoting, Reshaping with Hierarchical Indexing, Pivoting "Long" to "Wide"Format, Pivoting "Wide"to "Long"Format	**08**	**L2**
Module 5		
Use cases: USA.gov Data from Bitly, Counting Time Zones in Pure Python, Counting Time Zones with pandas, MovieLens 1M Dataset, Measuring Rating Disagreement, US Baby Names 1880–2010, Analyzing Naming Trends, USDA Food Database, 2012 Federal Election Commission Database, Donation Statistics by Occupation and Employer, Bucketing Donation Amounts, Donation Statistics by State, some examples of latest datasets.	**08**	**L3**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand the fundamental of NumPy and Ndarrays.
CO2	Understand the fundamental of Pandas.
CO3	Illustrate graphically data and results of statistical calculations.
CO4	Identify proficiency in the Data preparation and wrangling.
CO5	Apply the concepts of Data Science packages on the real world data.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3		2	2			2			2	3	
CO2	3	3	3		2	3					2	2	3	
CO3	3	2	3		2					3		2	2	
CO4	2	3	3		3	2			3	3		2	3	
CO5	3	3	3		2				2		3	3	2	
Average	3	3	3		2	2			3	3	2	2	3	

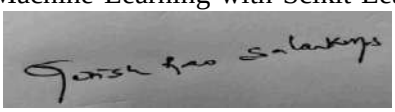
High-3: Medium-2: Low-1

Text Books:

1. Python Data Science handbook, by Jake Vander Plas, O'Reilly.
2. Python for Data Analysis, by Wes McKinney, 2nd Edition, O'Reilly.
3. Bharti Motwani, Data Analytics using Python, Wiley.

Reference Books:

1. Gowrishankar S, Veena A, ―Introduction to Python Programming, 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372.
2. AurelienGeron, ―Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools,



and Techniques to Build Intelligent Systems‖, 2nd Edition, O'Reilly Media, 2019. ISBN – 13: 978-9352139057.

E-Books / Web References:

1. Automate The Boring Stuff with Python
   https://automatetheboringstuff.com/
2. Python 3 Tutorial
   https://www.tutorialspoint.com/python3/python_tutorial.pdf
3. Python 3 for Absolute Beginners
   http://index-of.es/Python/Python%203%20for%20Absolute%20Beginners.pdf

MOOCs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.edx.org/course/python-basics-for-data-science
3. https://cognitiveclass.ai/courses/python-for-data-science

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

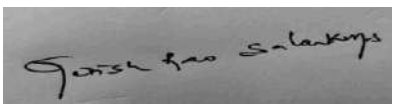
Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –III

OPERATING SYSTEM

Semester:	**03**	**CIE Marks:**	**50**
Course Code:	**22ADS36**	**SEE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course:	**AEC**	**Credits:**	**03**

Course Learning Objectives:

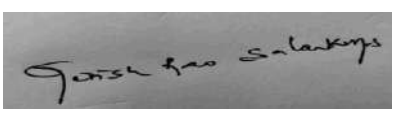
Sl. No	Course Learning Objectives (CLO)
1	To understand the OS services, types of OS and different computing environments.
2	To understand the concept of processes, IPC and multithreading models.
3	To understand scheduling algorithms to compute various scheduling criteria
4	To understand methods for handling deadlock and solve memory management problems using page replacement algorithms.

Module 1	No. of Hours	RBT Level
Introduction to OS: What Operating Systems Do, Computer-System Organization, Computer-System Architecture, Operating-System Operations, Resource Management. **Operating-System Services:** User and Operating-System Interface, System Calls, Operating-System Design andImplementation, Operating-System Structure.	**06**	**L1**
Module 2		
Process Management and Threads: Processes, Process Concept, Process Scheduling, Operations on Processes, InterprocessCommunication, IPC in Shared-Memory Systems, IPC in Message-Passing Systems. **Threads**: Overview, Multithreading Models.	**06**	**L1**
Module 3		
CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms (First Come First Serve, ShortestJob First, Shortest Remaining Time First, Priority Scheduling, Round Robin)	**06**	**L2**
Module 4		
Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance (Safe State, Banker's Algorithm), Deadlock Detection, Recovery from Deadlock	**06**	**L2**
Module 5		
Memory Management: Main Memory management- Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory Hardware -TLB, Page Replacement Algorithms (FIFO, LRU, Optimal Page Replacement) .	**06**	**L2**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand the Operating system functionality with system calls and computing environment.
CO2	Discuss the different process scheduling mechanisms and multithreading models.
CO3	Interpret the optimization of resource utilization using different scheduling algorithms.
CO4	Identify root causes of deadlock and provide the solution for deadlock elimination
CO5	Solve the memory allocation issues using page replacement algorithms.



CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3											2		
CO2	3											2		
CO3	3	2	2									2	3	
CO4	3	2	2									2	3	
CO5	3	2	2									2	3	
Average	3	2	2									2	3	

High-3: Medium-2: Low-1

Text Books:

1. Operating System Concepts‖, by Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Wiley, 9th Edition.
2. Operating Systems‖, by William Stallings, Pearson Education, 5th Edition.

Reference Books:

1. Operating Systems‖, by Ramez Elmasri, A Carrick, David Levine, A Spiral Approach, McGrawHill, 2009.
2. Modern Operating System‖, by Andrew S. Tanenbaum, PHI.

E-Books / Web References:

1. Operating system overview https://www.tutorialspoint.com/operating_system/os_overview.html
2. Lecture notes on Operating System https://www.bput.ac.in › lecture-notes-download
3. Operating System https://en.wikipedia.org/wiki/Operating_system
4. https://www.youtube.com/watch?v=vBURTt97 EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_ OQAeuVcp2O
5. https://www.youtube.com/watch?v=a2B69vCtj OU&list=PL3-wYxbt4yCjpcfUDz-TgD_ainZ2K3MUZ&index=2

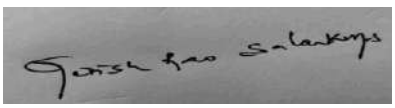
MOOCs:

1. https://www.coursera.org/learn/os-power-user
2. https://www.udacity.com/course/introduction-to-operating-systems--ud923

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouragedto use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.



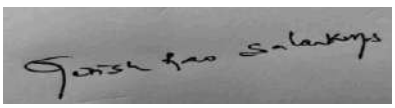
Typical evaluation pattern for regular courses is shown in Table 1:

	Components	Marks	Total
CIE	CIE TEST 1	40	50
	CIE TEST 2	40	
	CIE TEST 3	40	
	Quiz 1 / AAT	05	
	Quiz 2 / AAT	05	
SEE	SEE	50	50
Grand Total			100

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respective Board of Studies and can be given here.

Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER – IV

PROBABILITY AND LINEAR ALGEBRA

(Common for CSE/ISE/AI&DS/AIML/CS(AIML))

Course Code:	**22MAT41A**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**2:2:0**	**SEE Marks:**	**50**
No. of Credits:	**3**	**Examination Hours:**	**03**

Course Objectives: To enable students to apply the knowledge of Mathematics in fields of computer science and allied branches by making them to learn:

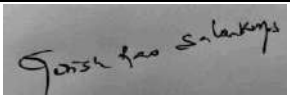
CLO1	Probability and Random Variables
CLO2	System of linear equations
CLO3	Vector spaces, linear transformations
CLO4	Eigenvalues, Eigenvectors, diagonalization and Singular value decomposition

Content	**No. of Hours/ RBT levels**
Module 1	
Random Variable, Binomial, Poisson, Exponential and Normal distributions. Joint distributions (both discrete and continuous), Expectation and Covariance. Central limit theorem and law of large numbers.	**08 Hours L2, L3**
Module 2	
System of linear equations, row reduction and echelon form, vector equations, The matrix equation AX = b. Linear independence and introduction to linear transformations. Matrix of linear transformation, invertible matrix, inverse of a matrix by Gauss Jordan method.	**08 Hours L2, L3**
Module 3	
Vector space, subspaces, linearly independent sets, Bases. Coordinate systems, the dimensions of a vector space, Rank, Change of basis. Eigen vectors and Eigen values, diagonalization, Eigen vectors and linear transformations.	**08 Hours L2, L3**
Module 4	
Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization.	**08 Hours L2, L3**
Module 5	
Least square solutions and fittings, diagonalization of symmetric matrices, quadratic forms, constrained optimization; Singular value decomposition.	**08 Hours L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO41.1	Solve problems associated with random variables using probability distributions
CO41.2	Solve systems of linear equations.
CO41.3	Work within vector spaces.
CO41.4	Use computational techniques for the study of Eigenvalues, Eigenvectors, and diagonalization



Textbooks:

1. T Veerarajan, Probability, Statistics and Random Processes for Engineers, Tata McGraw Hill, 3rd Edition, 2008
2. David C Lay, Linear Algebra and its applications, Pearson, 4th Edition, 2012.

Reference books:

1. Richard H Williams, Probability, Statistics and Random Processes for Engineers, Cengage Learning, 1st Edition, 2003
2. Gilbert Strang, Linear Algebra and its Applications, Cengage Learning, 4th Edition, 2006
3. K. Hoffman and R. Kunze, Linear Algebra, Prentice Hall, 2nd Edition, 2004.

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

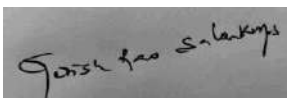
Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO41.1	3	2	1									3				
CO41.2	3	2	1									3				
CO41.3	3	2	1									3				
CO41.4	3	2	1									3				
Average	3	2	1									3				

Low-1: Medium-2: High-3



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER – IV

DESIGN AND ANALYSIS OF ALGORITHMS

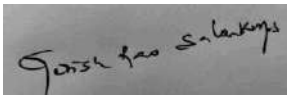
Semester:	**04**	**CIE Marks:**	**50**
Course Code:	**22ADS42**	**SEE Marks:**	**50**
Hours/Week(L:T:P):	**3: 1: 2**	**Duration of SEE(Hours):**	**03**
Type of Course:	**IPC**	**Credits:**	**04**

Prerequisites (if any): C Programming & Data Structures using C

Course Learning Objectives:

Sl. No.	Course Learning Objectives (CLO)
1	To apply mathematical concepts and notations to define a problem.
2	To understand and apply algorithms design techniques.
3	Ability to solve real life problems using algorithms techniques.
4	To understand the limitations of Algorithmic power.

Module 1	No. of Hours	RBT Level
Introduction: What is an Algorithm? Algorithm Specification, Analysis Framework **Performance Analysis:** Space complexity, Time complexity. **Asymptotic Notations:** Big-Oh notation (O), Omega notation (Ω), Theta notation (Q), and Little-oh notation (o), Mathematical analysis of Non- Recursive and recursive Algorithms with Examples. **Important Problem Types:** Sorting, Searching, String processing, Graph Problems, Combinatorial Problems.	**10**	**L3**
Module 2		
Algorithm Design Techniques – II: **Brute Force:** Introduction, Selection Sort, Sequential Search and Brute force string matching algorithms –NAIVE string-matching algorithms, **Exhaustive Search –** Travelling Salesman problem, Knapsack problem, Assignment problem. **Divide & Conquer:** General method, Recurrence equation for divide and conquer, Binary search, Merge sort, Quick sort, Strassen's matrix multiplication, Advantages and Disadvantages of divide and conquer.	**10**	**L3**
Module 3		
Algorithm Design Techniques – II: **Greedy Methods:** Introduction, General method, Knapsack Problem, Job sequencing with deadline. **Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm. Single source shortest paths: Dijkstra's Algorithm. **Optimal Tree problem:** Huffman Trees and Codes. **Transform and Conquer Approach:** Heaps and Heap Sort.	**10**	**L3**

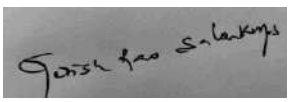


Module 4		
Algorithm Design Techniques – III: **Dynamic Programming:** Introduction, Computing Binomial Coefficients, Transitive closure - Warshall's and Floyd's algorithm, Bellman Ford algorithm, Knapsack problem & memory functions. **Decrease & Conquer: Introduction –** Decrease by constant, decrease by constant factor, variable size decrease, Breadth First search traversal, Depth First search traversal, Topological sorting using DFS and source removal method.	**10**	**L3**
Module 5		
Algorithm Design Techniques – IV: **Backtracking:** Introduction, N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles. **Branch & Bound:** Introduction, Travelling Salesman problem, Knapsack problem, Assignment problem. **Limitations Of Algorithm Power:** Decision Trees for sorting and searching, **Approximation Algorithms for NP-Hard Problems –** Traveling Salesperson Problem, Knapsack Problem.	**10**	**L3**

Course Outcomes:
Upon successful completion of this course, student will be able to

CO1	Choose the basic techniques of analyzing the algorithms using time & space complexity and asymptotic notations
CO2	Design algorithms using brute force and Divide and Conquer techniques for a given problem.
CO3	Demonstrate Graph Algorithms using greedy method, Transform and Conquer approach to model Engineering Problems.
CO4	Employ Dynamic Programming and Decrease & Conquer strategies to solve a given problem.
CO5	Apply Back Tracking, Branch and Bound design techniques for solving Computa - tionally hard problems.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3		2							2	3	
CO2	3	3	3		2							2	3	
CO3	3	3	3		2							2	3	
CO4	3	3	3		2							2	3	
CO5	3	3	3		2							2	3	
Average	3	3	3		2							2	3	



High-3: Medium-2: Low-1

Text Books:

1. Introduction to the Design and Analysis of Algorithms‖, by AnanyLevitin:, 2nd Edition, 2009 Pearson.
2. Computer Algorithms/C++‖, by Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press.

Reference Books:

1. Introduction to Algorithms‖, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, CliffordStein, 3rd Edition, PHI.

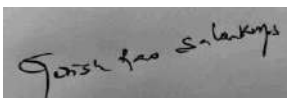
E-Books / Web References:

1. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
2. https://www.javatpoint.com/daa-tutorial

MOOCs:

1. https://onlinecourses.nptel.ac.in/noc19_cs47/preview
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/
3. https://www.coursera.org/specializations/algorithms
4. https://www.udemy.com/course/design-and-analysis-of-algorithms/

Prog. No.	Lab Programs	No. of Hours/ RBT levels
1	Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 10000 and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be generated using the random number generator. Demonstrate how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.	**03 L3**
2	Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 10000, and record thetime taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate how the divide-and-conquer method works along with its time complexity analysis.	**03 L3**
3	Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.	**03 L3**
4	Find Minimum Cost Spanning Tree of a given connected undirected graphusing Prim's algorithm.	**03 L3**
5	Write the program for the given weighted connected graph to find shortest paths to all other vertices from the given source vertex Using Dijkstra's algorithm.	**03 L3**
6	Write programs to: a. Implement All-Pairs Shortest Paths problem using Floyd's algorithm b. Implement the 0/1 Knapsack problem using Dynamic Programming.	**03 L3**
7	Implement Travelling Sales Person problem using Dyna mic programming.	**03 L3**
8	Write programs to: a. Print all the nodes reachable from a given starting node in a digraph usingBFS method. b. Check whether a given graph is connected or not using DFS method.	**03 L3**
9	Implement N-Queen's problem using Back Tracking.	**03 L3**
10	Design and implement c program to find a subset of a given set S = {Sl, S2,.....,Sn} of n positive integers Whose SUM is equal to a given positive integer d. For example, if S = {1, 2, 5, 6, 8} and d= 9, there are two Solutions {1, 2, 6} and {1, 8}. Display a suitable message, if the given problem instance doesn't have a solution.	**03 L3**



Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.

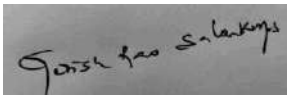
Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**50**
		Grand Total	**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –IV

MACHINE LEARNING - I

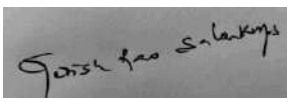
Semester:	**04**	**CIE Marks:**	**50**
Course Code:	**22ADS43**	**SEE Marks:**	**50**
Hours/Week(L:T:P):	**3: 1: 2**	**Duration of SEE(Hours):**	**03**
Type of Course:	**IPC**	**Credits:**	**04**

Prerequisites (if any): Python for Data Science.

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Examine the data for various features, properties, characteristics and assessment of the problemthey represent.
2	Learn methods to transform raw data into a form that is ready for application of algorithms.
3	Become conversant with types of Machine Learning Algorithms, their applicability and InductiveBias.
4	Familiarize with techniques for Dimensionality Reduction and Computational Efficiency.
5	Apply and practice the knowledge by solving real time problems.

Module 1	No. of Hours	RBT Level
Introduction to Machine Learning: Basic steps of ML, Perspectives and Issues, Designing learning systems, Concepts of hypotheses. **Datasets and Partitions, Data Pre-processing and Scaling:** Different Preprocessing techniques, Data Integration, Outlier removal, artifact removal, Applying Data Transformations, Scaling Training and Test Data the Same Way, Data Normalization, Data Transformation techniques.	**10**	**L2**
Module 2		
Dealing With Missing Values: Assumptions and Missing Data Mechanisms, Simple approaches to missing Data, Dealing With Noisy Data: Identifying Noise, Types of Noise Data, Noise filtering at data level. **Data Reduction:** Curse of Dimensionality, PCA, LDA, Data sampling, Binning.	**10**	**L2**
Module 3		
Feature Engineering: Feature Extraction, Feature Ranking, Best Features, Feature Selection	**10**	**L2**
Module 4		
Introduction to Supervised learning - Regression Algorithms: Linear Regression, Polynomial Regression, Lasso, Ridge and Elastic nets Regression, Regularization methods, Categorical Variables in Regression, Loss functions, Risk functions. **Use Case:** Relationship between Buying Intention and Awareness of Electric Vehicles, Application of Technology Acceptance Model in Cloud Computing, Impact of Social Networking Websites on Quality of Recruitment, Transportation optimization, Applications in Smart phones.	**10**	**L2**
Module 5		
Supervised Learning: Classification Algorithms: Supervised Machine Learning Algorithms: Sample Datasets, logistic regression, k-Nearest Neighbors (Regression and Classification) **Linear Models -** Naive Bayes, Decision Trees.	**10**	**L3**



Use Case: Prediction of Customer buying Intension due to Digital Marketing, Measuring Acceptability of a New Product, Predicting phishing websites, loan categorization, Diagnosis and Treatment of Diseases, Security applications		

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand the data pre-processing techniques used in the data science.
CO2	Understand how to handle missing and noisy data.
CO3	Demonstrate Supervised Learning techniques on real data using regression algorithms
CO4	Demonstrate Supervised Learning techniques on real data using classification algorithms
CO5	Implement machine learning models to classify data on exemplary applications related to real world.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	3	3	2					3	2	3	
CO2	2	2	2	3	3	2					3	2	3	
CO3	3	2	3	3	3	2			3		3	2	2	
CO4	3	2	3	3	3	2			3		3	2	3	
CO5	3	3	3	3	3	3			3		3	2	2	
Average	3	2	3	3	3	2			3		3	2	3	

High-3: Medium-2: Low-1

Text Books:

1. Data preprocessing in Data Mining‖, by Salvador García, JuliánLuengo Francisco Herrera, Springer.
2. Introduction to Machine Learning with Python ,by Sarah Guido, Andreas C. Müller, O‘ Reilly, 2017.
3. Bharti Motwani, _Data Analytics using Python‘, Wiley.

Reference Books:

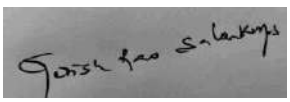
1. Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms‖, by John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy, Worked Examples, and Case Studies, The MIT Press, 2015.
2. Introduction to Machine Learning‖, by Ethem Alpaydin, PHI Learning, 2nd Edition, 2019

E-Books / Web References:

1. Building Machine Learning Systems with Python
   http://totoharyanto.staff.ipb.ac.id/files/2012/10/Building-Machine-Learning-Systems-with-Python-Richert-Coelho.pdf
2. Foundations of Machine Learning
   https://cs.nyu.edu/~mohri/mlbook/
3. Understanding Machine Learning: From Theory to Algorithms
   https://www.cs.huji.ac.il/w~shais/UnderstandingMachineLearning/understanding-machine-learning-theory-algorithms.pdf

MOOCs:

1. https://www.coursera.org/learn/machine-learning



2. https://www.tensorflow.org/resources/learnml?gclid=Cj0KCQjw29CRBhCUARIsAOboZbJrDLSTHJKj8iIDKyhQzv9srD_TMSSGpXRigtJAIysLYcGH_x2GC4UaAj7NEALw_wcB
3. https://www.udemy.com/course/machine-learning-one-our/?ranMID=39197&ranEAID=JVFxdTr9V80&ranSiteID=JVFxdTr9V80-CGdwe6MbhMFzQeBY4coFxw&LSNPUBID=JVFxdTr9V80&utm_source=aff-campaign&utm_medium=udemyads
4. https://www.udemy.com/course/what-is-machine-learning/?ranMID=39197&ranEAID=JVFxdTr9V80&ranSiteID=JVFxdTr9V80-cIV9JiZ_AJo5kC9cS9TbrQ&LSNPUBID=JVFxdTr9V80&utm_source=aff-campaign&utm_medium=udemyads

Prog. No.	Lab Programs	No. of Hours/ RBT levels
1	Write a program to implement different data imputations in Machine Learning using Python.	**03 L3**
2	Write a program to implement to implement different feature scaling techniques using python	**03 L3**
3	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	**03 L3**
4	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.	**02 L3**
5	For the iris dataset, Implement Logistic Regression and Linear Regression. Plot the following graphs: Accuracy and Loss values per iteration.	**02 L3**
6	Implement ID3 decision tree algorithm using Python.	**02 L3**
7	For the diabetics dataset implement RandomForest classifier.	**02 L3**
8	Extract features and perform text classification from unstructured text using Python	**02 L3**
9	Write a program to implement Word2Vec and produce the word embedding using Python.	**03 L3**
10	For the given dataset, develop the recommendation system using PCA.	**03 L3**

Scheme of Evaluation: (Integrated courses)

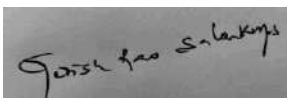
Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

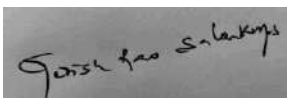
Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.



Typical Evaluation pattern for integrated courses is shown in the Table below

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**50**
		Grand Total	**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –IV

SOFT COMPUTING TECHNIQUES

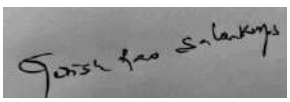
Semester:	**04**	**CIE Marks:**	**50**
Course Code:	**22ADS44**	**SEE Marks:**	**50**
Hours/Week(L:T:P):	**2: 2: 0**	**Duration of SEE(Hours):**	**03**
Type of Course:	**PC**	**Credits:**	**03**

Prerequisites (if any): Discrete Mathematics.

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
2	Provide an emphasis on the differences and similarities between fuzzy sets and classical sets theories.
3	Explain the concepts of fuzzy logic, and decision systems.
4	Enable students to Solve problems that are appropriately solved by fuzzy logic

Module 1	No. of Hours	RBT Level
Classical Sets and Fuzzy Sets: Classical Sets, Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions, Fuzzy Sets, Fuzzy Set Operations, Properties of Fuzzy Sets, Alternative Fuzzy Set Operations, Fuzzy Arithmetic. **Classical Relations and Fuzzy Relations:** Cartesian Product, Crisp Relations, Cardinality of Crisp Relations, Operations on Crisp Relations, Properties of Crisp Relations, Composition, Fuzzy Relations, Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition, Tolerance and Equivalence Relations, Crisp Equivalence Relation, Crisp Tolerance Relation, Fuzzy Tolerance and Equivalence Relations, Value Assignments, Cosine Amplitude, Max–Min Method.	**10**	**L2**
Module 2		
Properties of Membership Functions, Fuzzification, and Defuzzification: Features of the Membership Function, Various Forms, Fuzzification, Defuzzification to Crisp Sets, λ-Cuts for Fuzzy Relations, Defuzzification to Scalars. **Development of Membership Functions:** Membership Value Assignments, Intuition, Inference, Inductive Reasoning.	**10**	**L3**
Module 3		
Fuzzy Classification: Classification by Equivalence Relations, Cluster Analysis, Cluster Validity, c-Means Clustering, Hard c-Means (HCM), Fuzzyc-Means (FCM), Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering.	**10**	**L3**
Module 4		
Decision Making with Fuzzy Information: Fuzzy Synthetic Evaluation, Fuzzy Ordering, Nontransitive Ranking Preference and Consensus, Multiobjective Decision Making, Fuzzy BayesianDecision Method, Decision Making Under Fuzzy States and Fuzzy Actions.	**10**	**L3**
Module 5		
Applications of Fuzzy Systems: Fuzzy TOPSIS, Fuzzy AHP (Geometric and Mean method), Mamdani and Sugeno Fuzzy Systems and building the decision model on the real data (Medical applications).	**10**	**L3**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand basic knowledge of fuzzy sets and fuzzy logic.
CO2	Apply basic fuzzy inference and approximate reasoning.
CO3	Apply fuzzy classification algorithms on the real data
CO4	Apply basic fuzzy system modeling methods.
CO5	Apply principles of Fuzzy decision techniques to solve real world problems.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	3	3	2					3	2	3	
CO2	2	2	2	3	3	2					3	2	3	
CO3	3	2	3	3	3	2			3		3	2	2	
CO4	3	2	3	3	3	2			3		3	2	3	
CO5	3	3	3	3	3	3			3		3	2	2	
Average	3	2	3	3	3	2			3		3	2	3	

High-3: Medium-2: Low-1

Text Books:

1. Fuzzy Sets And Fuzzy Logic With Engineering Applications, by Timothy J. Ross, Fourth Edition, Wiley.
2. Principles of Soft Computing, by S. N Sivanandam, S.N Deepa, 3rd Edition, Wiley.

Reference Books:

1. Neuro-Fuzzy and Soft Computing, by J.S. R. Jang, C.-T. Sun, and E. Mizutani, Prentice Hall.
2. Fuzzy sets Fuzzy logic, by Klir, G. J and Yuan B.B, Prentice Hall of India Pvt. Ltd., New Delhi.

E-Books / Web References:

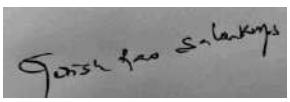
1. Fuzzy Sets by Lotfi A. Zadeh.
2. Fuzzy Logic by Lotfi A. Zadeh.

MOOCs:

1. https://www.udemy.com/course/fuzzy-logic/
2. https://www.udemy.com/course/intro-to-fuzzy-logic-and-artificial-intelligence/
3. https://onlinecourses.nptel.ac.in/noc20_ge09/preview
4. https://www.coursera.org/lecture/children-literacy/fuzzy-logical-model-of-perception-ZT8ZJ

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouragedto use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.



Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

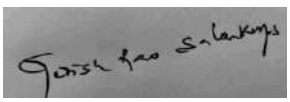
Table 1: CIE Evaluation		
Components	**Marks**	**Total**
CIE TEST 1	40	50
CIE TEST 2	40	
CIE TEST 3	40	
Quiz 1 / AAT	05	
Quiz 2 / AAT	05	

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respective Board of Studies and can be given here.

Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.

The students will have to answer five full questions, selecting one full



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –IV

IMAGE PROCESSING

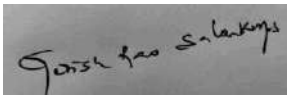
Semester:	**04**	**CIE Marks:**	**50**
Course Code:	**22ADS45**	**SEE Marks:**	**50**
Hours/Week (L: T: P):	**2:2:0**	**Duration of SEE (hours):**	**03**
Type of Course:	**ETC**	**Credits:**	**03**

Prerequisites (if any): None

Course Learning Objectives: The course will enable students to:

Sl. No.	Course Learning Objectives (CLO)
1	To develop insight into the fundamental concepts of Digital image processing.
2	To evaluate the techniques followed in image enhancements.
3	To illustrate the techniques involved in image compression algorithms.
4	To illustrate the techniques involved in image segmentation algorithms.

Module 1	No. of Hours	RBT Level
Introduction: Introduction, Fundamental steps in image processing, Components of an Image Processing System, Digital Image Fundamentals, Elements of visual perception, Image model, Sampling and quantization, Relationship between pixels	**08**	**L2**
Module 2		
Image Formation: Introduction, Geometric Model, Photometric Model. **Digitalization:** Introduction, Sampling, Quantization, Digital Image, Elements of Digital Geometry.	**08**	**L3**
Module 3		
Image Enhancement: Enhancement by point processing, Sample intensity transformation, Histogram processing, Image subtraction, Image averaging, Spatial filtering, Smoothing filters, Sharpening filters, Frequency domain: Low-Pass, High-Pass, Homomorphic filtering.	**08**	**L3**
Module 4		
Image Compression: Coding redundancy, Inter-pixel redundancy, Fidelity criteria, Image compression models, Error-free compression, Variable length coding, Bit-plane coding, Loss-less predicative coding, Lossy compression, Image compression standards, Fractal Compression, Real-Time image transmission, JPEG and MPEG.	**08**	**L3**
Module 5		
Image Segmentation: Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region oriented segmentation, Use of motion in segmentation, Spatial techniques, Frequency domain techniques, Spatial Operations and Transformations Spatially dependent transform template and convolution, Window operations, 2- Dimensional geometric transformations.	**08**	**L3**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Explain the fundamentals of Digital Image Processing.
CO2	Obtain an insight on the transformation algorithms underlying the formation of images
CO3	Explain the underlying concepts to contrast between Image enhancement and Image compression
CO4	Develop a good insight into Image segmentation technique
CO5	Contrast well between Enhancement, Compression and Segmentation algorithms

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1		1	1	1	1		2		2	3	
CO2	3	3	2	2	3	2	2	1		2		2	3	
CO3	3	3	3	2	3	2	2	1	2	2		3	3	
CO4	3	3	3	2	3	2	2	1	2	2	2	3	3	
CO5	3	3	3	2	3	2	2	1	2	2	2	3	3	
Average	3	3	3	2	3	2	2	1	2	2	2	3	3	

High-3: Medium-2: Low-1

Text Books:

1. R. Gonzalez and R. E. Wood, Digital Image Processing, Prentice Hall of India, 4th Edition, 2018.
2. B. Chanda and D. DuttaMajumder, Digital Image Processing and Analysis, Prentice Hall of India, 2nd Edition, 2011.

Reference Books:

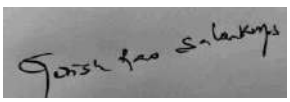
1. Andrian Low, Introductory Computer Vision and Image Procession, McGraw Hill Co., 1991.
2. Robert Schalkoff, Pattern Recognition-Statistical, Structural and neural approach, John Willey & Sons, 4th Edition, 2007.
3. W.K. Pratt, Digital Image Processing, McGraw Hill, 1992.
4. A. K. Jain, Fundamentals of Image Processing, PHI, 2nd Edition.

E-Books / Web References:

1. Principles of Digital Image Processing, Wilhelm Burger http://omercetin.com.tr/DERS/IP/Kitap/2.Principles%20of%20digital%20image%20processing.p df
2. Image Processing, Analysis and Machine Vision, Milan Sonka https://kgut.ac.ir/useruploads/1550563201478ety.pdf
3. Introductory Digital Image Processing, John R Jensen https://media.oiipdf.com/pdf/f11c7ea9-28a4-42c8-8854-21a2f96a6338.pdf

MOOCs:

1. https://www.coursera.org/specializations/image-processing
2. https://www.coursera.org/learn/digital
3. https://www.udemy.com/course/digital-image-processing-from-ground-up-in-python/



Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average marks scored is added to test component. CIEis executed by way of two quizzes / Alternate Assessment Tools (AATs), and Three tests. Two quizzes areto be conducted and each quiz is evaluated for 5 marks adding up to 10 marks.

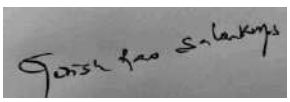
All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively.

Some possible AATs: seminar/ assignments/term paper/ open ended experiments/ mini-projects/ conceptvideos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic toolbox for problem solving/ report based on participation in create-a-thon/ make-a- thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical Evaluation pattern for regular courses is shown in Table.

Table: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –IV

PROGRAMMING IN JAVA

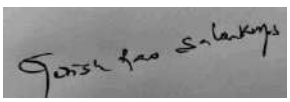
Semester:	**04**	**CIE Marks:**	**50**
Course Code:	**22ADS46**	**SEE Marks:**	**50**
Hours/Week (L: T: P):	**2:0:2**	**Duration of SEE (hours):**	**03**
Type of Course:	**AEC**	**Credits:**	**03**

Prerequisites (if any): None

Course Learning Objectives: The course will enable students to:

Sl. No.	Course Learning Objectives (CLO)
1	Introduces Object Oriented Programming concepts.
2	To understand in detail about the control statements, classes, and inheritance.
3	Importance of exception handling and how to handle exceptions.
4	Introduces the concept of J2EE and how to establish the connection with the database.
5	To enable students to understand Java servlets and JSP.

Module 1	No. of Hours	RBT Level
Object-Oriented Thinking: Different paradigms for problem solving, need for OOP paradigm, differences between OOP and Procedure oriented programming, Overview of OOP concepts: Abstraction, Encapsulation, Inheritance and Polymorphism, Summary of Object-Oriented concepts. Java buzzwords, An Overview of Java, Data types, Variables and Arrays, operators, expressions	**08**	**L2**
Module 2		
Classes: Control statements, Introducing classes, Methods and Classes, Inheritance.	**08**	**L3**
Module 3		
Exception handling: Fundamentals of exception handling, Exception types, Termination or resumptive models, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes. Multithreading- Differences between thread-based multitasking and process-based multitasking, Java thread model, creating threads, thread priorities, synchronizing threads, inter thread communication.	**08**	**L2**
Module 4		
The Concept of JDBC: JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; Result Set; Transaction Processing; Metadata, Data types; Exceptions.	**08**	**L2**
Module 5		
Servlets: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. **JSP:** Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects.	**08**	**L2**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs
CO2	Demonstrate the concepts of flow control
CO3	Describe exception handling and multithreading
CO4	Illustrate database access and details for managing information using the JDBC API
CO5	Describe how servlets and JSP fit into Java-based web application architecture

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1		2			1		2		2	3	
CO2	2	3	1		2			1		2		2	3	
CO3	1	2	3		2			1		2		2	3	
CO4	1	2	3		2			1		2		2	3	
CO5	3	3	3		2			1		2		2	3	
Average	2	2	2		2			1		2		2	3	

High-3: Medium-2: Low-1

Text Books:

1. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007.
2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007.

Reference Books:

1. Y. Daniel Liang: Introduction to JAVA Programming, 7thEdition, Pearson Education, 2007.
2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004.
3. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015.

E-Books / Web References:

1. https://www.javatpoint.com/java-tutorial
2. https://www.simplilearn.com/learn-java-basics-skillup

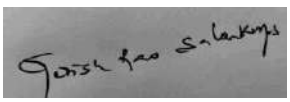
MOOCs:

1. udemy.com/topic/java
2. https://www.coursera.org/courses?query=java

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reducedto 50. There will be two full questions (with a maximum of four sub questions) from each module carrying20 marks each. Students are required to answer any **five full questions** choosing at



least **one full questionfrom each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average marks scored is added to test component. CIEis executed by way of two quizzes / Alternate Assessment Tools (AATs), and Three tests. Two quizzes areto be conducted and each quiz is evaluated for 5 marks adding up to 10 marks.

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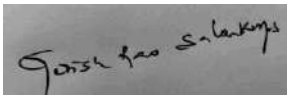
Table: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



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B.E. in Artificial Intelligence and Data Science Engineering Scheme of Teaching and Examinations 2023

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	22ADS51	Management and Economics for IT Engineers	TD & PSB: AI&DS	3	0	0		03	50	50	100	3
2	IPCC	22ADS52	Big Data Analytics Tools & Techniques	TD & PSB: AI&DS	3	0	2		03	50	50	100	4
3	PCC	22ADS53	Machine Learning II	TD & PSB: AI&DS	4	0	0		03	50	50	100	4
4	PCCL	22ADSL54	Machine Learning II Laboratory	TD & PSB: AI&DS	0	0	2		03	50	50	100	1
5	PEC	22ADS55X	Professional Elective Course	TD & PSB: AI&DS	3	0	0		03	50	50	100	3
6	PROJ	22ADS56	Mini Project	TD & PSB: AI&DS	0	0	4		03	100		100	2
7	AEC	22RMIK57	Research Methodology and IPR	HSS	2	2	0		02	50	50	100	3
8	MC	22CIVK58	Environmental Studies and E-Waste Management	TD: CV PSB:CV	2	0	0		02	50	50	100	2
9	MC	22NSK59	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	0
		22PEK59	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YOK59	Yoga	Yoga Teacher									
									Total	**550**	**350**	**900**	**22**

Professional Elective Course

22ADS551	Introduction to NoSQL
22ADS552	Computer Networks

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B.E. in Artificial Intelligence and Data Science Engineering Scheme of Teaching and Examinations 2023

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2024-25)

Scheme A-VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self ,Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22ADS61	Data Visualization using Tableau	TD & PSB: AI&DS	3	0	2		03	50	50	100	4
2	PCC	22ADS62	Neural Networks and Deep Learning	TD & PSB: AI&DS	4	0	0		03	50	50	100	4
3	PEC	22ADS63X	Professional Elective Course	TD & PSB: AI&DS	3	0	0		03	50	50	100	3
4	OEC	22ADS64X	Open Elective Course	TD & PSB: AI&DS	3	0	0		03	50	50	100	3
5	PROJ	22ADS65	Project Phase I	TD & PSB: AI&DS	0	0	4		03	100	--	100	2
6	PCCL	22ADSL66	Neural Networks & Deep Learning Laboratory	TD & PSB: AI&DS	0	0	2		03	50	50	100	1
7	AEC/ SDC	22ADS67X	Ability Enhancement Course/ SkillDevelopment Course V	TD & PSB: AI&DS	If the course is offered as a Theory: 1 / If course is offered as a practical: 0	0	If the course is offered as a Theory: 0 / If course is offered as a practical: 2		01	50	50	100	1
8	IKS	22IKS68	Indian Knowledge System		1	0	0		01	50	50	100	0
9	MC	22NSK69	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		22PEK69	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YOK69	Yoga	Yoga Teacher									
10	UHV	22UHV69	Universal Human Values	Any Department	1	0	0		01	50	50	100	0
									Total	**600**	**300**	**900**	**20**

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Professional Elective Course					
22ADS631	Introduction to Quantum Computing				
22ADS632	Cryptography				
Open Elective Course					
22ADS641	Big data analytics				
22ADS642	Foundations of Data Science				
Ability Enhancement Course / Skill Enhancement Course - V					
22ADS671	Web Technologies				
22ADS672	Data Analytics for IOT				

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER – V

COURSE: MANAGEMENT AND ECONOMICS FOR IT ENGINEERS

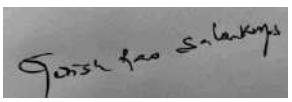
Semester:	**5**	**CIE Marks**	**50**
Course Code	**22ADS51**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Examination Hours**	**03**
Type of Course		**Credits**	**03**

Prerequisites: NIL

Course Objectives: This Course will enable the students to:

CLO1	Explain the principles of management, organization and entrepreneur.
CLO2	Understand the importance of planning, organizing, staffing, directing and controlling and gain the leadership qualities required to run an enterprise.
CLO3	Infer the importance of ERP, intellectual property rights and understand the significance of institutional support.
CLO4	Explain how to prepare the project reports effectively.
CLO5	Understand the functions and roles of Engineering Economics.

Content	**No. of Hrs/ RBT levels**
Module 1	
Management: Meaning, Nature and characteristics of management, Scope and Functional areas of management, Goals of management, Levels of management. Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, Types of Organization, Staffing- Meaning, Process of recruitment and selection. **Case Study**: The Bangalore International Airport	**06 Hrs L2**
Module 2	
Directing and controlling- Meaning and Nature of Directing, Leadership Styles, Motivation theories, Communication- Meaning and importance, Coordination meaning and importance, Controlling- meaning, steps in controlling. **Case Study**: True Lies in Satyam	**06 Hrs L2**
Module 3	
Entrepreneur – Meaning of entrepreneur, Characteristics of entrepreneurs, classification and types of entrepreneurs, role of entrepreneurs in economic development, entrepreneurship in India, Market feasibility study, Technical feasibility study, Financial feasibility study and Social feasibility study. **Case Study:** Mokshagundam Visvesvaraya, Mohan Singh Oberoi: From Homeless to Hotelier	**06 Hrs L2**
Module 4	
Preparation of project and ERP - Meaning of project, Project Identification, Project Selection, Project Report, Need and Significance of Project Report, Contents, Formulation, Guidelines by planning commission for Project Report, Enterprise Resource Planning: Meaning and Importance, Human Resources – Types of reports and methods of report generation. **Case Study**: Naresh Goyal & Jet Airways	**06 Hrs L2**



Module 5	
Engineering and Economics: Definition of micro and small enterprises, steps in establishing micro and small enterprises, problem solving and decision making, Laws of demand and supply, Law of Returns, Interest and interest factors, simple and compound interest, Cash flow diagrams, personal loans and EMI payment calculation with flexible interest rates. **Case Study**: Shahnaz Husain- The Ayurveda Entrepreneur	**06 Hrs** **L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1	Understand the functional areas of management and apply their principles in establishing an enterprise.
CO2	Outline the business opportunities and analyze the management skills for the economic growth of the society.
CO3	Interpret how the entrepreneur applies the principles of management to meet the personal and societal needs.
CO4	Illustrate the project proposals and reports for the effective management of an organization.
CO5	Understand the importance of small scale industries in economic development

CO PO MAPPING														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ADS51.1	1	1	-	-	-	-	-	3	3	3	3	3	1	-
22ADS51.2	1	1	-	-	-	-	-	3	3	3	3	3	1	-
22ADS51.3	1	1	-	-	-	-	-	3	3	3	3	3	1	-
22ADS51.4	1	1	-	-	-	-	-	3	3	3	3	3	1	-
22ADS51.5	1	1	-	-	-	-	-	3	3	3	3	3	1	-
Average	1	1	-	-	-	-	-	3	3	3	3	3	1	-

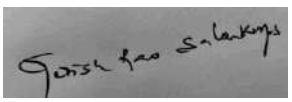
Low-1: Medium-2: High-3

Text Books:

1. Principles of Management -P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th / 6th Edition, 2010.
2. Management and Enterpreneurship- Kanishka Bedi- Oxford University Press-2017.
3. Engineering Economy- Riggs J.L, McGraw Hill, 4th edition,2015.

Reference Books:

1. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier– Thomson.
2. Entrepreneurship Development -S S Khanka -S Chand & Co.
3. Management -Stephen Robbins -Pearson Education /PHI -17th Edition, 2003.
4. Dynamics of Entrepreneurial Development & Management -Vasant Desai Himalaya Publishing House.
5. Entrepreneurship Development -Small Business Enterprises-Poornima M Charantimath Pearson Education – 2006.



MOOCs

1. http://nptel.ac.in
2. https://www.class-central.com (MOOCS)
3. E-learning: www.vtu.ac.in

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

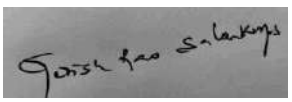
Three Tests are to be conducted for 40 marks each. Average marks scored is added to test component. adding up the assignment marks of 10 marks.

Some possible AATs: seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic toolbox for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical Evaluation pattern for regular courses is shown in Table.

Table: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignment	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER V

BIG DATA ANALYTICS TOOLS AND TECHNIQUES

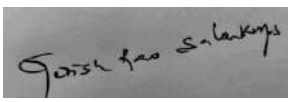
Course Code:	**22ADS52**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:2**	**SEE Marks:**	**50**
Type of Course:	**IPCC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): None

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Understand fundamentals of Big Data analytics
2	Explore the Hadoop framework and Hadoop Distributed File system
3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
4	Understand various mining streams
5	Understand various tools like Hive and Pig for Big Data Analytics.

Content	No. of Hours	RBT Level
Module 1		
Introduction to Big Data: Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data processing platforms: HADOOP, SPARK, FLINK, and MOA, Challenges of Conventional Systems, Big Data Analytics Applications and Case Studies.	**10**	**L2**
Module 2		
HADOOP: Introduction to Hadoop: Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. Hadoop Distributed File System Basics: HDFS Design Features, Components, HDFS User Commands. Hadoop Map-Reduce Framework.	**10**	**L3**
Module 3		
Hive – What is Hive? Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), CREATE TABLE, DROP TABLE, ALTER TABLE, CREATE DATABASE, DROP DATABASE, DESCRIBE, INSERT, COUNT(*), SELECT, DISTINCT, HAVING, LIMIT, GROUP BY,ORDER BY, VARIOUS JOINS. **Pig**-What is Pig? Pig on Hadoop, Datatypes in Pig, Running Pig, Execution modes of Pig, HDFS Commands, Relational operators, Eval Function, Pig-Latin Language-DISTINCT, FILTER, FOREACH, GROUP, JOINS(Inner, Outer, Full), LIMIT, LOAD, ORDER BY, RANK, STORE, STREAM, UNION, DUMP. Complex Data Types, User Defined Functions, Word Count example using Pig.	**10**	**L3**
Module 4		
Essential Hadoop Tools: Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase. Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive - fundamentals of HBase and ZooKeeper, IBM Info Sphere Big Insights and Streams.-	**10**	**L3**



Module 5		
NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL DataStore, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases. **Overview and History of NoSQL Databases:** NO-SQL database Techniques for Big Data, Comparison of Relational Databases with NO-SQL Databases. Advantages of NO-SQL over RDBMS,Scale out VS Scale up, Types of NO-SQL databases, Characteristics of NO-SQL Databases.NO-SQL solutions for Big Data Management,NO-SQL Data Models, Key-value stores, column based stores, graph based stores and document based stores.	**10**	**L3**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Explain fundamentals of Big Data analytics.
CO2	Investigate Hadoop framework and Hadoop Distributed File system
CO3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
CO4	Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.
CO5	Demonstrate how to work with Hive and Pig.

CO / PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1		2			1		2		2	3	
CO2	2	3	1		2			1		2		2	3	
CO3	1	2	3		2			1		2		2	3	
CO4	1	2	3		2			1		2		2	3	
CO5	3	3	3		2			1		2		2	3	
Average	2	2	2		2			1		2		2	3	

High-3: Medium-2: Low-1

Textbooks:

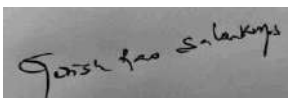
1. Raj Kamal and Preeti Saxena, Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning,McGraw Hill Education, 2018.
2. Douglas Eadline, Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem, Pearson Education, 1st Edition, 2016
3. Seema Acharya, Subhashini Chellappan, Big data and Analytics, Wiley publications, 2nd Edition, 2019.

Reference Books:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
2. Tom White, Hadoop: The Definitive Guide, O'Reilly Media, Third Edition, 2012.

E-Books / Web References:

1. Big Data Now: http://cdn.oreillystatic.com/oreilly/radarreport/0636920028307/Big_Data_Now_2012_Edition.pdf
2. Bigdata Analytics with Hadoop: https://www.packtpub.com/free-ebook/big-data-analytics-



with- hadoop-3/9781788628846

MOOCs:

1. Big Data Computing, IIT Patna, https://nptel.ac.in/courses/106104189
2. https://www.udemy.com/course/the-ultimate-hands-on-hadoop-tame-your-big-data/

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Explain fundamentals of Big Data analytics.
CO2	Investigate Hadoop framework and Hadoop Distributed File system
CO3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
CO4	Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.
CO5	Demonstrate how to work with Hive and Pig.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1		2			1		2		2	3	
CO2	2	3	1		2			1		2		2	3	
CO3	1	2	3		2			1		2		2	3	
CO4	1	2	3		2			1		2		2	3	
CO5	3	3	3		2			1		2		2	3	
Average	2	2	2		2			1		2		2	3	

High-3: Medium-2: Low-1

Textbooks:

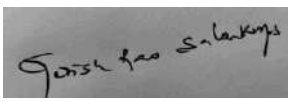
4. Raj Kamal and Preeti Saxena, Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning,McGraw Hill Education, 2018.
5. Douglas Eadline, Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem, Pearson Education, 1st Edition, 2016
6. Seema Acharya, Subhashini Chellappan, Big data and Analytics, Wiley publications, 2nd Edition, 2019.

Reference Books:

3. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
4. Tom White, Hadoop: The Definitive Guide, O'Reilly Media, Third Edition, 2012.

E-Books / Web References:

1. Big Data Now: http://cdn.oreillystatic.com/oreilly/radarreport/0636920028307/Big_Data_Now_2012_Edition.pdf
2. Bigdata Analytics with Hadoop: https://www.packtpub.com/free-ebook/big-data-analytics-with- hadoop-3/9781788628846



MOOCs:

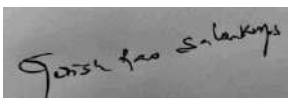
3. Big Data Computing, IIT Patna, https://nptel.ac.in/courses/106104189
4. https://www.udemy.com/course/the-ultimate-hands-on-hadoop-tame-your-big-data/

Prog. No.	Lab Programs	No. of Hours/ RBT levels
1	Install Virtual Box. Install a virtual machine (that has Hadoop Installed) on the top of Virtual box. Learn HDFS and execute general and user commands.	**02 L3**
2	Write and execute Map-reduce word-count program in a single node as well as a multimode cluster.	**02 L3**
3	Write and execute a MAP-Reduce Python program to calculate the Total sales amount of various stores, at stores level and store/order date level.	**02 L3**
4	Write and execute a Map-reduce program to print year wise sales of a company from a given CSV file.	**02 L3**
5	Write and execute a Map-reduce program to read data from multiple files and perform mapper side join to print order amount	**02 L3**
6	Understand and practice various PIG-Latin Commands.	**02 L3**
7	Practice and write PIG-Latin scripts using the following commands.DISTINCT, FILTER, FOREACH, GROUP, JOINS(Inner, Outer, Full), LIMIT, LOAD, RDER BY, RANK, STORE, STREAM, UNION, DUMP.	**02 L3**
8	Understand and practice various HQL Query Commands.	**02 L3**
9	Practice and write HQL Queries using the following commands. CREATE TABLE, DROP TABLE, ALTER TABLE, CREATE DATABASE, DROP DATABASE, DESCRIBE, INSERT, COUNT(*), SELECT, DISTINCT, HAVING, LIMIT, GROUP BY,ORDER BY, VARIOUS JOINS.	**02 L3**
10	Create partition and buckets in a HIVE database. Query from a partitioned and bucketed database.	**02 L3**
11	Understand and practice various Mongo-DB Commands.	**02 L3**
12.	Practice with the following Mongo-DB commands. CREATECOLLECTION, FIND, UPDATEONE, UPDATEMANY, REPLACEONE, DELETEONE, DELETEMANY, INSERTONE, INSERTMANY, COUNT, PRETTY,SIZE,AGGREGATE COMMANDS, Etc.	**02 L3**

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.

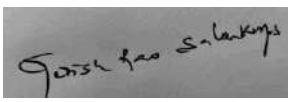


Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER V

MACHINE LEARNING II

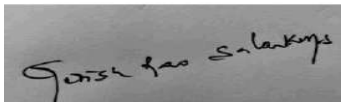
Course Code:	**22ADS53**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**4:0:0**	**SEE Marks:**	**50**
Type of Course:	**PCC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): Machine Learning I

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Understanding of the fundamental classification algorithms and challenges of supervised algorithms
2	Become conversant with types of multiclass classification algorithms, and their applicability
3	Familiarize with the unsupervised machine learning algorithms
4	To improve the performance of the algorithms using hyperparameter tuning techniques.
5	To understand and apply reinforcement learning concepts to the real data.

Module 1	No. of Hours	RBT Level
Supervised Learning (Classification): Support Vector Machine (SVC and SVR), Kernel Methods, Random Forest, Ensemble classification methods (Bagging and Boosting Techniques).	**10**	**L3**
Module 2		
Multiclass Classification: Multiclass classification problem, Generalization bounds, Uncombined multi-class algorithms, aggregated multi-class algorithms, Performance Metrics **Explainable AI:** Introduction to XAI, LIME, SHAP.	**10**	**L3**
Module 3		
Unsupervised Learning: Introduction to Unsupervised Learning, Clustering, k-means Clustering, Bisecting k- means, K-Means as special case of Expectation Maximization, Agglomerative Clustering and Divisive Clustering, DBSCAN, Comparing and Evaluating Clustering Algorithms, Semi-Supervised Learning models.	**10**	**L3**
Module 4		
Hyperparameter Tuning: Overview, Manual Search, Grid Search, Random Search, Random Search with Hyperopt, Bayesian Optimization, Multi-fidelity Optimization, Optuna.	**10**	**L3**
Module 5		
Reinforcement Learning(RL): Key elements of RL, the RL Algorithm, how RL differs from other ML paradigms, The Markov Decision Process, Action space, Episodic and Continuous tasks, Return and discount factor, The Value function, Q-function, model-based and model-free learning, types of environments, Applications.	**10**	**L3**



Course Outcomes:

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

CO1	Apply supervised learning techniques to real data using classification algorithms
CO2	Apply multiclass classification learning techniques to real data
CO3	Apply unsupervised learning algorithms for prediction.
CO4	Apply hyperparameter tuning techniques to improve the performance of the model
CO5	Apply reinforcement learning algorithms to solve real-world problems.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	3	3	2					3	2	3	
CO2	2	2	2	3	3	2					3	2	3	
CO3	3	2	3	3	3	2			3		3	2	2	
CO4	3	2	3	3	3	2			3		3	2	3	
CO5	3	3	3	3	3	3			3		3	2	2	
Average	3	2	3	3	3	2			3		3	2	3	

High-3: Medium-2: Low-1

Text Books:

1. Introduction to Machine Learning with Python‖ Sarah Guido, Andreas C. Müller, O' Reilly, 2017.
2. Deep Reinforcement Learning with Python – Sudharsan Ravichandiran, by Packt Publishing – 2nd edition 2020.
3. Principles of Data Science by Sinan Ozdemir, Sunil Kakade, Packt Publishing Limited, 2nd Edition, 2018.

Reference Books:

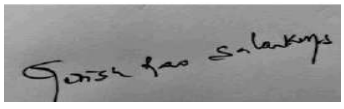
1. Principles of Soft Computing by S N Sivanandam and S N Deepa, 3rd Edition, Wiley.
2. Introduction to Machine Learning‖, by Ethem Alpaydin, PHI Learning, 2nd Edition, 2019.

E-Books / Web References:

1. https://towardsdatascience.com/hyperparameter-tuning-for-machine-learning-models-1b80d783b946.
2. https://smartlabai.medium.com/reinforcement-learning-algorithms-an-intuitive-overview-904e2dff5bbc.

MOOCs:

1. Udemy.
2. Coursera
3. NPTEL



Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper will be set for 50 marks. There will be 50 questions, 10 questions from each module, each question carrying 1 marks each. Students are required to answer all the questions.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average marks scored is added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and Three tests. Two quizzes are to be conducted and each quiz is evaluated for 5 marks adding up to 10 marks.

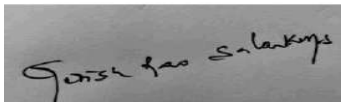
All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively.

Some possible AATs: Seminar/ Assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic toolbox for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a- thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER V

MACHINE LEARNING II LABORATORY

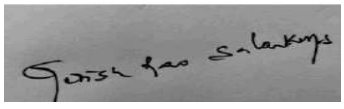
Course Code:	**22ADSL54**	**CIE Marks:**	**50**
Hours/Week (L:T:P):	**0:0:2**	**SEE Marks:**	**50**
Type of Course:	**PCCL**	**Duration of SEE (hours):**	**03**
Credits: 01			

Prerequisites: Basics of Probability

Course Objectives: The course will enable students to:

1	Implement the advanced programming skills of Python.
2	To develop skills to analyze Unsupervised, Semi-supervised machine learning algorithms.
3	To strengthen the ability to the students to identify and apply the suitable algorithm for the given real-world problem.
4	Enables to gain knowledge in practical applications of machine learning.

Sl. No.	Programs	No. of Hours/ RBT levels
1	Write a program to demonstrate Support Vector Machine using different Kernel functions.	**03 L3**
2	Write a program to implement Bagging and Boosting classifiers.	**03 L3**
3	Write a program to demonstrate pipeline in Machine Learning.	**03 L3**
4	Write a program to classify the data using Multiclass classification algorithm 1.	**03 L3**
5	Write a program to classify the data using Multiclass classification algorithm 2.	**03 L3**
6	Write a program to cluster the data using K-Means clustering algorithm.	**03 L3**
7	Write a program to implement Label Propagation algorithm (Semi – Supervised Learning)	**03 L3**
8	Write a program to demonstrate Random Forest algorithm and improve the performanceusing different Hyper Parameter Tuning Techniques (Randomized and Grid search CV).	**03 L3**
9	Write a program to demonstrate on classification algorithm and improve the performanceusing different Hyper Parameter Tuning Techniques (Bayesian and Optuna).	**03 L3**
10	Write a program to implement Q-Learning.	**03 L3**



Course Outcomes: Upon successful completion of this course, student will be able to

CO1	Understand, appreciate and effectively explain the underlying concepts of Machine Learning algorithms.
CO2	Code, debug and demonstrate the working nature of different types of Ensemble algorithms.
CO3	Choose the appropriate Unsupervised learning algorithm on any given dataset.
CO4	Implement Semi-supervised learning algorithms on real-world problems.
CO5	Implement Q-Learning Reinforcement Learning algorithm on any gaming dataset.

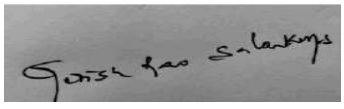
Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of the answer script tobe strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovativepedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/concept videos/ partial reproduction of research work/ oral presentation.



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER V

INTRODUCTION TO NOSQL

(Professional Elective Course)

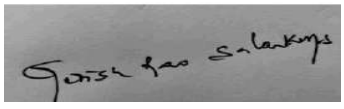
Course Code:	**22ADS551**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type o Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): Basic Knowledge about DBMS.

Course Learning Objectives:

Sl. No.	Course Learning Objectives (CLO)
1	Illustrate the Emergence of NoSQL.
2	Understand the challenges of NoSQL approach.
3	Outline the features of Key/value databases.
4	Define Column Oriented NoSQL databases.
5	Understand Databases using Riak.

Module 1	No. of Hrs	RBT Level
Overview and History of NoSQL Databases: Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.	**08**	**L3**
Module 2		
Comparison of relational databases to new NoSQL stores: MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key- Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. **Distribution Models:** Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.	**08**	**L3**
Module 3		
Map-Reduce on databases: Basics, Partitioning and Combining, Composing Map-Reduce Calculations. **NoSQL Key/Value databases using MongoDB**: Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.	**08**	**L3**
Module 4		
Column- oriented NoSQL databases using Apache HBASE and Cassandra: Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.	**08**	**L3**



Module 5		
NoSQL Key/Value databases using Riak: Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases(storing session info, User profiles, shopping cart data), When not to use Key-Value stores. **Graph NoSQL databases using Neo4(Graph Databases):** Graph structure, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.	**08**	**L3**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Explain and compare different types of NoSQL Databases
CO2	Compare and contrast RDBMS with different NoSQL databases.
CO3	Demonstrate the detailed architecture and performance tune of Document-orientedNoSQL databases.
CO4	Explain performance tune of Key-Value Pair NoSQL databases.
CO5	Explain NoSQL development tools on different types of NoSQL Databases.

CO / PO Mapping													
CO /PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1		2			1		2		2	3	
CO2	2	3	1		2			1		2		2	3	
CO3	1	2	3		2			1		2		2	3	
CO4	1	2	3		2			1		2		2	3	
CO5	3	3	3		2			1		2		2	3	
Average	2	2	2		2			1		2		2	3	

High-3: Medium-2: Low-1

Text Books:

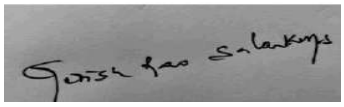
1. Sadalage P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2012.

Reference Books:

1. Making Sense of NoSQL, Dan McCreary and Ann Kelly, Manning publications, 1st edition, 2013.

E-Books / Web References:

1. https://www.ibm.com/cloud/learn/nosql-databases
2. https://www.javatpoint.com/nosql-databa
3. https://www.geeksforgeeks.org/introduction-to-nosql/



MOOCs:

1. https://www.ibm.com/cloud/learn/nosql-databases
2. https://www.javatpoint.com/nosql-databa
3. https://www.geeksforgeeks.org/introduction-to-nosql/

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reducedto 50. There will be two full questions (with a maximum of four sub questions) from each module carrying20 marks each. Students are required to answer any **five full questions** choosing at least **one full questionfrom each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average marks scored is added to test component. CIEis executed by way of two quizzes / Alternate Assessment Tools (AATs), and Three tests. Two quizzes areto be conducted and each quiz is evaluated for 5 marks adding up to 10 marks.

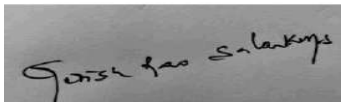
All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively.

Some possible AATs: seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic toolbox for problem solving/ report based on participation in create-a-thon/ make-a- thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical Evaluation pattern for regular courses is shown in Table.

Table: Distribution of weightage for CIE & SEE of Regular courses

	Component	**Marks**	**Total Marks**
CIE	**CIE Test-1**	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	**Semester End Examination**	**50**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER V

COMPUTER NETWORKS

(Professional Elective Course)

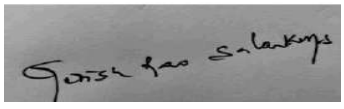
Course Code:	**22ADS552**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type o Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): None.

Course Learning Objectives: The course will enable students to:

Sl. No.	Course Learning Objectives (CLO)
1	Build an understanding of the fundamental concepts of computer networking
2	Familiarize students with the concepts of switching & framing
3	Introduce the concepts of Wireless LANs
4	Describe various layers of networks and the operating protocols
5	Understand the concepts of Adhoc networks & Sensor networks

Module 1	No. of Hours	RBT Level
Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer-1: Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance.	**08**	**L2**
Module 2		
Switching: Introduction, Circuit Switched Networks and Packet switching. Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Forward error correction.: Framing, Flow and Error Control	**08**	**L2**
Module 3		
Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, Wireless LANs: Introduction, IEEE 802.11 Project and Bluetooth. Data Traffic, Congestion and Congestion Control	**08**	**L2**
Module 4		
Protocols : Internet Protocol, ICMPv4,Mobile IP, Next generation IP: IPv6 addressing, The IPv6 Protocol, The ICMPv6 Protocol and Transition from IPv4 to IPv6.Domain Name System: Name Space, Domain name space, Distribution Name Space, DNS in the Internet, Resolution, DNS Messages, Types of Records	**08**	**L2**
Module 5		
Mobile AdHoc Networks and Wireless Sensor Neworks: Overview of Wireless Ad-Hoc networks, Routing in AdHOc Networks, Routing protocols for and Security of AdHoc networks, Sensor Networks and protocol structures, Communication Energy model, Clustering protocols, Routing protocols, ZigBee technology and 802.15.4.	**08**	**L2**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand basic computer networking concepts OSI,TCP/IP models.
CO2	Describe various networking architectures, flow & error control mechanisms .
CO3	Understand Wireless LAN concepts
CO4	Identify the protocols and services of different layers
CO5	Understand basics of Wireless Adhoc & Sensor networks.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	2	2			2			2	2	2	2
CO2	2	2	3	2	2			2			2	2	2	2
CO3	2	2	3	2	3			2			2	2	2	2
CO4	2	2	3	3	3			2			3	3	2	2
CO5	2	2	3	3	3			2			3	3	2	2
Average	2	2	3	3	3			2			3	3	2	2

High-3: Medium-2: Low-1

Text Books:

1. Behrouz A Forouzan, Data Communications and Networking, Sixth Edition, McGraw Hill, Indian Edition.
2. Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014(Chapter 19 & Chapter 20).

Reference Books:

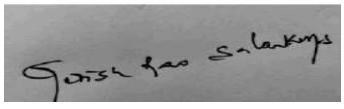
1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017
2. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER

E-Books / Web References:

1. NPTEL Lecture https://nptel.ac.in/courses/112/103/112103280/
2. https://archive.nptel.ac.in/courses/117/104/117104099/

MOOCs:

1. https://learn.saylor.org/course/CS402



2. https://www.coursera.org/specializations/computer-communications

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reducedto 50. There will be two full questions (with a maximum of four sub questions) from each module carrying20 marks each. Students are required to answer any **five full questions** choosing at least **one full questionfrom each module.**

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average marks scored is added to test component. CIEis executed by way of two quizzes / Alternate Assessment Tools (AATs), and Three tests. Two quizzes areto be conducted and each quiz is evaluated for 5 marks adding up to 10 marks.

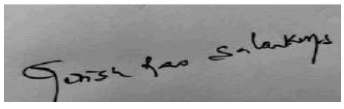
All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively.

Some possible AATs: seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic toolbox for problem solving/ report based on participation in create-a-thon/ make-a- thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical Evaluation pattern for regular courses is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –V

MINI PROJECT

Course Code:	**22ADS56**	**CIE Marks:**	**100**
Hours/Week (L: T: P):	**0:0:4**	**Credits:**	**02**
Type of Course:	**PROJ**		

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	Acquire the ability to make links across different areas of knowledgeand to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
2	Acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific audience in both the written and oral forms.
3	Acquire collaborative skills through working in a team to achieve common goals.
4	Learn on their own, reflect on their learning and take appropriate action to improve it.

Guidelines for Mini Project

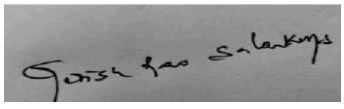
The mini project is to be carried out individually or by a team of two-four students.

1. Each student in a team must contribute equally in the tasks mentioned below.
2. Each group has to select a current topic that will use the technical knowledge of their program of study after intensive literature survey.
3. The project should result in system/module which can be demonstrated, using the available resources in the college.
4. The CIE evaluation will be done by the committee constituted by the department. The committee shall consist of respective guide & two senior faculty members as examiners. The evaluation will be done for each student separately.
5. The final copy of the report should be submitted after incorporation of any modifications suggested by the evaluation committee.

The mini-project tasks would involve:

1. Carry out the Literature Survey of the topic chosen.
2. Understand the requirements specification of the mini-project.
3. Detail the design concepts as applicable through appropriate functional block diagrams.
4. Commence implementation of the methodology after approval by the faculty.
5. Conduct thorough testing of all the modules developed and carry out integrated testing.
6. Demonstrate the functioning of the mini project along with presentations of the same.
7. Prepare a project report covering all the above phases with proper inference to the results obtained.
8. Conclusion and Future Enhancements must also be included in the report.

The students are required to submit the report in the prescribed format provided by the department.



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Interpreting and implementing the project in the chosen domain by applying the concepts learnt.
CO2	The course will facilitate effective participation by the student in team work and development of communication and presentation skills essential for being part of any of the domains in his / her future career.
CO3	Appling project life cycle effectively to develop an efficient product.
CO4	Produce students who would be equipped to pursue higher studies in a specialized area or carry out research work in an industrial environment.

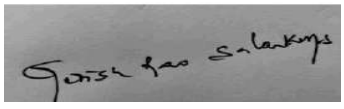
CO / PO Mapping														
CO / PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**1**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**1**
CO4	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**1**	**1**	**1**
Average	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**1**

High-3: Medium-2: Low-1

Scheme of Evaluation:

Continuous Internal Evaluation (CIE):

Phase	**Activity**	**Weightage**
I	Synopsis submission, approval of the selected topic, Problem definition, Literature review, formulation of objectives, methodology	20M
II	Mid-term evaluation to review the progress of implementation, design, testing and result analysis along with documentation	30M
III	Submission of report, Final presentation and demonstration	50M
	Total	**100M**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –V

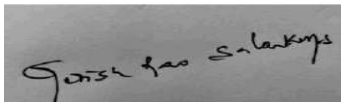
Course: Research Methodology and IPR

Course Code	**22RMIK57**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**03**

Course Objectives:

CLO1	To make the student understand the foundations of Research and problem solution
CLO2	Knowledge in Research design, Qualitative and Quantitative Research
CLO3	Knowledge to formulate and derive static and dynamic aero elastic equations of motion.
CL04	To understand the different types of IPR

Content	**No. of Hrs/ RBT levels**
Module 1	
RESEARCH METHODOLOGY: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. **DEFINING THE RESEARCH PROBLEM:** Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration	**08 Hours/ L3**
Module 2	
REVIEWING THE LITERATURE: Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed. **RESEARCH DESIGN**: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs	**08 Hours/ L3**
Module 3	
DESIGN OF SAMPLE SURVEYS: Design of Sampling: Introduction, Sample Design, Sampling and Non-Sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. **MEASUREMENT AND SCALING:** Qualitative and Quantitative Data, **DATA COLLECTION:** Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.	**08 Hours/ L3**



Module 4	
TESTING OF HYPOTHESES: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. **INTERPRETATION AND REPORT WRITING:** Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.	**08 Hours/ L3**
Module 5	
INTELLECTUAL PROPERTY: Principles of IPR, Kinds of IPR, Patent-Concepts, Novelty, Utility Inventiveness/Non-obviousness, Procedure for granting and obtaining patents; Copyright- conditions for grant of copyright, Copyright in Literary, Dramatic and Musical ,Works, Sound Recording, Cinematograph Films, Copyright in Computer Programme, Author Special Rights, Right of Broadcasting and performers, Trademark Law and Practices - Procedure of registration of trademark; Emerging Issues and Challenges; Few Future Aspects of Intellectual Property Rights;	**08 Hours/ L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1	Understand the research problem by literature review to solve problems
CO2	Develop skills in qualitative and quantitative data analysis and presentation.
CO3	Develop advanced critical thinking skills.
CO4	Understand to write the report writing and awareness about IPR

Textbook:

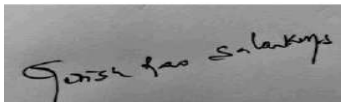
1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
4. Lionel Bently., Brad Sherman-Intellectual Property Law, 3rd Edition

Reference Books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reducedto 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20



marks each. Students are required to answer any **five full questions** choosing at least **onefull question from each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is addedto test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproductionof research work/ group activity/ any other.

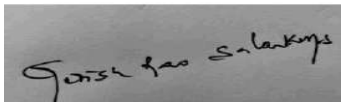
Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO	PO6	PO8
CO 1	3	3
CO 2	3	3
CO 3	3	3
CO 4	3	3
CO 5	3	3
Average	3	3

Low-1: Medium-2: High



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER – V

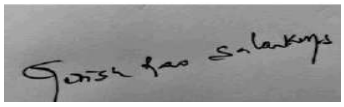
ENVIRONMENTAL STUDIES

Course Code	**22CIVK58**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:0:0**	**SEE Marks**	**50**
No. of Credits	**2**	**Examination Hours**	**3**

Course Objectives: Students will be taught:

CLO1	To understand ecosystem functions and 17 SDG's for sustainable development
CLO2	To understand advanced energy systems and natural resource management.
CLO3	To understand about pollution and waste management solutions and laws
CLO4	To understand global environmental issues, related policies and solutions through case studies
CLO5	To understand key environmental legislation related to water, air, waste and environmental protection.

Content	No. of Hrs/ RBT levels
Module 1	
Ecosystem and Sustainability: Ecosystems (Structure and Function): Forest, Desert, Wetlands, River, Oceanic and Lake. Sustainability: 17 SDGs-History, targets, implementation, Capacity Development	**06 Hours/ L2**
Module 2	
Natural Resource Management: Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind. Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining - case studies and Carbon Trading	**06 Hours/ L2**
Module 3	
Environmental Pollution & Waste Management: Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. Waste Management: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge	**06 Hours/ L2**
Module 4	
Global Environmental Issues: Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology	**06 Hours/ L3**
Module 5	
Environmental Legislation: Environmental Legislation: Water Act 1974, Air Act 1981, Environmental Protection Act 1984, Solid Waste Management Rules-2016, E- Waste management Rule - 2022, Biomedical Waste management- 2016	**06 Hours/ L2**



COURSE OUTCOMES:

Upon completion of this course, student will be able to:

22CIVK58.1	**Analyze** ecosystem dynamics to formulate strategies for addressing sustainability challenges and implementing the SDGs.
22CIVK58.2	**Evaluate** energy technologies to design effective resource management strategies.
22CIVK58.3	**Evaluate** the impacts of pollution to develop effective waste management strategies.
22CIVK58.4	**Evaluate** global environmental issues to design solutions for sustainable management.
22CIVK58.5	**Interpret** environmental laws and regulations for sustainable management practices.

Textbooks:

1. Environmental studies, Benny Joseph, Tata Mcgraw-Hill 2nd edition 2012
2. Environmental studies, S M Prakash, pristine publishing house, Mangalore 3rd edition-2018

References:

1. Benny Joseph, Environmental studies, Tata Mcgraw-Hill 2nd edition 2009
2. M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007
3. Dr. B.S Chauhan, Environmental studies, university of science press 1st edition

Web Reference:

https://www.hzu.edu.in/bed/E%20V%20S.pdf
https://onlinecourses.nptel.ac.in/noc23_hs155/preview
https://onlinecourses.swayam2.ac.in/cec19_bt03/preview

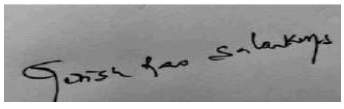
Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of three test marks will be added to test component. CIE is executed by way of two quizzes/Alternate Assessment Tools(AAT's), some possible AAT's: Seminar/ assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

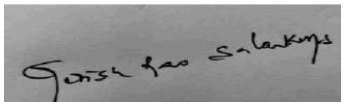


Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	**Semester End Examination**	**100**	**50**
Grand Total			**100**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIVK58.1	2					1	1	1							3
22CIVK58.2	2	2	2			1	3	1							3
22CIVK58.3		2	2	2		1	3	1							2
22CIVK58.4		2	2	2		1	3	1							2
22CIVK58.5	1	2	2	2		1	2	1							2
Average	**1.67**	**2**	**2**	**2**		**1**	**2.4**	**1**							**2.4**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER V
NATIONAL SERVICE SCHEME (NSS)

Course Code	**22NSK59**	**CIE Marks**	**25*4 = 100**
Teaching Hours/Week (L:T:P: S)	**0:0:2**	**SEE Marks**	**------**
Total Hours of Pedagogy	**40 hour Practical Session +15 hour Planning**	**Total Marks**	**25*4 = 100**
Examination nature (SEE)	**Activities Report Evaluation by College NSS Officer at the end of the semester**		
Credits	**NCMC – Non Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)**		

Course objectives: National Service Scheme (NSS) will enable the students to:

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem –solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledgein finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integrationand social harmony in general.

General Instructions - Pedagogy :

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so thatthe activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documentingstudents' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

National Service Scheme (NSS) – Contents

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social andeconomic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach forimplementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat,Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc
9. Spreading public awareness under rural outreach programs.(minimum5 programs).

10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants
12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

NOTE:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of thatrespective semester for successful completion as per the instructions of NSS officer with the consent of HOD of thedepartment.
- At the end of the semester, activity report should be submitted for evaluation.

Distribution of Activities

Sem	Topics / Activities to be Covered
3rd Sem for 25 Marks	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4th Sem for25 Marks	4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
5th Sem for25 Marks	7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs.(minimum5 programs). 10. Social connect and responsibilities.
6th Sem for 25 Marks	11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

Pedagogy – Guidelines, it may differ depending on local resources available for the studyas well as environment and climatic differences, location and time of execution.

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / community area/ College campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contributionin social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc…..	Group selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	site selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme,Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
9.	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
10.	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

11.	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	May be individu al or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Place selection/proper consultation/Continu ous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individu al or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Place selection/proper consultation/Continu ous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities For Each Semester)

Sl.NO	Practice Session Description
1	**Lecture session by NSS Officer**
2	**Students Presentation on Topics**
3	**Presentation - 1 , Selection of topic, PHASE - 1**
4	**Commencement of activity and its progress - PHASE - 2**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
8	**Execution of Activity**
9	**Execution of Activity**
10	**Case study based Assessment, Individual performance**
11	**Sector wise study and its consolidation**
12	**Video based seminar for 10 minutes by each student At the end of semester with Report.**

- In every semester from 3rd semester to 6th semester, Each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**	• Implementation strategies of the project (NSS work). • The last report should be signed by NSS Officer, the HOD and principal. • At last report should be evaluated by the NSS officer of the institute. • Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Presentation - 1 Selection of topic, PHASE - 1	10 Marks	
Commencement of activity and its progress - PHASE - 2	10 Marks	
Case study based Assessment Individual performance	10 Marks	
Sector wise study and its consolidation	10 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report.	10 Marks	
Total marks for the course in each semester	**50 Marks**	

Marks scored for 50 by the students should be Scale down to 25 marks In each semester for CIE entry in the VTU portal.

25 marks CIE entry will be entered in University IA marks portal at the end of each semester 3rd to 6th sem, Report and assessment copy should be made available in the department semester wise.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general.

Suggested Learning Resources:

Books :

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER V

PHYSICAL EDUCATION (SPORTS & ATHLETICS)

Course Code	**:**	**22PEK59**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**0:0:2**				
Total Hours	**:**	**24 P**				

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

1. Understand the fundamental concepts and skills of Physical Education, Health, Food, Nutrition and general fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state / national / international levels.
5. Understand and practice of specific games and athletic throwing events.

Module I : Orientation **4 Hours**

A. Fitness
B. Food & Nutrition

Module II: General Fitness & Components of Fitness **4 Hours**

A. Agility – Shuttle Run
B. Flexibility – Sit and Reach
C. Cardiovascular Endurance – Harvard step Test

Module III : Specific games (Any one to be selected by the student) **16 Hours**

1. Badminton (Fore hand low/high service, back hand service, smash, drop)
2. Basketball (Dribbling, passing, shooting etc.)
3. Athletics (Field events – Throws)

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Yoga for Better Life		Semester	V
Course Code	**22YOK59**	CIE Marks	100/sem
Teaching Hours/Week (L:T:P: S)	0:0:2	SEE Marks	000
Total Hours of Pedagogy per semester	24 - 28 hours (Theory + practical)	Total Marks	100/sem
Examination nature (SEE)	**Objective type Theory / Practical / Viva-Voce**		

Course objectives:

1) To enable the student to have good health.
2) To practice mental hygiene.
3) To possess emotional stability.
4) To integrate moral values.
5) To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

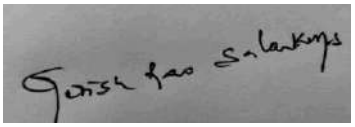
The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substanceabuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical
    1. Improved body flexibility and balance
    2. Improved cardiovascular endurance (stronger heart)
    3. Improved digestion
    4. Improved abdominal strength
    5. Enhanced overall muscular strength
    6. Relaxation of muscular strains
    7. Weight control
    8. Increased energy levels
    9. Enhanced immune system
- Mental
    1. Relief of stress resulting from the control of emotions
    2. Prevention and relief from stress-related disorders
    3. Intellectual enhancement, leading to improved decision-making skills
- Spiritual
    1. Life with meaning, purpose, and direction
    2. Inner peace and tranquility



3. Contentment

Yoga Syllabus

Semester III

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, importance of prayerYogic practices for common man to promote positive health Rules to be followed during yogic practices by practitionerYoga its misconceptions,

Difference between yogic and non yogic practices

Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12count, 2 rounds

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name,technique, precautionary measures and benefits of each asana

Different types of Asanas

a.	Sitting	1. Padmasana	2. Vajrasana
b.	Standing	1. Vrikshana	2. Trikonasana
c.	Prone line	1. Bhujangasana	2. Shalabhasana
d.	Supine line	1. Utthitadvipadasana	2. Ardhahalasana

Semester IV

Patanjali's Ashtanga Yoga, its need and importance. Yama
:Ahimsa, satya, asteya, brahmacarya, aparigraha
Niyama :shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan

Suryanamaskar12 count- 4 rounds of practice

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name,technique, precautionary measures and benefits of each asana

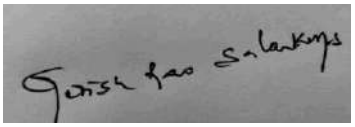
Different types of Asanas

a. Sitting 1. Sukhasana
   2. Paschimottanasana
b. Standing 1. Ardhakati Chakrasana
   2. Parshva Chakrasana
c. Prone line 1. Dhanurasana
d. Supine line 1. Halasana
   2. Karna Peedasana

Meaning, importance and benefits of Kapalabhati.40 strokes/min 3 rounds

Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama

Pranayama – 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana 4. Chandra Bhedana 5. Nadishodhana



Semester V

Patanjali'sAshtanga Yoga its need and importance.

Ashtanga Yoga

1. Asana
2. Pranayama
3. Pratyahara

Asana its meaning by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

a. Sitting 1. Ardha Ushtrasana
   2. Vakrasana
   3. Yogamudra in Padmasana

b. Standing 1. UrdhvaHastothanasana
   2. Hastapadasana
   3. ParivrittaTrikonasana
   4. Utkatasana

c. Prone line 1. Padangushtha Dhanurasana
   2. Poorna Bhujangasana / Rajakapotasana

d. Supine line 1. Sarvangasana
   2. Chakraasana
   3. Navasana/Noukasana
   4. Pavanamuktasana

Revision of practice 60 strokes/min 3 rounds

Meaning by name, technique, precautionary measures and benefits of each Pranayama

1. Ujjayi 2. Sheetali 3. Sheektari

Semester VI

Ashtanga Yoga 1. Dharana 2. Dhyana (Meditation) 3. Samadhi

Asana by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

a. Sitting 1. Bakasana
   2. Hanumanasana
   3. Ekapada Rajakapotasana
   4. Yogamudra in Vajrasana

b. Standing 1. Vatayanasana
   2. Garudasana

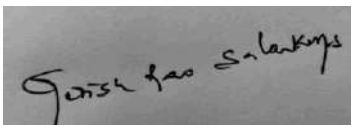
c. Balancing 1. Veerabhadrasana
   2. Sheershasana

d. Supine line 1. Sarvangasana
   2. Setubandha Sarvangasana
   3. Shavasanaa (Relaxation poisture).

Revision of Kapalabhati practice 80 strokes/min - 3 rounds

Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama 1. Bhastrika 2. Bhramari

Meaning, Need, importance of Shatkriya. Different types. Meaning by name, technique, precautionary measures and benefits of each Kriya 1. Jalaneti & sutraneti 2. Nouli (only formen) 3. Sheetkarma Kapalabhati



Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Understand the meaning, aim and objectives of Yoga.
- Perform Suryanamaskar and able to Teach its benefits.
- Understand and teach different Asanas by name, its importance, methods and benefits.
- Instruct Kapalabhati and its need and importance.
- Teach different types of Pranayama by its name, precautions, procedure and uses

Coach different types of Kriyas , method to follow and usefulness.

Assessment Details (both CIE and SEE)

- Students will be assessed with internal test by a. Multiple choice questions b. Descriptive type questions (Two internal assessment tests with 25 marks/test)
- Final test shall be conducted for whole syllabus for 50 marks. Continuous Internal Evaluation shall be for 100 marks (including IA test)

Suggested Learning Resources:

Books:

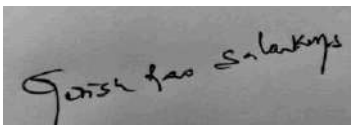
1. **Yogapravesha in Kannada by Ajitkumar**
2. **Light on Yoga by BKS Iyengar**
3. **Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly**

- **Yoga Instructor Course hand book published by SVYASA University, Bengaluru Yoga for Children – step by step – by Yamini Muthanna**

Web links and Video Lectures (e-Resources): Refer links

https://youtu.be/KB-TYlgd1wE

- **https://youtu.be/aa-TG0Wg1Ls**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

DATA VISUALIZATION USING TABLEAU

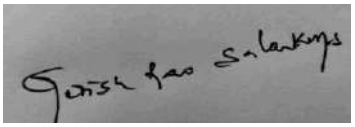
Course Code	**22ADS61**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**SEE Marks**	**50**
Type of Course	**IPCC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): None

Course Learning Objectives:

Sl.No	Course Learning Objectives (CLO)
1	Provide an overview of the good practice of data visualization.
2	Introduce students to the key design principles and techniques for visualizing data.
3	Learn how to navigate Tableau and connect to data sources, leverage drag-and-drop interface to create impactful visualizations.
4	Provide an overview and develop an introductory level of competency on the use of Power BI that can be used for data visualization.
5	Facilitate project-based opportunities to identify, understand, analyze, prepare, and present effective visualizations on a variety of data.

Module 1	No. of Hours	RBT Level
Data Visualization: Introduction to the Art and Science of Data Visualization, What is Data Visualization and why does it matter? Why Use Data Visualization? Brief History of Data Visualization, Data Visualization Tools, Pros and cons of Data Visualization. **Design Fundamentals:** Design Principles, Colors, and "Chart Junk", The Shaffer 4 C's of Data Visualization, Best practices (examples).	**10**	**L3**
Module 2		
Storytelling with Data: Creating a good data set for analysis, Selecting data for your KPIs, Approaches to storytelling with data, Dashboards vs. Storyboards vs. Infographics, The Duell Rules for Actionable Visualizations. **Tableau:** What is Tableau? History of Tableau, Advantages and disadvantages of Tableau, Tableau architecture, Tableau Public and Tableau Desktop, Workspace, Connecting to data source, Files and folders, Tableau navigation, Terminologies, Data types, Data roles, Data aggregation, File types.	**10**	**L3**
Module 3		
Data connection: Extracting data, Joining, Blending, Splits, Sorting, Fields operations. **Tableau calculations:** Operators, Functions, Numeric, string, date, tablecalculations, Level of Details expressions.	**10**	**L3**
Module 4		
Sort and filter: Basic filters, Filter operations, Extract filters, Quick filters, Context filters, Condition filters, Data source filters, Top filters, Build groups, hierarchy, sets.		



Charts: Bar, Line, Pie, Crosstab, Bubble, Bullet, Area, Pareto, Bump chart, Gantt chart, Histogram, Motion charts, Waterfall charts. Plots: Scatter, Boxplot. Maps: Heat map, Tree map.	**10**	**L3**
Module 5		
Advanced Tableau: Dashboard, Formatting, Forecasting, Trend Lines. **Power BI:** Introduction, Architecture, Tableau vs Power BI, Data modelling, Dashboard, Visualization options, Data Analysis Expressions.	**10**	**L3**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Develop insight on the fundamentals and various design techniques for effective Data Visualization.
CO2	Learn ways to create dashboards as well as story points to develop a strong, powerful data story.
CO3	Learn ways and methods to analyze and apply design principles to Tableau visualization.
CO4	Acquaint themselves with various functions available in Advanced Tableau, Power BI tools.
CO5	Familiarize themselves well with current trends in Data Visualization through relevant case studies.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	3		2	2			2		2	2	3	3
CO2	2	1	2		2	2			2		3	2	3	2
CO3	1	2	3		3	2			2		2	2	3	2
CO4	2	1	3		3	2			2		3	2	3	3
CO5	2	1	3		3	2			2		3	2	3	3
Average	2	1	3		3	2			2		3	2	3	3

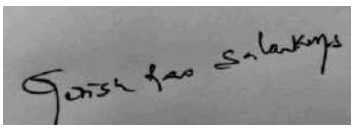
High-3: Medium-2: Low-1

Text Books:

1. Tableau 10 Business Intelligence Cookbook Book – Donabel Santos, Packt Publishing, 2016
2. The Wall Street Journal Guide to Information Graphics: The Dos and Don'ts of PresentingData, Facts, and Figures, Dona M. Wong, W. W. Norton & Company,

Reference Books:

1. Information Dashboard Design: Displaying Data for At-a-Glance Monitoring, Stephen Few, O'Reilly Media, 2013
2. Show Me the Numbers: Designing Tables and Graphs to Enlighten, Stephen Few, AnalyticsPress, 2004



3. Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics, Nathan Yau, Wiley, 2011
4. Now You See It, Stephen Few, Analytics Press, 2009
5. The Visual Display of Quantitative Information, Edward Tufte, Graphics Press, 2nd Edition, 2001

Books / Web References:

1. Data Visualization and Exploration with R A Practical Guide to Using R RStudio and Tidyverse for Data Visualization Exploration and Data Science Applications: https://www.pdfdrive.com/data-visualization-and-exploration-with-r-a-practical- guide-to-using-r-rstudio-and-tidyverse-for-data-visualization-exploration-and- data-science-applications-d176184240.html
2. Beginning Data Science in R: Data Analysis, Visualization, and Modelling for the Data Scientist: https://www.pdfdrive.com/beginning-data-science-in-r-data- analysis-visualization-and-modelling-for-the-data-scientist-d181093942.html

MOOCs:

1. https://www.coursera.org/learn/datavisualization
2. https://freevideolectures.com/course/4041/nptel-introduction-to-learning-analytics/11
3. https://www.edx.org/course/data-visualization-for-all
4. https://www.udemy.com/course/the-complete-data-visualization-course/

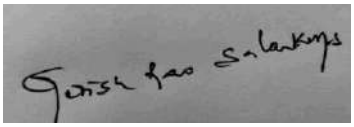
Sl. No.	Programs	No. of Hours/ RBT levels
1	Implement Data Blending on the given dataset using Tableau.	**03 L3**
2	Demonstrate Calculated Fields on the given dataset using Tableau.	**03 L3**
3	Demonstrate Tableau measure names and measure values on the given dataset.	**03 L3**
4	Implement Tableau Parameters on the given dataset.	**03 L3**
5	Illustrate clustering on the given dataset using Tableau.	**03 L3**

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end

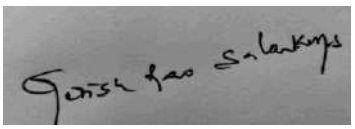


of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

NEURAL NETWORKS AND DEEP LEARNING

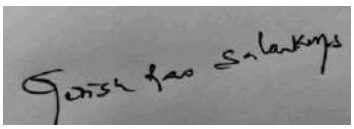
Course Code:	**22ADS62**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**4:0:0**	**SEE Marks:**	**50**
Type of Course:	**PCC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): Machine Learning I and Machine Learning II

Course Learning Objectives:

Sl.No	Course Learning Objectives (CLO)
1	To impart hands-on knowledge on Advanced Machine Learning Topics.
2	Provide in-depth coverage of Data Augmentation and Convolutions.
3	Impart application of Deep Learning techniques like CNN and RNN.
4	Exposure to unsupervised feature engineering techniques

Module 1	No. of Hours	RBT Level
Introduction: Understanding the Biological Neurons, Exploring the Artificial Neurons (Perceptron), Perceptron learning rule, Examples on single layer perceptron, Process of designing a Neural Networks (Architecture), Types of Activation Functions, derivative of activation functions. Multilayer perceptron (Mathematics Behind Back propagation, Deep L layer Neural Network, Understanding the notion of forward and backward propagation), Optimization algorithms in NN, Loss functions, Dropout, Implementation of ANN.	**10**	**L2**
Module 2		
Convolutional Neural Networks: Mathematics behind CNN, Layers, Architectures of CNN, ILSVRC winner architectures, Implementation of CNN, Building the model from the scratch	**10**	**L3**
Module 3		
Introduction: Gradient based approaches, Visualizing gradients, Saliency map, Class Model, SmoothGRAD, DeConvolution, Guided Back Propagation Grad-CAM, Occlusion sensitivity	**10**	**L3**
Module 4		
Recurrent Neural Networks: Types of RNN, Challenges in training RNN: Exploding and Vanishing Gradients, Networks with Memory **Long Short-Term Memory (LSTM):** Gated Recurrent Unit (GRU), Sequence Learning Architectures, Sequence Learning with one RNN Layer, Sequence Learning with multiple RNN Layers Implementation example using Keras in Python: sentiment analysis	**10**	**L3**



Module 5		
Other Deep Learning Architectures: Encoder-Decoder Architecture, AttentionMechanism, Transformer Architecture, Generative Adversarial Networks, Unet.	**10**	**L3**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand the fundamental concepts in the neural networks.
CO2	Apply deep neural models to various learning problems.
CO3	Develop insight behind the theory of deep learning methods (CNN, RNN, etc.).
CO4	Design Deep Learning Methods for working with sequential data.
CO5	Develop GAN to generate more images to solve the problems on less data.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	3	3	2					3	2	3	
CO2	2	2	2	3	3	2					3	2	3	
CO3	3	2	3	3	3	2			3		3	2	2	
CO4	3	2	3	3	3	2			3		3	2	3	
CO5	3	3	3	3	3	3			3		3	2	2	
Average	3	2	3	3	3	2			3		3	2	3	

High-3: Medium-2: Low-1

Text Books:

1. Deep learning – Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra, Amlan, 1st Edition, Pearson.
2. Deep learning- Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville, MIT Press,2015

Reference Books:

1. Neural Networks: A Systematic Introduction, Raúl Rojas, Springer.
2. Pattern Recognition and Machine Learning, Bishop C, Springer, 2006

E-Books / Web References:

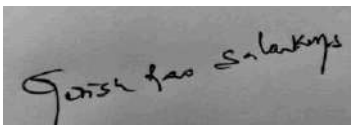
1. https://cs231n.github.io/convolutional-networks/
2. https://github.com/terryum/awesome-deep-learning-papers
3. https://project.inria.fr/deeplearning/files/2016/05/deepLearning.pdf

MOOCs:

1. Deep Learning specialization in Coursera.
2. https://nptel.ac.in/courses/106106184
3. https://www.udemy.com/topic/deep-learning/

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have beenencouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.



Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

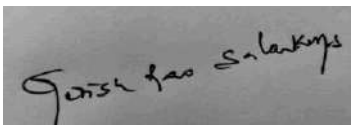
Table 1: CIE Evaluation		
Components	**Marks**	**Total**
CIE TEST 1	40	50
CIE TEST 2	40	
CIE TEST 3	40	
Assignment	10	

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respective Board of Studies and can be given here.

Scheme of Examination (SEE):

• The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.

- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

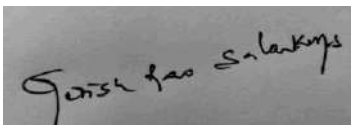
INTRODUCTION OF QUANTUM COMPUTING

(Professional Elective Course)

Course Code:	**22ADS631**	**CIE Marks:**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): None

Module 1	**No. of Hours**	**RBT Level**
Introduction to Quantum Computing: Introduction to QC and brief about the quantum mechanics, Why QC, Classic architecture vs quantum architecture, History of QC, What is QC, Qubit notations,Features of QC (Superposition, entanglement, decoherence), Usecases of QC, Linear vector spaces, Postulates of quantum mechanics.	**08**	**L2**
Module 2		
Quantum bits (qubits) & Quantum logic gates: Quantum State Transformation, Introduction to Logic Gates, Quantum gates & Circuits - Single Qubit Gates and Operations, Multiple Qubit Gates and Operations, Introduction to Quantum Simulator. **Textbook:** Learn Quantum Computing with Python and IBM Quantum Experienceby Robert Loredo.	**08**	**L2**
Module 3		
Practical Implementation: Introduction to Qiskit and QSim simulator toolkit, Python libraries needed for the implementation of Quantum computing, Implementation of Pauli gates in Qiskit and QSim, Implementation of Hadamard gate, Implementation of 2 qubit quantum gates, Implementation of three qubit quantum gates.	**08**	**L3**
Module 4		
Quantum Algorithms I: No cloning theorem, Quantum Teleportation, Deutsch's-Jozsa Algorithm, Bernstien Vazirani, practical implementation of the algorithms using Qiskit. **Textbook:** Fundamentals of Quantum Computing Theory and Practice, Venkateswaran Kasirajan, Springer, 1 st Edn., 2021.	**08**	**L3**
Module 5		
Quantum Algorithms II: Quantum Fourier transformation, Simon, Shor's, Grover's algorithm & generalization, practical implementation of the algorithms using Qiskit, Introduction to Quantum Machine Learning **Textbook:** QISKIT textbook: https://qiskit.org/textbook/content/ch-ex/ https://medium.com/@SPX701/quantum-machine-learning-a-beginners-guide-7c7f1d349693	**08**	**L3**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand Quantum Machine Learning - What Quantum Computing Means To Data Mining.
CO2	Understand the basics of quantum machine learning
CO3	Apply by implementing quantum classification algorithms on the real dataset
CO4	Apply by implementing regression on the real dataset
CO5	Apply by implementing pattern recognition on real dataset

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1		2	2	2	1		2		2	3	
CO2	3	3	2	2	3	2	2	1		2		2	3	
CO3	3	3	3	2	3	2	2	1	2	2		3	3	
CO4	3	3	3	2	3	2	2	1	2	2	2	3	3	
CO5	3	3	3	2	3	2	2	2	2	2	2	3	3	
Average	3	3	3	2	3	2	2	1	2	2	2	3	3	

High-3: Medium-2: Low-1

Text Books:

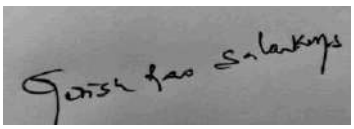
1. Learn Quantum Computing with Python and IBM Quantum Experience by RobertLoredo.
2. Fundamentals of Quantum Computing Theory and Practice, VenkateswaranKasirajan, Springer, 1 st Edn., 2021.
3. Quantum Machine Learning - What Quantum Computing Means To Data Mining,Peter Wittek, Elsevier, 2014.

Reference Books:

1. Quantum Machine Learning With Python: Using Cirq from Google Research and IBM Qiskit by Santanu Pattanayak.

MOOCs:

1. https://www.educative.io/courses/hands-on-quantum-machine-learning-python
2. https://www.udemy.com/course/quantum-computing-and-quantum-machine-learning-part-1/
3. https://www.udemy.com/course/quantum-computing-and-quantum-machine-learning-part-2/



Scheme of Examination (CIE):

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Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

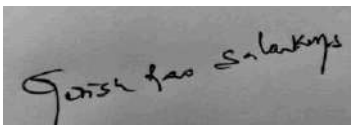
Typical evaluation pattern for regular courses is shown in Table 1:

Table 1: CIE Evaluation		
Components	**Marks**	**Total**
CIE TEST 1	40	50
CIE TEST 2	40	
CIE TEST 3	40	
Class test	10	

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respective Board of Studies and can be given here.

Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionatelyreduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

CRYPTOGRAPHY

(Professional Elective Course)

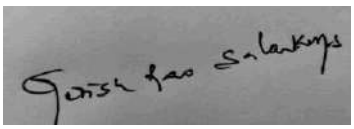
Course Code:	**22ADS632**	**CIE Marks:**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): None

Course Learning Objectives: The course will enable students to:

Sl. No.	Course Learning Objectives (CLO)
1	Enable students to understand the basics of symmetric key and public key cryptography
2	Equip students with some basic mathematical concepts and pseudorandom number generators required for cryptography.
3	Enable students to authenticate and protect the encrypted data.

Module 1	No. of Hours	RBT Level
Basic Concepts of Number Theory and Finite Fields: Divisibility and the divisibility algorithm, Euclidean algorithm, Modular arithmetic, Groups, Rings and Fields, Finite fields of the form GF(p), Polynomial arithmetic, Finite fields of the form GF(2n)(Text 1: Chapter 3) L1, L2	**08**	**L2**
Module 2		
Classical Encryption Techniques: Symmetric cipher model, Substitution techniques, Transposition techniques, Steganography (Text 1: Chapter 1) SYMMETRIC CIPHERS: Traditional Block Cipher structure, Data Encryption Standard (DES) (Text 1: Chapter 2: Section1, 2)	**08**	**L2**
Module 3		
SYMMETRIC CIPHERS: The AES Cipher. (Text 1: Chapter 4: Section 2, 3, 4) Pseudo-Random-Sequence Generators and Stream Ciphers: Linear Congruential Generators, Linear Feedback Shift Registers, Design and analysis of stream ciphers, Stream ciphers using LFSRs (Text 2: Chapter 16: Section 1, 2, 3, 4)	**08**	**L2**
Module 4		
More number theory: Prime Numbers, Fermat‘s and Euler‘s theorem, Primality testing, Chinese Remainder theorem, discrete logarithm. (Text 1: Chapter 7) Principles of Public-Key Cryptosystems: The RSA algorithm, Diffie - Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography	**08**	**L2**
Module 5		
One-Way Hash Functions: Background, Snefru, N-Hash, MD4, MD5, Secure Hash Algorithm [SHA],One way hash functions using symmetric block algorithms, Using public key algorithms, Choosing a one-way hash functions, Message Authentication Codes. Digital Signature Algorithm, Discrete Logarithm Signature Scheme (Text 2: Chapter 18: Section 18.1 to 18.5, 18.7, 18.11 to 18.14 and Chapter 20: Section 20.1, 20.4)	**08**	**L2**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Use basic cryptographic algorithms to encrypt the data.
CO2	Generate some pseudorandom numbers required for cryptographic applications.
CO3	Provide authentication and protection for encrypted data.

CO / PO Mapping													
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	2	2			2			2	2	2	2
CO2	2	2	3	2	2			2			2	2	2	2
CO3	2	2	3	2	3			2			2	2	2	2
Average	2	2	3	3	3			2			3	3	2	2

High-3: Medium-2: Low-1

Text Books:

1. William Stallings , ―Cryptography and Network Security Principles and Practice‖, Pearson Education Inc., 6th Edition, 2014, ISBN: 978-93-325-1877-3 2.
2. Bruce Schneier, ―Applied Cryptography Protocols, Algorithms, and Source code in C‖, Wiley Publications, 2nd Edition, ISBN: 9971-51-348-X

Reference Books:

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2017 .
2. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER

E-Books / Web References:

1. NPTEL Lecture https://nptel.ac.in/courses/112/103/112103280/
2. https://archive.nptel.ac.in/courses/117/104/117104099/

MOOCs:

1. https://learn.saylor.org/course/CS402
2. https://www.coursera.org/specializations/computer-communications

Scheme of Examination (CIE):

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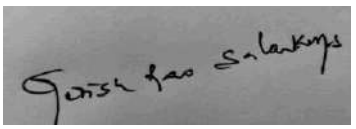

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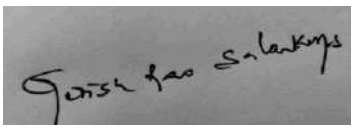
CIE TEST 2	40	
CIE TEST 3	40	
Class test	10	

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respectiveBoard of Studies and can be given here.

Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

BIG DATA ANALYTICS

(Open Elective Course)

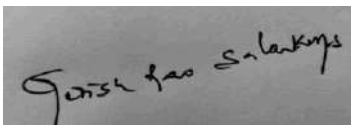
Course Code:	**22ADS641**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**OEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): None

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Understand fundamentals of Big Data analytics
2	Explore the Hadoop framework and Hadoop Distributed File system
3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
4	Understand various mining streams
5	Understand various tools like Hive and Pig for Big Data Analytics.

Module 1	No. of Hours	RBT Level
Introduction to Big Data: Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data processing platforms: HADOOP, SPARK, FLINK, and MOA, Challenges of Conventional Systems, Big Data Analytics Applications and Case Studies.	**08**	**L2**
Module 2		
HADOOP: Introduction to Hadoop: Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. Hadoop Distributed File System Basics: HDFS Design Features, Components, HDFS User Commands. Hadoop Map-Reduce Framework.	**08**	**L3**
Module 3		
Hive – What is Hive? Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), CREATE TABLE, DROP TABLE, ALTER TABLE, CREATE DATABASE, DROP DATABASE, DESCRIBE, INSERT, COUNT(*), SELECT, DISTINCT, HAVING, LIMIT, GROUP BY,ORDER BY, VARIOUS JOINS. **Pig**-What is Pig? Pig on Hadoop, Datatypes in Pig, Running Pig, Execution modes of Pig, HDFS Commands, Relational operators, Eval Function, Pig-Latin Language- DISTINCT, FILTER, FOREACH, GROUP, JOINS(Inner, Outer, Full), LIMIT, LOAD, ORDER BY, RANK, STORE, STREAM, UNION, DUMP. Complex Data Types, User Defined Functions, Word Count example using Pig.	**08**	**L3**



Module 4		
Essential Hadoop Tools: Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase. Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive - fundamentals of HBase and ZooKeeper, IBM Info Sphere Big Insights and Streams.	**08**	**L3**
Module 5		
NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL DataStore, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared- Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases. **Overview and History of NoSQL Databases:** NO-SQL database Techniques for Big Data, Comparison of Relational Databases with NO-SQL Databases. Advantages of NO-SQL over RDBMS,Scale out VS Scale up, Types of NO-SQL databases, Characteristics of NO-SQL Databases.NO-SQL solutions for Big Data Management,NO-SQL Data Models, Key-value stores, column based stores, graph based stores and document based stores.	**08**	**L3**

Course Outcomes:

Upon successful completion of this course, student will be able to

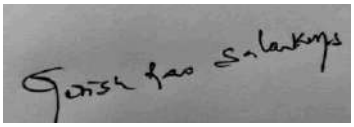
CO1	Explain fundamentals of Big Data analytics.
CO2	Investigate Hadoop framework and Hadoop Distributed File system
CO3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
CO4	Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.
CO5	Demonstrate how to work with Hive and Pig.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1		2			1		2		2	3	
CO2	2	3	1		2			1		2		2	3	
CO3	1	2	3		2			1		2		2	3	
CO4	1	2	3		2			1		2		2	3	
CO5	3	3	3		2			1		2		2	3	
Average	2	2	2		2			1		2		2	3	

High-3: Medium-2: Low-1

Textbooks:

1. Raj Kamal and Preeti Saxena, Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning,McGraw Hill Education, 2018.
2. Douglas Eadline, Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem, Pearson Education, 1st Edition, 2016
3. Seema Acharya, Subhashini Chellappan, Big data and Analytics, Wiley publications, 2nd Edition, 2019.



Reference Books:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
2. Tom White, Hadoop: The Definitive Guide, O'Reilly Media, Third Edition, 2012.

E-Books / Web References:

1. Big Data Now: http://cdn.oreillystatic.com/oreilly/radarreport/0636920028307/Big_Data_Now_2012_Edition.pdf
2. Bigdata Analytics with Hadoop: https://www.packtpub.com/free-ebook/big-data-analytics-with-hadoop-3/9781788628846

MOOCs:

1. Big Data Computing, IIT Patna, https://nptel.ac.in/courses/106104189
2. https://www.udemy.com/course/the-ultimate-hands-on-hadoop-tame-your-big-data/

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average marks scored is added to test component. CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and Three tests. Two quizzes are to be conducted and each quiz is evaluated for 5 marks adding up to 10 marks.

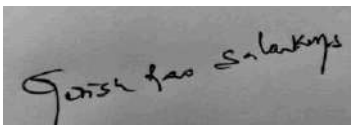
All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively.

Some possible AATs: seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic toolbox for problem solving/ report based on participation in create-a-thon/ make-a- thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical Evaluation pattern for regular courses is shown in Table.

Table: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER – VI

FOUNDATIONS OF DATA SCIENCE

(Open Elective Course)

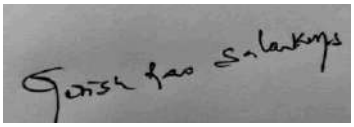
Course Code:	**22ADS642**	**CIE Marks:**	**50**
Hours/Week (L:T:P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**OEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): Basics of Probability

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To understand the problems solvable with data science
2	Ability to solve problems from a statistical perspective.
3	To build the skills to create data analytical pipelines
4	To bring the familiarity with the data science ecosystem and the various tools needed to continue developing as a data scientist.

Module 1	No. of Hours	RBT Level
Introduction to Data Science: Evolution of Data Science, Data Science Roles,Lifecycle of Data Science, Representation of Data Science as a Venn Diagram, Technologies revolving around Data Science. **Types of Data:** Structured and Unstructured Data, Quantitative and Qualitative Data,Four Levels of data (Nominal, Ordinal, Interval, Ratio Level). **Data Pre-processing:** Asking interesting question, Obtaining of data, Exploration of data, Modeling of data, Communication and visualization.	**08**	**L2**
Module 2		
Data Mining: What is Data Mining? Types of Data Mining, Challenges of implementation in Data Mining, Advantages and Disadvantages, Applications of DataMining. **Overview of Basic Data Mining Tasks:** Classification, Regression, Time Series Analysis, Prediction, Clustering, Sequence Discovery.	**08**	**L3**
Module 3		
Basics of Statistics: Introduction to Statistics, Terminologies in Statistics, Measures ofcenter, variance and relative standing, Normalization of data using the z-score, Empirical rule, Categories in Statistics (Descriptive and Inferential Statistics). **Descriptive Statistics:** Data Objects and Attribute, Basic Statistical Description of Data (Measuring the Central Tendency of Data, Measuring the Dispersion of Data, Graphical Displays), Data Visualization Techniques, Measuring Data Similarity and Dissimilarity.	**08**	**L3**
Module 4		
Inferential Statistics: Overview of Probability Distributions (Bernoulli, Binomial, Poisson, Chi-square, t-tail), Joint distribution of the Sample Mean and Sample Variance, Confidence Intervals, Bayesian Analysis of samples from Normal Distribution, Fisher Estimator, Central Limit Theorem.	**08**	**L3**
Module 5		
Hypothesis Testing: Testing simple hypotheses, Uniform tests, Two-sided alternatives, t-Test, F-Distribution, Bayes Test Procedures, Case studies based onHypothesis Testing.	**08**	**L3**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand the basics of data science, data mining techniques.
CO2	Apply the advanced mining concepts.
CO3	Interpret the basic statistical description of data.
CO4	Implement Data sampling Techniques.
CO5	Apply the data mining concepts on the real data.

CO / PO Mapping													
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3		2			2		2		2	3	
CO2	3	3	3		2			2		2		2	3	
CO3	3	3	3		2			2		2		2	3	
CO4	3	3	3		2			2		2		2	3	
CO5	3	3	3		2			2		2		2	3	
Average	3	3	3		2			2		2		2	3	

High-3: Medium-2: Low-1

Text Books:

1. Principles of Data Science by Sinan Ozdemir, Sunil Kakade, Packt Publishing Limited,2nd Edition, 2018
2. Probability and Statistics, by Morris H Degroot, Mark J Schervish, Pearson, 4th Edition, 2012.

Reference Books:

1. Data Mining Concepts and Techniques by Jiawei Han and Micheine Kamber, Morgan Kaufmann, 3rd Edition, 2011.
2. Machine Learning:A probabilistic perspective, by Murphy, KevinP, MIT Press, 2012.

E-Books / Web References:

1. **Learn Data Science : Open content for self-directed learning in Data Science :** http://learnds.com/
2. **Foundations of Data Science:** https://www.cs.cornell.edu/jeh/book.pdf

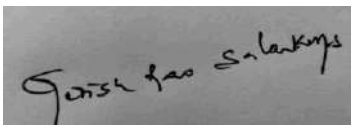
MOOCs:

1. **Introduction to Mathematical Thinking:** https://www.coursera.org/learn/mathematical-thinking
2. **IBM Data Science Professional Certificate:** https://www.coursera.org/professional-certificates/ibm-data-science

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouragedto use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/partial reproduction of research work/ oral presentation of research work/ group activity/ developing



a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

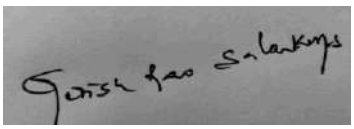
Typical evaluation pattern for regular courses is shown in Table 1:

Table 1: CIE Evaluation		
Components	**Marks**	**Total**
CIE TEST 1	40	50
CIE TEST 2	40	
CIE TEST 3	40	
Quiz 1 / AAT	05	
Quiz 2 / AAT	05	

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respective Board of Studies and can be given here.

Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

MAJOR PROJECT PHASE-I

Course Code:	**22ADS65**	**CIE Marks:**	**100**
Hours/Week (L: T: P):	**0:0:4**	**Credits:**	**2**
Type of Course:	**PROJ**		

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	Acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
2	Acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific
3	Acquire collaborative skills through working in a team to achieve common goals.
4	Self-learn, reflect on their learning and take appropriate action to improve it.
5	Prepare schedules and budgets and keep track of the progress and expenditure.

Major Project Guidelines:

6. The project topic, title and synopsis have to be finalized and submitted to their respective internal guide(s) before the beginning of the 7th semester.
7. The detailed Synopsis (approved by the department Project Review Committee) has to be submitted during the last of 7th semester.

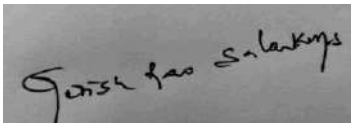
Batch Formation:

- Students are free to choose their project partners from within the program or any other program.
- Each student in the team must contribute towards the successful completion of the project. The project may be carried out In-house / Industry / R & D Institution.
- ***The project work is to be carried out by a team of two to four students , in exceptional cases where a student is placed in a company and offered an internship through the competitive process or student is selected for internship at national or international level through competitive process,*** the student can work independently.
- ***The students are allowed to do either a project for full 5 days in the industry or full 5 days in the college.***
- ***In case the project work is carried out outside Bengaluru, such students must be available during Project Evaluation process scheduled by the respective departments and they must also interact with their guide regularly through Email / Webinar / Skype etc.***

Project Topic Selection:

The topics of the project work must be in the ***field of respective program areas or in line with CoE's (Centre of Excellence) identified by the college*** or **List of project areas as given by industry/Faculty. The projects as far as possible should have societal relevance with focus on sustainability.**

Students can select courses in ***NPTEL*** from the discipline of ***Humanities and Social Sciences, Management, Multidisciplinary and Design Engineering.*** The course chosen could be either of ***4w/8w/12w*** duration. The students need to enrol for a course, register for the exam and submit the



e-certificate to the department, as and when it is released by NPTEL. ***The same will be considered as one of the components during project evaluation of phase 1.***

Project Evaluation:

- Continuous monitoring of project work will be carried out and cumulative evaluation will be done.
- The students are required to meet their internal guides once in a week to report their progress in project work.
- **Weekly Activity Report** (WAR) has to be maintained in the form of a diary by the project batch and the same has to be discussed with the Internal Guide regularly.
- In case of ***Industry project,*** during the course of project work, the internal guides will have continuous interaction with external guides and will visit the industry at least twice during the project period.
- The presentation by each group will be for 20-30 minutes and every member of the team needs to justify literature survey, design and development of the project.
- The project team is required to submit Hard copies of the detailed Project Synopsis in the prescribed format to the department.

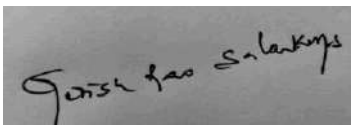
Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Apply knowledge of mathematics, science and engineering to solve respective engineering domain problems.
CO2	Design, develop, present and document innovative/multidisciplinary modules for a complete engineering system.
CO3	Use modern engineering tools, software and equipment to solve problem and engage in life-long learning to follow technological developments.
CO4	Function effectively as an individual, or leader in diverse teams, with the understanding of professional

CO / PO Mapping														
CO / PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**2**
CO4	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**1**	**1**	**2**
Average	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**2**

High-3: Medium-2: Low-1



Scheme of Evaluation:

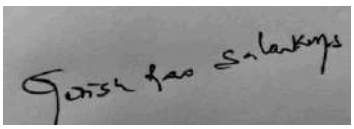
Continuous Internal Evaluation (CIE):
The following are the weightings given for the various stages of the project

Sl No.	Activity	Weightage
1.	Selection of the topic and formulation of objectives	30%
2.	Design and Development of Project methodology	40%
3.	Written presentation of synopsis	30%

Calendar of Events for the Project Work:

Week	Event
Prior to beginning of 7th Semester	Formation of group, problem selection and approval by the department committee.
Beginning of 7th Semester	Finalization of project and guide allotment
7th Semester	Literature survey, Design and Development of Project methodology
Last two weeks of 7th Semester	Synopsis submission and CIE Presentation

Scheme of Evaluation for CIE	
Particulars	**%Marks**
Major Project Evaluation I (Problem Statement**)**	30%
Major Project Evaluation II (Design and Development)	40%
Major Project Synopsis (Initial Write up)	30%
Total	100



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER – VI

NEURAL NETWORKS & DEEP LEARNING LABORATORY

Subject Code	**22ADSL66**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
Type of course	**PCCL**	**Examination Hours**	**03**
No. of Credits: 01			

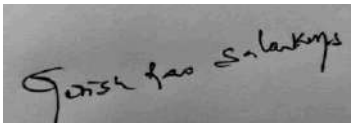
Course Objectives: The course will enable students to:

1	To impart hands-on knowledge on Advanced Machine Learning Topics.
2	Provide in-depth coverage of Data Augmentation and Convolutions.
3	Impart application of Deep Learning techniques like CNN and RNN.
4	Exposure to unsupervised feature engineering techniques

Prog. No.	**Lab Programs**	**No. of Hours/ RBT levels**
1	For the set of images perform the following a. Read the images from the folder. b. For one image – Apply text, borders, noise removal, brightness increase, filtering, enhancement, and augmentation.	**03 L3**
2	Write a python program to implement YOLO V8 and apply NMS.	**03 L3**
3	Write a python program to implement Faster R-CNN and apply NMS.	**03 L3**
4	Write a python program to demonstrate the Image captioning.	**03 L3**
5	Write a python program to demonstrate the VAE	**03 L3**
6	Write a python program to implement the variant of GAN.	**03 L3**
7	Write a python program to demonstrate the diffusion model from the scratch.	**03 L3**
8	Write a python program to demonstrate the diffusion model on the text.	**03 L3**
9	Write a Python program to build a model for face recognition.	**03 L3**
10	Write a Python program to build a model for face recognition using FaceNet and VGGFace2.	**03 L3**

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of the answer script tobe strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedurepart to be made zero.



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

WEB TECHNOLOGIES

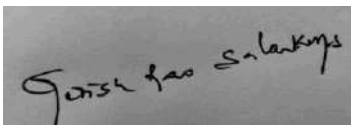
Course Code:	**22ADS671**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**1:0:0**	**SEE Marks:**	**50**
Type of Course:	**AEC**	**Duration of SEE (hours):**	**03**
Credits: 01			

Prerequisites (if any): None

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Illustrate the Semantic Structure of HTML
2	Illustrate CSS and Compose forms and tables using HTML and CSS
3	Understand different approaches to creating page layout
4	Design Client-Side programs using JavaScript
5	Design Server-Side programs using PHP

Module 1	No. of Hours	RBT Level
Website Basics: Clients, Servers and communication, The Internet, World wide web, HTTP Request message, HTTP response message, Web Clients, Web Servers **Introduction to HTML:** What is HTML and Where did it come from? HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements.	**08**	**L2**
Module 2		
Introduction to CSS: What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling. **HTML Tables and Forms:** Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility	**08**	**L2**
Module 3		
Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design	**08**	**L2**
Module 4		
JavaScript: Client-Side Scripting, What is JavaScript and What can it do?, JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms	**08**	**L3**
Module 5		
PHP: Quick Tour of PHP, Program Control, Functions, PHP Arrays, $_GET and $_POST, Reading/Writing Files, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation.	**08**	**L3**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Adapt HTML syntax and semantics to build web pages.
CO2	Construct and visually format tables and forms using HTML and CSS
CO3	Construct complex layouts to build web pages.
CO4	Develop Client-Side Scripts using JavaScript to display the contents dynamically
CO5	Develop Server-Side Scripts using PHP to generate and display the contents dynamically.

CO / PO Mapping													
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2									3	3	
CO2	2	2	2									3	3	
CO3	2	2	2									3	3	
CO4	3	3	3									3	3	
CO5	3	3	3									3	3	
Average	2	2	2									3	3	

High-3: Medium-2: Low-1

Text Books:

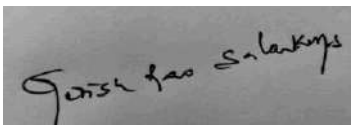
1. Fundamentals of Web Development, Randy Connolly, Ricardo Hoar, Pearson Education India, (ISBN:978-9332575271), 1st Edition.

Reference Books:

1. Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5, Robin Nixon, O'ReillyPublications (ISBN:978-9352130153), 4th Edition, 2015.
2. PHP and MySQL Web Development, Luke Welling, Laura Thomson, Pearson Education(ISBN:978-9332582736), 5th Edition, 2016.
3. Professional JavaScript for Web Developers, Nicholas C Zakas, Wrox/Wiley India(ISBN:978-8126535088), 3rd Edition, 2012.

E-Books / Web References:

1. http://www.pearsonglobaleditions.com/connolly
2. https://www.w3schools.com/html/html5_intro.asp
3. https://www.w3schools.com/css/
4. https://www.w3schools.com/jS/default.asp
5. https://www.w3schools.com/pHP/default.asp
6. https://getbootstrap.com/
7. https://www.apachefriends.org/index.html
8. https://www.w3schools.com/xml/



9. https://www.w3schools.com/xml/ajax_intro.asp https://jquery.com

MOOCs:

1. NPTEL: https://nptel.ac.in/courses/106105084
2. Udemy: https://www.udemy.com/topic/web-app-development/

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reducedto 50. There will be two full questions (with a maximum of four sub questions) from each module carrying20 marks each. Students are required to answer any **five full questions** choosing at least **one full questionfrom each module.**

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average marks scored is added to test component. CIEis executed by way of two quizzes / Alternate Assessment Tools (AATs), and Three tests. Two quizzes areto be conducted and each quiz is evaluated for 5 marks adding up to 10 marks.

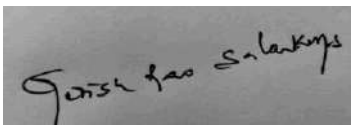
All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively.

Some possible AATs: seminar/ assignments/term paper/ open ended experiments/ mini-projects/ conceptvideos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic toolbox for problem solving/ report based on participation in create-a-thon/ make-a- thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical Evaluation pattern for regular courses is shown in Table.

Table: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

DATA ANALYTICS FOR IOT

Course Code:	**22ADS672**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**1:0:0**	**SEE Marks:**	**50**
Type of Course:	**AEC**	**Duration of SEE (hours):**	**01**
Credits: 01			

Prerequisites (if any): IOT

Course Learning Objectives: The course will enable students to

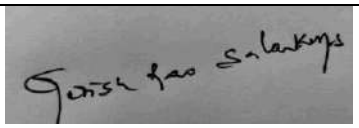
Sl. No	Course Learning Objectives (CLO)
1	Understand the basics of IoT analytics
2	Understand Elastic analytics concepts
3	Learn about the basic concepts of Machine Learning
4	Know about Linked analytical Datasets.

Module 1	No. of Hours	RBT Level
The situation, Defining IoT analytics, IoT analytics challenges. Chapter 1 (Except Business value concerns)	**5**	**L2**
Module 2		
Building Elastic analytics, Elastic analytics concepts, Designing for scale, Cloud security and analytics Chapter 3 (Only the above mentioned topics)	**5**	**L2**
Module 3		
Exploring and Visualizing Data-The Tableau Overview, Techniques to understand data quality, Basic time series analysis, Get to know categories in the data, Bring in Geography, Using R for statistical Analysis. Chapter 6 (Only the above mentioned topics)	**5**	**L2**
Module 4		
Machine Learning Basics: What is machine learning, Generalization, Feature Engineering with IoT data, Validation methods, Random forest model using R. Chapter 10 (Only the above mentioned topics)	**5**	**L2**
Module 5		
Linked analytical Datasets, Managing Data lakes, The Data retention strategy. Chapter 11	**5**	**L2**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Identify the requirement and measurements for capacity planning by considering the goal, issues, and processes.
CO2	Explain capacity measurement and monitoring
CO3	Make use of measurement data for prediction towards the overall planning process.
CO4	Explain the concepts related to deployment, installation, configuration, and management.
CO5	Demonstrate how the virtualization and cloud services fit into a capacity plan



CO / PO Mapping														
CO / PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	3	2								2	2	
CO2	2	2	3	2								2	2	
CO3	2	2	3	2								2	2	
CO4	2	2	3	3								2	2	
CO5	2	2	3	3								2	2	
Average	2	2	3	3								2	2	

High-3: Medium-2: Low-1

Text Books:

1. Analytics for the Internet of Things (IoT): Intelligent analytics for your intelligent devices, by Andrew

Scheme of Evaluation: (Integrated courses)

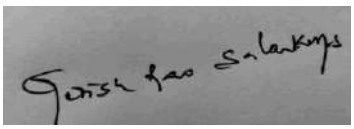
Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 40, the CIE would also include assignment evaluation for 10 marks.

Typical Evaluation pattern for integrated courses is shown in the Table below

Table: Distribution of weightage for CIE & SEE of Integrated courses

Component		**Marks**	**Total Marks**
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignment	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

INDIAN KNOWLEDGE SYSTEMS

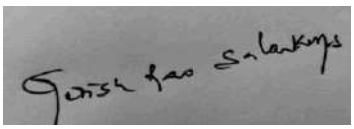
Course Code	**:**	**22IKS68**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0: 0: 0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**15L**		**SEE Duration**	**:**	**01 Hours**

Course Learning Objectives: The students will be able to	
1	To facilitate the students with the concepts of Indian traditional knowledge and to makethem understand the Importance of roots of knowledge system.
2	To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.

Unit-I	**05 Hrs**
Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.	
Unit – II	**05 Hrs**
Traditional Knowledge in Humanities and Sciences: Lingistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Tradein India and Engineering and Technology.	
Unit -III	**05 Hrs**
Traditional Knowledge in Professional domain: Town planning and architecture-Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Provide an overview of the concept of the Indian Knowledge System and its importance.
CO2:	Appreciate the need and importance of protecting traditional knowledge.
CO3:	Recognize the relevance of Traditional knowledge in different domains.
CO4:	Establish the significance of Indian Knowledge systems in the contemporary world.

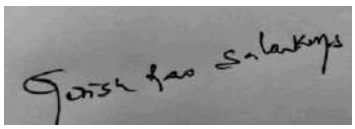
Reference Books	
1	**Introduction to Indian Knowledge System- concepts and applications**, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93-91818-21-0
	Traditional Knowledge System in India, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230,
2	**Knowledge Traditions and Practices of India**, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334,
	Suggested Web Links:
1.	**https://www.youtube.com/watch?v=LZP1StpYEPM**
2.	**http://nptel.ac.in/courses/121106003/**
3.	http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4.	https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5.	https://unctad.org/system/files/official-document/ditcted10_en.pdf
6.	http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf
7.	https://unfoundation.org/what-we-do/issues/sustainable-development-goals/?gclid=EAIaIQobChMInp-Jtb_p8gIVTeN3Ch27LAmPEAAYASAAEgIm1vD_BwE



ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50% (CIE)**	**50%(SEE)**
QUIZZES		
Quiz-I	Each quiz is evaluated for 05 marks adding up to **10 Marks.**	*****
Quiz-II		
THEORY COURSE - (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)		
Test – I	Each test will be conducted for 25 Marks adding upto 50 marks. Final test marks will be reduced to **20 Marks**	*****
Test – II		
EXPERIENTIAL LEARNING	**20**	*****
Case Study-based Teaching-Learning	**--**	*****
Sector wise study & consolidation (viz., Engg. Semiconductor Design, Healthcare & Pharmaceutical, FMCG, Automobile, Aerospace and IT/ ITeS)	**--**	
Video based seminar (4-5 minutes per student)	**--**	
Maximum Marks for the Theory	**---**	**50 Marks**
Practical	**--**	**--**
Total Marks for the Course	**50**	**50**

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	-	-	-	-	-	-	3	-	-	-	1
CO2	-	-	-	-	-	2	-	-	-	-	-	-
CO3	-	-	2	2	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	3	2	-	-	-	-	-

High-3 : Medium-2 : Low-1



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B.E. in Artificial Intelligence and Data Science Engineering Scheme of Teaching and Examinations 2023

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme A- VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22ADS71	Natural Language Processing	TD & PSB: AI&DS	3	0	2		03	50	50	100	4
2	IPCC	22ADS72	Advanced Data Visualization	TD & PSB: AI&DS	3	0	2		03	50	50	100	4
3	PCC	22ADS73	Deep Learning for Computer Vision	TD & PSB: AI&DS	4	0	0		03	50	50	100	4
4	PEC	22ADS74X	**Professional Elective Course / (Online)**	TD & PSB: AI&DS	3	0	0		03	50	50	100	3
5	OEC	22ADS75X	**Open Elective Course / (Online)**	TD & PSB: AI&DS	3	0	0		03	50	50	100	3
6	PROJ	22ADS76	**Major Project Phase-II**	TD & PSB: AI&DS	0	0	12		03	100	100	200	6
									Total	**350**	**350**	**700**	**24**

Professional Elective Course	
22ADS741	Cloud Computing
22ADS742	Cyber Security

Open Elective Course	
22ADS751	Neural Networks and Deep Learning
22ADS752	Data Visualization Tools

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L**: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester.

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

K. M. Rajashekhar Swamy

Dean Academic

Global Academy of Technology,

Rajarajeshwarinagar, Bengaluru-98

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme A- VIII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	22ADS81X	**Professional Elective (Online Courses)**	TD & PSB: AI&DS	3	0	0		03	50	50	100	3
2	OEC	22ADS82X	**Open Elective (Online Courses)**	TD & PSB: AI&DS	3	0	0		03	50	50	100	3
3	INT	22ADS83	**Internship (Industry/Research) (14 - 20 weeks)**	TD : AI&DS	0	0	12		03	100	100	200	10
									Total	**200**	**200**	**400**	**16**

Professional Elective Course (Online courses)

22ADS811	Predictive and Time Series Analysis
22ADS812	Data Science for Security

Open Elective Courses (Online Courses)

22ADS821	Large Language Models

L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work, **INT**: Industry Internship / Research Internship / Rural Internship

Note: VII and VIII semesters of IV years of the program

Swapping Facility

- Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate **research internships/ industry internships/Rural Internship** after the VI semester.
- Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester **Research Internship /Industrial Internship / Rural Internship** shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, centre of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. **University shall not bear any cost involved in carrying out the internship by students.** However, students can receive any financial assistance extended by the organization.

Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students on the VTU web portal.

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme B- VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22ADS71	Natural Language Processing (To be Completed in 5th/6th Semester)	TD & PSB: AI&DS	3	0	2		03	50	50	100	4
2	IPCC	22ADS72	Advanced Data Visualization (To be Completed in 5th/6th Semester)	TD & PSB: AI&DS	3	0	2		03	50	50	100	4
3	PCC	22ADS73	Deep Learning for Computer Vision (To be Completed in 5th/6th Semester)	TD & PSB: AI&DS	4	0	0		03	50	50	100	4
4	PEC	22ADS74X	**Professional Elective Course / (Online)** (To be Completed in 5th/6th Semester)	TD & PSB: AI&DS	3	0	0		03	50	50	100	3
5	OEC	22ADS75X	**Open Elective Course / (Online)** (To be Completed in 5th/6th Semester)	TD & PSB: AI&DS	3	0	0		03	50	50	100	3
6	PROJ	22ADS76	**Major Project Phase-II**	TD & PSB: AI&DS	0	0	12		03	100	100	200	6
									Total	**350**	**350**	**700**	**24**

Professional Elective Course

22ADS741	Cloud Computing
22ADS742	Cyber Security

Open Elective Course

22ADS751	Neural Networks and Deep Learning
22ADS752	Data Visualization Tools

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Note: VII and VIII semesters of IV years of the program

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Scheme B - VIII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
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Elucidation:

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Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. **University shall not bear any cost involved in carrying out the internship by students.** However, students can receive any financial assistance extended by the organization.

Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students on the VTU web portal.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VII

NATURAL LANGUAGE PROCESSING

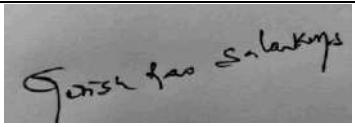
Course Code:	**22ADS71**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:2**	**SEE Marks:**	**50**
Type of Course:	**IPCC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): Machine Learning and Deep Learning

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To learn the fundamentals of natural language processing.
2	To understand the working of Language based models and apply word embedding algorithms.
3	To understand the role of semantics of sentences and pragmatics and apply them in NER.
4	To perform sentiment analysis and text classification.
5	Facilitate project-based opportunities under machine translation, dialog systems and ethical considerations in NLP.

Module 1	No. of Hours	RBT Level
Introduction to NLP and Text Processing: Definition and scope of NLP, Historical overview and milestones in NLP, Components of NLP, NLP applications, Phases of NLP, Tokenization, Stemming, Lemmatization, Stop word removal, Zipf's law, Punctuation handling, Text normalization, Case conversion	**10**	**L2**
Module 2		
Language Modeling: Bag of Words, Bag of N-grams, TF-IDF, Hashing with HashingVectorizer, Split words, Encoding with one_hot, Hash encoding, N-gram models and language probability **Word embeddings:** Word2Vec, Training word embeddings, Applications of word embeddings, Word embedding algorithms, CBOW, Skip-Gram, GloVe, reuse an embedding, Gensim Python Library, Plot word vectors using PCA	**10**	**L3**
Module 3		
Syntax, Parsing: Part-of-speech tagging, Dependency parsing and constituency parsing, Parsing algorithms and techniques **Named Entity Recognition:** Introduction to NER, NER techniques and tools, Applications of NER in information extraction	**10**	**L3**
Module 4		
Applied NLP: Classical NLP pipeline, Sentiment analysis applications in social media and reviews, Text classification methods, Interpreting Text Classification models, Text summarization.	**10**	**L3**
Module 5		
Machine Translation and Dialog Systems: Introduction to machine translation, Statistical and neural machine translation, Types of dialog systems, Introduction to chatbots and virtual assistants **NLP Ethics and Bias:** Ethical considerations, Fairness, Accountability, Multilingual NLP	**10**	**L3**



Prog. No.	Lab Programs	No. of Hours / RBT levels
1	Write a Python program to demonstrate Lemmatization and Stemming.	**02/L3**
2	Write a program to implement TF-IDF technique and demonstrate Word2vec embedding.	**02/L3**
3	Write a program for implementing POS tagging and Named Entity Recognition using NLTK.	**02/L3**
4	Write a program for spam detection using NLTK.	**02/L3**
5	Write a program to demonstrate Neural machine translation with attention.	**02/L3**
6	Write a program to build an NLP classifier which can use input text parameters to determine the label/s of the blog.	**02/L3**
7	Write a program to design and test a sequential model that analyses the customer's sentiments based on their reviews in the IMDB database.	**02/L3**
8	Write a program to implement transfer learning, paraphrasing from iNLTK.	**02/L3**

Course Outcomes:

Upon successful completion of this course, student will be able to

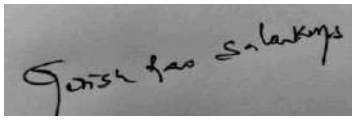
CO 1	Understand NLP foundations, text processing techniques, and practical applications.
CO 2	Apply diverse language models, embeddings; adapt in practical applications.
CO 3	Implement tagging, parsing, Named Entity Recognition techniques.
CO 4	Perform classical NLP, sentiment analysis, text classification, and summarization.
CO 5	Obtain competence in machine translation, dialog systems, and ethical NLP practices.

CO / PO Mapping														
CO /PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	1	2	3	3					3	2	
CO2	3	2	2	2	2	3	3					3	3	
CO3	3	2	3	1	2	3	2					3	3	
CO4	3	2	2	2	2	3	3					3	2	
CO5	3	2	2	2	2	3	2					3	3	
Average	3	2	2	2	2	3	3					3	3	

High-3: Medium-2: Low-1

Text Books:

1. Deep Learning for Natural Language Processing - Jason Brownlee, 2018.
2. Practical Natural Language Processing - Sowmya Vajjala, Bodhisattwa Majumder, O'Reilly, 2020.
3. Foundations of Statistical Natural Language Processing - Christopher D. Manning, The MIT Press, 2000.



Reference Books:

1. Natural Language Processing with Python - Steven Bird, Ewan Klein, and Edward Loper, O'Reilly, 2009.
2. Speech and Language Processing - Daniel Jurafsky, James H. Martin, 2023.

E-Books / Web References:

1. Natural Language Processing in Action - Hobson Lane, Cole Howard, and Hannes Max.
   file:///C:/Users/Admin/Downloads/Natural%20Language%20Processing%20in%20Action_%20Understanding,%20analyzing,%20and%20generating%20text%20with%20Python%20(%20PDFDrive%20).pdf

MOOCs:

1. https://www.udemy.com/course/data-science-natural-language-processing-in-python/
2. https://www.coursera.org/specializations/natural-language-processing

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.

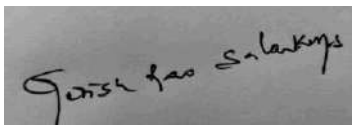
Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**50**
		Grand Total	**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VII

ADVANCED DATA VISUALIZATION

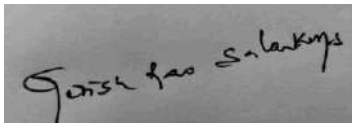
Course Code:	**22ADS72**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:2**	**SEE Marks;**	**50**
Type of Course:	**IPCC**	**Duration of SEE (hours) :**	**03**
Credits: 04			

Prerequisites (if any): Data Visualization using Tableau.

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To introduce students to the fundamental problems, concepts and approaches in the design and analysis of data visualization using the most widely used visualization tools such as Tableau and PowerBI.
2	To familiarize students with the understanding of the features and rich capabilities provided by visualization tools and build the required skillset that are required in the current and future industry.
3	To familiarize students with the stages of data modelling, visualization pipeline and evaluating the effectiveness of visualizations for specific data, task.
4	Provide an overview and develop an advanced level of competency in the use of Power BI and Tableau that can be used for data visualization.
5	Facilitate project-based opportunities to identify, understand, analyze, prepare, and present effective visualizations on a variety of data.

Module 1	No. of Hours	RBT Level
Data Modelling in Tableau: Performing Data Analysis on a relational model, Building Relationships in Tableau, working on creating calculated fields, Building Visualizations using related data, Performing a case study on a set of related data. Filtering at a large scale using calculated fields and nested CASE statements. Table summary statistics – show percentage of values down and across the table. Dynamic population of Rows and columns with Parameterization.	**10**	**L3**
Module 2		
Level of Details Expression (LOD) fundamentals: FIXED, INCLUDE and EXCLUDE LODs and their application to solve complex problems, multiple examples of how to use these LODs in different scenarios. Complex data Analysis using LODs and nested LODs. Ranking at multiple levels, Bringing Data on a dual Axis, Creating moving averages chart. Reference bands and distribution bands with parameterization.	**12**	**L3**
Module 3		
Importing Data into PowerBI: Creation of Various charts – Stacked Bar chart, stacked column chart, clustered column chart, Area chart, stacked area chart, Line and stacked column chart etc. Build Visual, Format Page. Sort and Filters, Slicing, Simple and multi-level Ranking. Data Modelling in PowerBI, Performing Data Analysis on a relational Model, Create Model Relationships, Building Visualizations using related data from the data Model.	**10**	**L3**
Module 4		
The language of Power BI - Data Analysis Expressions (DAX) Engine Basics: Aggregate functions – AVERAGE, AVERAGEX, AVERAGEA, COUNT, COUNTA, COUNTX, MAX, MAXA, MAXX, MIN, MINA, MINX, SUM, SUMA, SUMX. Date Functions – DATE, DAY, MONTH, YEAR, DATEDIFF	**10**	**L3**



Filter Functions – ALL, ALLEXCEPT, ALLSELECTED, CALCULATE, CALCULATETABLE, KEEPFILTERS, SELECTEDVALUE DAX statements – DEFINE, EVALUATE, ORDER BY, VAR		
Module 5		
The language of Power BI - Table Manipulation functions – ADDCOLUMNS, CROSSJOIN, CURRENTGROUP, DATATABLE, GENERATE, GENERATEALL, GROUPBY, NATURALJOIN, NATURALOUTERJOIN, SELECTCOLUMNS, SUMMARIZE, SUMARIZECOLUMNS, TOPN, VALUES Creating Measures, Calculated Columns and Tables. Problem solving Techniques using Measures and Calculated columns and Tables using above functions. Dashboard creation.	**10**	**L3**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Develop insight on the fundamentals and various design techniques for effective Data Visualization.
CO2	Learn ways to create dashboards as well as story points to develop a strong, powerful data story.
CO3	Learn ways and methods to analyze and apply design principles to Tableau visualization.
CO4	Acquaint themselves with various functions available in Advanced Tableau, Power BI tools.
CO5	Familiarize themselves well with current trends in Data Visualization through relevant case studies.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	3		2	2			2		2	2	3	3
CO2	2	1	2		2	2			2		3	2	3	2
CO3	1	2	3		3	2			2		2	2	3	2
CO4	2	1	3		3	2			2		3	2	3	3
CO5	2	1	3		3	2			2		3	2	3	3
Average	2	1	3		3	2			2		3	2	3	3

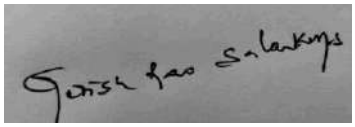
High-3: Medium-2: Low-1

Text Books:

1) Tableau 10 Business Intelligence Cookbook Book – Donabel Santos, Packt Publishing, 2016
2) The Wall Street Journal Guide to Information Graphics: The Dos and Don'ts of Presenting Data, Facts, and Figures, Dona M. Wong, W. W. Norton & Company.
3) Power BI – Jack Hyman (Free online pdf available)

Reference Books:

1. Information Dashboard Design: Displaying Data for At-a-Glance Monitoring, Stephen Few, O'Reilly Media, 2013



2. Show Me the Numbers: Designing Tables and Graphs to Enlighten, Stephen Few, Analytics Press, 2004
3. Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics, Nathan Yau, Wiley, 2011
4. Now You See It, Stephen Few, Analytics Press, 2009
5. The Visual Display of Quantitative Information, Edward Tufte, Graphics Press, 2nd Edition, 2001
6. Data Analysis with Microsoft Power BI 1st edition – Brian Larson

Books / Web References:

1. Data Visualization and Exploration with R A Practical Guide to Using R RStudio and Tidyverse for Data Visualization Exploration and Data Science Applications: https://www.pdfdrive.com/data-visualization-and-exploration-with-r-a-practical-guide-to-using-r-rstudio-and-tidyverse-for-data-visualization-exploration-and-data-science-applications-d176184240.html
2. Beginning Data Science in R: Data Analysis, Visualization, and Modelling for the Data Scientist: https://www.pdfdrive.com/beginning-data-science-in-r-data-analysis-visualization-and-modelling-for-the-data-scientist-d181093942.html
3. Micrsoft Power BI Cookbook – Brett Powell, Packt Publishing, 2017 (Free online PDF download available)
4. Microsoft PowerBI web reference – learn.microsoft.com/en-us/dax (Best reference manual)

MOOCs:

1. https://www.coursera.org/learn/datavisualization
2. https://freevideolectures.com/course/4041/nptel-introduction-to-learning-analytics/11
3. https://www.edx.org/course/data-visualization-for-all
4. https://www.udemy.com/course/the-complete-data-visualization-course/

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.

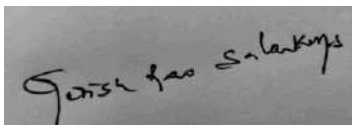
Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table below

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	CIE Test-3	**30**	
	Laboratory	**20**	
SEE	Semester End Examination	**100**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER-VII

DEEP LEARNING FOR COMPUTER VISION

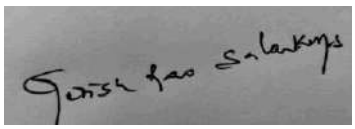
Course Code:	**22ADS73**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**4:0:0**	**SEE Marks:**	**50**
Type of Course:	**PCC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): Image Processing & Deep Learning

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To impart the fundamentals of image formation, the major ideas, methods, and techniques of computer vision and pattern recognition
2	To understand the workings of Generative AI and the diffusion models.
3	To develop an appreciation for various techniques of Computer Vision for Object detection and Face Recognition systems
4	To provide the student with programming experience from implementing computer vision and object recognition applications.

Module 1	No. of Hours	RBT Level
Introduction to Computer Vision Basic concepts: pixel representation of an image, Image in frequency domain, different color models, and their transformation, Filtering and Convolution, Image preprocessing using PIL/Pillow, OpenCV, and Keras: reading multiple images from a directory, plotting, enhancement,filtering, re-scaling, morphological operations and image data augmentation.	**8**	**L2**
Module 2		
Object Detection Basic concepts: bounding box representation, sliding window methods, anchorboxes, grid cells, and non-maximum suppression (NMS). State-of-the-artarchitectures: R-CNN and YOLO. Evaluation metrics: Intersection over Union (IoU) and Mean Average Precision (mAP), Practical use case.	**10**	**L3**
Module 3		
Generative AI Models Introduction to Gen AI, Types, Variational Autoencoders and GANs (Variations of GANs – cGAN, wGAN, cyclic GAN, style tranfers using GAN), difference between VAEs & GANs, Image Captioning – LSTMs based, Transformers based.	**12**	**L3**
Module 4		
Normalizing Flows and Diffusion Models Diffusion process, Forward Diffusion, Reverse Diffusion, Training a diffusion model, Architecture, Guided Diffusion, Stable diffusion, Sampling Procedure, Practical Implementation.	**12**	**L3**



Module 5		
Face Recognition Deep learning for face recognition: face detection in photographs, face identification & verification using VGGFace2, and face classification using FaceNet. Practical use case. Challenges: privacy and ethical considerations, variability in pose, expression, lightning, and occlusion.	**8**	**L3**

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

CO1	Understand the basic concepts, terminology, theories, models, and methods in the field of computer vision.
CO2	Apply Generative AI for text and image applications.
CO3	Apply diffusion models to understand the working of removal of noise.
CO4	Apply state-of-the-art architectures such as R-CNN and YOLO for object detection.
CO5	Demonstrate the face recognition concepts in detecting the photography, face identification, face classification.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	3	3	2					3	2	3	
CO2	2	2	2	3	3	2					3	2	3	
CO3	3	2	3	3	3	2			3		3	2	2	
CO4	3	2	3	3	3	2			3		3	2	3	
CO5	3	3	3	3	3	3			3		3	2	2	
Average	3	2	3	3	3	2			3		3	2	3	

High-3: Medium-2: Low-1

Text Books:

1. Deep learning for Computer Vision by Jason Brownlee.

Reference Books:

1. Internet source.

E-Books / Web References:

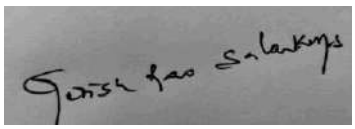
1. https://analyticsindiamag.com/optimisation-machine-learning-methods-gradient-descent/
2. https://serokell.io/blog/ml-optimization
3. https://machinelearningmastery.com/why-optimization-is-important-in-machine-learning/

MOOCs:

1. Deep Learning specialization in Coursera.
2. https://nptel.ac.in/courses/106106184
3. https://www.udemy.com/topic/deep-learning/

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances individual faculty's autonomy (freedom and flexibility) and enablesthem to create innovative pedagogical practices.



Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problemsolving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

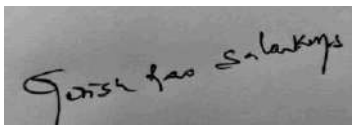
Typical evaluation pattern for regular courses is shown in Table 1:

Table 1: CIE Evaluation		
Components	**Marks**	**Total**
CIE TEST 1	40	50
CIE TEST 2	40	
CIE TEST 3	40	
Quiz 1 / AAT	05	
Quiz 2 / AAT	05	

Note: The CIE pattern for courses like Drawing and Laboratories can be decided by the respective Board of Studies and given here.

Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VII

CLOUD COMPUTING

Professional Elective Course / (Online)

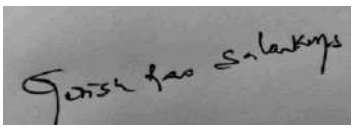
Course Code:	**22ADS741**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): None

Course Learning Objectives: The course will enable students to:

Sl. No.	Course Learning Objectives (CLO)
1	To understand the fundamental ideas behind cloud computing, evolution of the paradigm,its applicability, benefits and challenges.
2	Discuss virtualization and outline their role in enabling the cloud computing system model and different platforms in regard to industry relevance.
3	Illustrate the security aspects for building cloud based applications and outline theapplications of cloud in various industries.

Module 1	No. of Hours	RBT Level
Introduction: Introduction to cloud computing, History of cloud computing, Characteristics and Benefits, Challenges Ahead, Types of clouds: (Public cloud, private cloud and hybrid cloud), Economics of cloud, Building Cloud Computing platforms and technologies.	**08**	**L2**
Module 2		
Virtualization: Introduction to Virtualization, Characteristics of Virtualization, Taxonomy of Virtualization techniques, Types of Virtualization Techniques, Pros and Cons of Virtualization, Technology examples Xen: Paravirtualization, VMware: Full Virtualization.	**08**	**L2**
Module 3		
Cloud Computing Architecture: Introduction, cloud reference model, cloud computing services: Infrastructure as a service (IAAS), Platform as a service (PAAS) and Software as a service (SAAS), Aneka framework overview, Anatomy of the Aneka Container, Building Aneka clouds, Cloud Programming and Management, Open source platforms for private clouds.	**08**	**L3**
Module 4		
Cloud Security: Operating System (OS) Security, Virtual Machine (VM) Security, Security risks posed by shared images, ethical issues. **Cloud Platforms**: Amazon Web Services (AWS) - Compute services, Storage services, Communication services, Microsoft Azure- Azure concepts, SQL Azure.	**08**	**L3**
Module 5		
Cloud Applications: Scientific Applications: Healthcare: ECG analysis in the cloud, Biology: Gene expressions data analysis for cancer diagnosis. **Business and Consumer Applications:** Social Networking, media applications and multiplayer online gaming.	**08**	**L3**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand the core concepts of cloud computing paradigm and Describe the various cloud computing platforms.
CO2	Outline the various virtualization technologies and Illustrate a virtual instance usingvirtualization.
CO3	Explain the architecture, infrastructure and deployment models of cloud computing.
CO4	Understand the security aspects of cloud and Identify the platforms for development ofcloud applications.
CO5	Obtain an insight on applications of cloud and Develop a project for the applications

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3						1					3		
CO2	3	2	3									3	2	
CO3	3	2	2		1		1					3	3	
CO4	3	3	3		2	1						3	3	
CO5	3	3	3		2	1	1					3	3	
Average	3	2	3		2	1	1					3	3	

High-3: Medium-2: Low-1

Text Books:

1. Rajkumar Buyya, Christian Vecchiola and Thamrai Selvi Mastering Cloud Computing McGraw Hill Education.
2. Dan C Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elseveir 2013.

Reference Books:

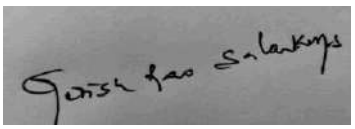
1. Logic Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Osborne Media.
2. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the cloud, O'Reilly Publication.
3. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press.

E-Books / Web References:

1. Mastering Cloud Computing : https://dokumen.pub/download/mastering- cloud computing9781259029950.html
2. Cloud Computing Theory and Practice https://eclass.uoa.gr/modules/document/file.php/D416/CloudComputingTh eoryAndPractice.pdf

MOOCs:

1. https://www.udemy.com/course/cloudintro/
2. https://www.coursera.org/learn/cloud-computing-foundations-duke



Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouragedto use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

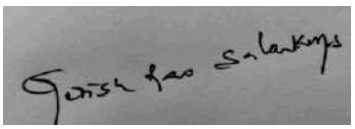
Typical evaluation pattern for regular courses is shown in Table 1:

Table 1: CIE Evaluation		
Components	**Marks**	**Total**
CIE TEST 1	40	50
CIE TEST 2	40	
CIE TEST 3	40	
Quiz 1 / AAT	05	
Quiz 2 / AAT	05	

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respective Board of Studies and can be given here.

Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VII

CYBER SECURITY

Professional Elective Course / (Online)

Course Code:	**22ADS742**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

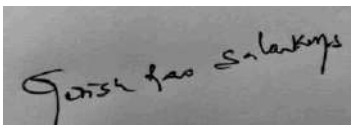
Prerequisites (if any): None

Prerequisites (if any): Basics of Computer Networks.

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To understand various types of cyber-attacks and cyber-crimes
2	To learn threats and risks within context of the cyber security
3	To have an overview of the cyber laws & concepts of cyber forensics
4	To study the defensive techniques against these attacks

Module 1	No. of Hours	RBT Level
Understanding Cyber Crime: Cyber Security–the need of the hour, impact of internet, CIA triad, Reasons for cybercrime, Cyber Terrorism, Classification of cybercrimes, Cyber Criminals, Types of Cybercrimes,	**8**	**L2**
Module 2		
Cyber Crime in Devices: Introduction, Proliferation of mobile and wireless devices, Credit card fraud in the mobility era, Challenges posed by mobile devices, Registry settings, Attacks on mobile/cell phones, Security implications and Measures for organizations in handling mobile devices, Organizational security policies and measures in mobile computing era, Laptops	**8**	**L2**
Module 3		
Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics	**8**	**L2**
Module 4		
Tools and method used in Cybercrime: Introduction, proxy servers and Anonymizers, Phishing, Password cracking, Keyloggers and spywares, virus and worms, Trojan Horses and back doors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer overflow	**8**	**L2**
Module 5		
Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc. **Cybercrime: Examples and Mini-Cases:** The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.	**8**	**L3**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Describe cybercrime, its classifications and various types of Cyber attacks
CO2	Describe the organizational methods and policies for cyber-crime handling in mobile and wireless devices
CO3	Understand Cyber Security Regulations and Roles of International Law and Learn, analyze and validate Forensics Data
CO4	Distinguish the different tools and methods used in cybercrime and discuss the impact of Phishing
CO5	Apply policies and procedures to manage Privacy issues

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	1	1				1		1		1		1
CO2	2	2	1	1				1		1		1		1
CO3	2	2	1	1				1		1		1		1
CO4	2	2	1	1				1		1		1		1
CO5	2	2	1	1				1		1		1		1
Average	2	2	1	1				1		1		1		1

High-3: Medium-2: Low-1

Text Books:

1. Sunith Belapure and Nina Godbole, "Cyber Security: Understanding Cyber crime, computer forensics and legal perspectives", Wiley India, 2013.
2. Anand Shinde, "Introduction to Cyber Security: Guide to the world of cyber security", Notion Press, 2021.

Reference Books:

1. Marjie T Britz, "Computer Forensics and Cyber Crime - An Introduction", Pearson Education, 2nd Edition, 2012.
2. Harish Cahnder, "Cyber Laws and IT Protection", PHI, 2012.
3. Thomas JMoubray, "Cyber Security: Managing Systems, Conducting Testing and Investigating Inrusions", John Wiley, 2014.
4. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi,

MOOCs:

2. https://www.cyberdegrees.org/
3. https://www.udemy.com/course/the-complete-internet-security-privacy-course-volume-1/E-Books /

Scheme of Examination (CIE):

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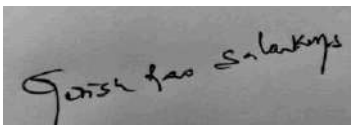


Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

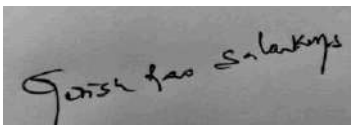
Typical evaluation pattern for regular courses is shown in Table 1:

Table 1: CIE Evaluation		
Components	**Marks**	**Total**
CIE TEST 1	40	50
CIE TEST 2	40	
CIE TEST 3	40	
Assignment	10	

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respectiveBoard of Studies and can be given here.

Scheme of Examination (SEE):

• The SEE question paper will be set for 100 marks and the marks scored will be proportionatelyreduced to 50.
• The question paper will have ten full questions carrying 20 marks each.
• There will be two full questions (with a maximum of four sub questions) from each module.
• The students will have to answer five full questions, selecting one full question from each module.



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

NEURAL NETWORKS AND DEEP LEARNING

SEMESTER –VII

Open Elective Course / (Online)

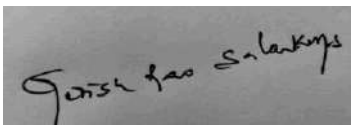
Course Code:	**22ADS751**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**OEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): Machine Learning I and Machine Learning II

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To impart hands-on knowledge on Advanced Machine Learning Topics.
2	Provide in-depth coverage of Data Augmentation and Convolutions.
3	Impart application of Deep Learning techniques like CNN and RNN.
4	Exposure to unsupervised feature engineering techniques

Module 1	No. of Hours	RBT Level
Introduction: Understanding the Biological Neurons, Exploring the Artificial Neurons (Perceptron), Perceptron learning rule, Examples on single layer perceptron, Process of designing a Neural Networks (Architecture), Types of Activation Functions, derivative of activation functions. Multilayer perceptron (Mathematics Behind Back propagation, Deep L layer Neural Network, Understanding the notion of forward and backward propagation), Optimization algorithms in NN, Loss functions, Dropout, Implementation of ANN.	**10**	**L2**
Module 2		
Convolutional Neural Networks: Mathematics behind CNN, Layers, Architectures of CNN, ILSVRC winner architectures, Implementation of CNN, Building the model from the scratch	**10**	**L3**
Module 3		
Introduction: Gradient based approaches, Visualizing gradients, Saliency map,Class Model, SmoothGRAD, DeConvolution, Guided Back Propagation Grad-CAM, Occlusion sensitivity	**10**	**L3**
Module 4		
Recurrent Neural Networks Types of RNN, Challenges in training RNN: Exploding and Vanishing Gradients, Networks with Memory **Long Short-Term Memory (LSTM)** Gated Recurrent Unit (GRU), Sequence Learning Architectures, Sequence Learning with one RNN Layer, Sequence Learning with multiple RNN Layers Implementation example using Keras in Python: sentiment analysis	**10**	**L3**
Module 5		
Other Deep Learning Architectures: Encoder-Decoder Architecture, Attention Mechanism, Transformer Architecture, Generative Adversarial Networks, Unet.	**10**	**L3**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand the fundamental concepts in the neural networks.
CO2	Apply deep neural models to various learning problems.
CO3	Develop insight behind the theory of deep learning methods (CNN, RNN, etc.).
CO4	Design Deep Learning Methods for working with sequential data.
CO5	Develop GAN to generate more images to solve the problems on less data.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	3	3	2					3	2	3	
CO2	2	2	2	3	3	2					3	2	3	
CO3	3	2	3	3	3	2			3		3	2	2	
CO4	3	2	3	3	3	2			3		3	2	3	
CO5	3	3	3	3	3	3			3		3	2	2	
Average	3	2	3	3	3	2			3		3	2	3	

High-3: Medium-2: Low-1

Text Books:

3. Deep learning – Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra, Amlan, 1st Edition, Pearson.
4. Deep learning- Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville, MIT Press,2015

Reference Books:

3. Neural Networks: A Systematic Introduction, Raúl Rojas, Springer.
4. Pattern Recognition and Machine Learning, Bishop C, Springer, 2006

E-Books / Web References:

4. https://cs231n.github.io/convolutional-networks/
5. https://github.com/terryum/awesome-deep-learning-papershttps://project.inria.fr/deeplearning/files/2016/05/deepLearning.pdf

MOOCs:

4. Deep Learning specialization in Coursera.
5. https://nptel.ac.in/courses/106106184
6. https://www.udemy.com/topic/deep-learning/

Scheme of Examination (CIE):

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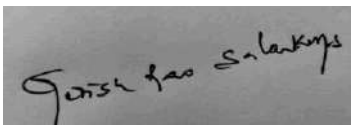

tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

Table 1: CIE Evaluation		
Components	**Marks**	**Total**
CIE TEST 1	40	50
CIE TEST 2	40	
CIE TEST 3	40	
Assignment	10	

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respectiveBoard of Studies and can be given here.

Scheme of Examination (SEE):

• The SEE question paper will be set for 100 marks and the marks scored will be proportionatelyreduced to 50.
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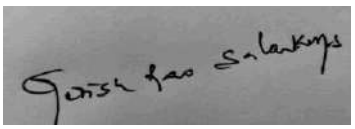


DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VII

DATA VISUALIZATION TOOLS

Open Elective Course / (Online)

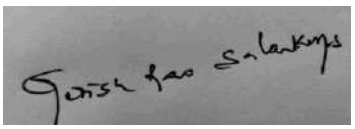
Course Code:	**22ADS752**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**OEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): None

Course Learning Objectives:

Sl.No	Course Learning Objectives (CLO)
1	Provide an overview of the good practice of data visualization.
2	Introduce students to the key design principles and techniques for visualizing data.
3	Learn how to navigate Tableau and connect to data sources, leverage drag-and-drop interface to create impactful visualizations.
4	Provide an overview and develop an introductory level of competency on the use of Power BI that can be used for data visualization.
5	Facilitate project-based opportunities to identify, understand, analyze, prepare, and present effective visualizations on a variety of data.

Module 1	No. of Hours	RBT Level
Data Visualization: Introduction to the Art and Science of Data Visualization, Whatis Data Visualization and why does it matter? Why Use Data Visualization? Brief History of Data Visualization, Data Visualization Tools, Pros and cons of Data Visualization. **Design Fundamentals:** Design Principles, Colors, and "Chart Junk", The Shaffer 4C's of Data Visualization, Best practices (examples).	**10**	**L3**
Module 2		
Storytelling with Data: Creating a good data set for analysis, Selecting data for yourKPIs, Approaches to storytelling with data, Dashboards vs. Storyboards vs. Infographics, The Duell Rules for Actionable Visualizations. **Tableau:** What is Tableau? History of Tableau, Advantages and disadvantages of Tableau, Tableau architecture, Tableau Public and Tableau Desktop, Workspace, Connecting to data source, Files and folders, Tableau navigation, Terminologies, Data types, Data roles, Data aggregation, File types.	**10**	**L3**
Module 3		
Data connection: Extracting data, Joining, Blending, Splits, Sorting, Fieldsoperations. **Tableau calculations:** Operators, Functions, Numeric, string, date, table calculations, Level of Details expressions.	**10**	**L3**



Module 4		
Sort and filter: Basic filters, Filter operations, Extract filters, Quick filters, Contextfilters, Condition filters, Data source filters, Top filters, Build groups, hierarchy, sets. **Charts:** Bar, Line, Pie, Crosstab, Bubble, Bullet, Area, Pareto, Bump chart, Gantt chart, Histogram, Motion charts, Waterfall charts. Plots: Scatter, Boxplot. Maps: Heat map, Tree map.	**10**	**L3**
Module 5		
Advanced Tableau: Dashboard, Formatting, Forecasting, Trend Lines. **Power BI:** Introduction, Architecture, Tableau vs Power BI, Data modelling,Dashboard, Visualization options, Data Analysis Expressions.	**10**	**L3**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Develop insight on the fundamentals and various design techniques for effective Data Visualization.
CO2	Learn ways to create dashboards as well as story points to develop a strong, powerfuldata story.
CO3	Learn ways and methods to analyze and apply design principles to Tableauvisualization.
CO4	Acquaint themselves with various functions available in Advanced Tableau, Power BItools.
CO5	Familiarize themselves well with current trends in Data Visualization through relevant case studies.

CO / PO Mapping													
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	3		2	2			2		2	2	3	3
CO2	2	1	2		2	2			2		3	2	3	2
CO3	1	2	3		3	2			2		2	2	3	2
CO4	2	1	3		3	2			2		3	2	3	3
CO5	2	1	3		3	2			2		3	2	3	3
Average	2	1	3		3	2			2		3	2	3	3

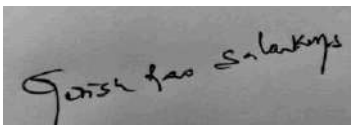
High-3: Medium-2: Low-1

Text Books:

1) Tableau 10 Business Intelligence Cookbook Book – Donabel Santos, Packt Publishing, 2016
2) The Wall Street Journal Guide to Information Graphics: The Dos and Don'ts of PresentingData, Facts, and Figures, Dona M. Wong, W. W. Norton & Company,

Reference Books:

1. Information Dashboard Design: Displaying Data for At-a-Glance Monitoring, Stephen Few, O'Reilly Media, 2013



2. Show Me the Numbers: Designing Tables and Graphs to Enlighten, Stephen Few, AnalyticsPress, 2004
3. Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics, Nathan Yau,Wiley, 2011
4. Now You See It, Stephen Few, Analytics Press, 2009
5. The Visual Display of Quantitative Information, Edward Tufte, Graphics Press, 2nd Edition,2001

Books / Web References:

1. Data Visualization and Exploration with R A Practical Guide to Using R RStudioand Tidyverse for Data Visualization Exploration and Data Science Applications:https://www.pdfdrive.com/data-visualization-and-exploration-with-r-a-practical-guide-to-using-r-rstudio-and-tidyverse-for-data-visualization-exploration-and- data-science-applications-d176184240.html
2. Beginning Data Science in R: Data Analysis, Visualization, and Modelling for the Data Scientist: https://www.pdfdrive.com/beginning-data-science-in-r-data- analysis-visualization-and-modelling-for-the-data-scientist-d181093942.html

MOOCs:

1. https://www.coursera.org/learn/datavisualization
2. https://freevideolectures.com/course/4041/nptel-introduction-to-learning-analytics/11
3. https://www.edx.org/course/data-visualization-for-all
4. https://www.udemy.com/course/the-complete-data-visualization-course/

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Assignment	10	

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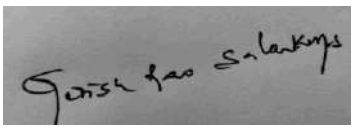


DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VII

MAJOR PROJECT PHASE-II

Course Code:	**22ADS76**	**CIE Marks:**	**100**
Hours/Week (L: T: P):	**0:0:12**	**SEE Marks:**	**100**
Credits:	**6**	**SEE Duration:**	**3 Hrs**
Type of Course:	**PROJ**		

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	Acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
2	Acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific
3	Acquire collaborative skills through working in a team to achieve common goals.
4	Self-learn, reflect on their learning and take appropriate action to improve it.
5	Prepare schedules and budgets and keep track of the progress and expenditure.

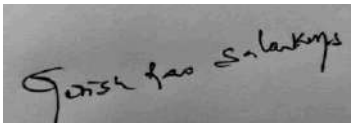
Major Project Guidelines:

- Continuous monitoring of project work will be carried out and cumulative evaluation will be done.
- The students are required to meet their internal guides once in a week to report their progress in project work.
- **Weekly Activity Report** (WAR) has to be maintained in the form of a diary by the project batch and the same has to be discussed with the Internal Guide regularly.
- In case of ***Industry project,*** during the course of project work, the internal guides will have continuous interaction with external guides and will visit the industry at least twice during the project period.
- For CIE assessment the project groups must give a final seminar with the draft copy of the project report.
- The presentation by each group will be for 20-30 minutes and every member of the team needs to justify the contributions to the project.
- The project team is required to submit Hard copies of the detailed Project Report in the prescribed format to the department.
- For CIE 50% weightage should be given to the project guide and 50% weightage to the project evaluation committee.
- Before the final evaluations the project group is required to produce a No dues certificate from Industry, Central Library and Department.

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Apply knowledge of mathematics, science and engineering to solve respective engineering domain problems.
CO2	Design, develop, present and document innovative/multidisciplinary modules for a complete engineering system.
CO3	Use modern engineering tools, software and equipment to solve problem and engage in life-long learning to follow technological developments.
CO4	Function effectively as an individual, or leader in diverse teams, with the understanding of professional



CO / PO Mapping														
CO / PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**2**
CO4	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**1**	**1**	**2**
Average	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**2**

High-3: Medium-2: Low-1

Scheme of Evaluation:

Continuous Internal Evaluation (CIE):
The following are the weightings given for the various stages of the project

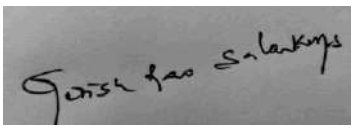
Sl No.	Activity	Weightage
1.	Execution of Project	30%
2.	Presentation, Demonstration and Results Discussion	40%
3.	Report Writing & Publication	30%

Semester End Evaluation (SEE):
The following are the weightings given during Viva Examination.

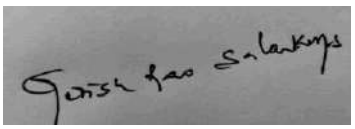
Sl No.	Activity	Weightage
1.	Presentation/Demonstration of the project	30%
2.	Methodology and Experimental Results & Discussion	30%
3.	Report	20%
4	Viva Voce	20%

Calendar of Events for the Project Work:

Week	Event
II Week of 8th Semester	Preliminary seminar
III Week	First visit of the internal guides to industry (In case of project being carried out in industry)
III to IX Week	Implementation of the project
X Week	Submission of draft copy of the project report
XI and XII Week	Second visit by guide to industry for demonstration. Final seminar by Department project Committee and guide for internal assessment. Finalization of CIE.



Scheme of Evaluation for CIE		Scheme of Evaluation for SEE	
Particulars	**%Marks**	**Particulars**	**%Marks**
Major Project Evaluation III (Implementation**)**	30%	Project Demo / Presentation	40%
		Methodology and Results Discussion	30%
Major Project Evaluation Phase-IV (Submission of Draft Project Report for Verification**)**	40%	Project Work Report	10%
Major Project Evaluation Phase-V (Project Final Internal Evaluation**)**	30%	Viva-voce	20%
Total	100	Total	100



DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

SEMESTER – VIII

PREDICTIVE AND TIME SERIES ANALYSIS

Professional Elective (Online Courses)

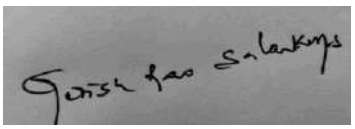
Course Code:	**22ADS811**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): Foundations of Data Science

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To understand the estimation and handling of time series data
2	To study the concept of forecasting on time series data.
3	To get exposure to predictive modelling.

Module 1	No. of Hrs	RBT Level
Introduction to Time Series and Trend: **Time Series:** Introduction to times series data, Application of time series from various fields, Components of a time series, Decomposition of time series. **Trend:** Estimation of trend by free hand curve method, Method of semi averages, Fitting a various mathematical curve, and growth curves.	**8**	**L2**
Module 2		
Estimation of Trend and Seasonal Component: **Estimation of Trend:** Method of moving averages, Detrending, Effect of elimination of trend on other components of the time series. **Seasonal Component:** Estimation of seasonal component by Method of simple averages, Ratio to Trend, Ratio to moving average and Link relatives.	**8**	**L2**
Module 3		
Forecasting: **Stationary Time series:** Variate component method, Weak stationary, auto correlation function and correlogram of moving average. **Forecasting:** Exponential smoothing methods, Short-term forecasting methods: Brown's discounted regression, Box-Jenkins Method	**8**	**L2**
Module 4		
Overview of Predictive Analytics: Core ideas in data mining, Supervised and unsupervised learning, Classification vs Prediction, Steps in data mining, SEMMA Approach, Sampling, Pre-processing, Data cleaning, Data Partitioning, Building a model, Statistical models for predictive analytics.	**8**	**L2**
Module 5		
Implementation of Predictive Analytics: Data splitting, Balancing, Overfitting, Oversampling, Multiple Regression, Artificial neural networks (MLP), Variable importance, Profit/loss/prior probabilities, Model specification, Model selection, Multivariate Analysis.	**8**	**L3**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Obtain an overview of trend surrounding time series data.
CO2	Illustrate the estimation of trend and seasonal component
CO3	Understand and apply forecasting on time series data
CO4	Obtain a good fundamental knowledge of Predictive Analysis
CO5	Implement Predictive Analysis by understanding the underlying principles.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	-	-	-	2	1	-	1	2	1	1
CO2	3	2	2	1	-	-	-	2	2	-	2	2	2	1
CO3	3	2	2	1	-	-	-	2	1	-	3	2	1	1
CO4	3	2	2	1	-	-	-	2	2	-	2	2	1	1
CO5	3	2	2	1	-	-	-	2	2	-	3	2	2	1
Average	3	2	2	1				2	2		2	2	2	1

High-3: Medium-2: Low-1

Text Books:

1) Hamilton, James D. *Time series analysis*. Princeton university press, 2020.
2) Montgomery, Douglas C., Cheryl L. Jennings, and Murat Kulahci. *Introduction to time series analysis and forecasting*. John Wiley & Sons, 2015.
3) Larose, Daniel T. *Data mining and predictive analytics*. John Wiley & Sons, 2015.

Reference Books:

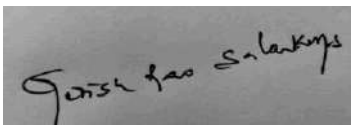
1) Siegel, Eric. *Predictive analytics: The power to predict who will click, buy, lie, or die*. John Wiley & Sons, 2013.
2) Carlberg, Conrad. *Predictive Analytics: Microsoft® Excel 2016*. Que Publishing, 2017.
3) Howard, Jeremy, Margit Zwemer, and Mike Loukides. *Designing great data products*. " O'Reilly Media, Inc.", 2012.
4) Bisgaard, Søren, and Murat Kulahci. *Time series analysis and forecasting by example*. John Wiley & Sons, 2011.

E-Books / Web References:

1) NPTEL Lecture: Applied Time Series Analysis: https://onlinecourses.nptel.ac.in/noc21_ch28/preview

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

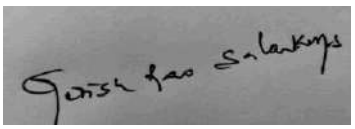


Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

Table 1: CIE Evaluation		
Components	**Marks**	**Total**
CIE TEST 1	40	50
CIE TEST 2	40	
CIE TEST 2	40	
Quiz 1 / AAT	05	
Quiz 2 / AAT	05	

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respective Board of Studies and can be given here.



DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

SEMESTER - VIII

DATA SCIENCE FOR SECURITY

Professional Elective (Online Courses)

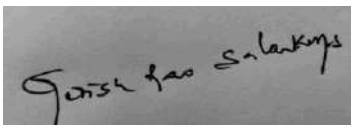
Course Code:	**22ADS812**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any):None

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Learn the security challenges that exist in the interconnected network of Internet.
2	Understand various data science approaches to solve security related challenges and problems.
3	Learn how to convert a security problem to a ML problem.
4	Understand the available technology that exist today to solve the security problems.
5	Understand the emerging threats of Adversarial Machine Learning.

Module 1	No. of Hours	RBT Level
Introduction to Data Science for Security, Thread landscape, Different types of threats, Basics of Malware, Typical Malware behaviors, Understanding Malware, Defining Malware classification, Static analysis and Dynamic analysis of Malware, Building Static and Dynamic malware detectors using Machine learning approaches.	**10**	**L3**
Module 2		
Advanced Malware detection, Detecting Obfuscated Java Script, Featurizing PDF files, Extracting N-grams using the hash-gram algorithm, Building the dynamic Malware classifier using the N-GRAMS approach on the sequence of API calls, Building the classifiers for the packers.	**10**	**L3**
Module 3		
Introduction to Penetration testing, Methodology, Foot printing, Scanning, Enumeration, Gaining access, escalating Privileges, Covering Tracks, Creating Back Doors, Machine Learning techniques for Pen Testing, Captcha Breaker, Deep Exploit, Malicious URL detector.	**10**	**L3**
Module 4		
Intrusion Detection, Denial of Service, DOS attack types, Distributed Denial Service (DDOS) attacks, DDOS detection, Machine learning approaches for DOS and DDOS, Phishing URL detection, Spam filtering, Credit card fraud detection, Anomaly detection using Isolation Forest.	**10**	**L3**
Module 5		
Introduction to Adversarial machine learning, Categories of attacks on Machine Learning, classification of attacks along dimensions namely timing, information and goals, evasion attack, attack on training data, white and black box attacks, decision time attacks on machine learning, attacks on anomaly detection and attack on PDF malware classifiers.	**10**	**L3**



Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Apply the knowledge gained in the class to illustrate the security challenges that exist today.
CO2	Apply the knowledge gained in the class to perform analysis on real-world case studies and datasets.
CO3	Build both fundamental and practical expertise.
CO4	Demonstrate the fundamental concepts on selecting the appropriate models in cyber security settings.
CO5	Explain the concept of Adversarial Machine Learning threats.

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1		2			1		2		2	3	
CO2	2	3	1		2			1		2		2	3	
CO3	1	2	3		2			1		2		2	3	
CO4	1	2	3		2			1		2		2	3	
CO5	3	3	3		2			1		2		2	3	
Average	2	2	2		2			1		2		2	3	

High-3: Medium-2: Low-1

Textbooks:

1. Machine Learning for Cyber Security – Cook Book, Emmanuel Tsukerman,Packt publications.
2. Machine Learning and Security, Clarence Chio & David Freeman

Reference Books:

1. Malware Data Science, Attack Detection and Attribution, Joshua Saxe, Hillary Sanders
2. Mastering Machine Learning for Penetration Testing, Chiheb Chebbi, Packt publications

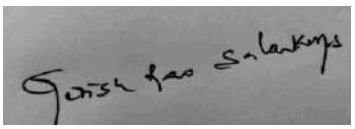
Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reducedto 50. There will be two full questions (with a maximum of four sub questions) from each module carrying20 marks each. Students are required to answer any **five full questions** choosing at least **one full questionfrom each module.**

Continuous Internal Evaluation (CIE):

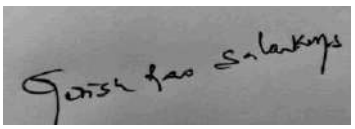
Three Tests are to be conducted for 40 marks each. Average marks scored is added to test component. CIEis executed by way of two quizzes / Alternate Assessment Tools (AATs), and Three tests. Two quizzes areto be conducted and each quiz is evaluated for 5 marks adding up to 10 marks.



Typical Evaluation pattern for regular courses is shown in Table.

Table: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

SEMESTER – VIII

LARGE LANGUAGE MODELS

Open Elective (Online Courses)

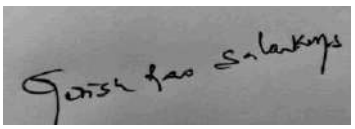
Course Code:	**22ADS821**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**OEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): Natural Language Processing

Course Learning Objectives: The students will be abler to:

Sl. No	Course Learning Objectives (CLO)
1	To learn the fundamentals of LLMs.
2	To understand the scutting-edge research topics centering around pre-trained language models
3	To understand the technical foundations (BERT, GPT, T5 models, mixture-of-expert models, retrieval-based models), emerging capabilities (knowledge, reasoning, few-shot learning, in-context learning), fine-tuning and adaptation, system design, as well as security and ethics.

Module 1	No. of Hours	RBT Level
Introduction to LLMs-What are LLMs? BERT: Deep contextualized word representations (ELMo), Improving Language Understanding by Generative Pre-Training (OpenAI GPT), **T5(Encoer-decoder models)** Exploring the Limits of Transfer Learning with a Unified Text-to-Text Transformer **GPT-3 (decoder-only models):** Language Models are Unsupervised Multitask Learners (GPT-2), PaLM: Scaling Language Modeling with Pathways	**10**	**L2**
Module 2		
How to use and adapt LLMs? **Prompting for few-shot learning:** Exploiting Cloze Questions for Few Shot Text Classification and Natural Language Inference, True Few-Shot Learning with Language Models. **Prompting as parameter-efficient fine-tuning :** Prefix-Tuning: Optimizing Continuous Prompts for Generation, Factual Probing Is [MASK]: Learning vs. Learning to Recall, P-Tuning v2: Prompt Tuning Can Be Comparable to Fine-tuning Universally Across Scales and Tasks , LoRA: Low-Rank Adaptation of Large Language Models, Towards a Unified View of Parameter-Efficient Transfer Learning	**10**	**L2**
Module 3		
How to use and adapt LLMs? Continued In-context learning: What Makes Good In-Context Examples for GPT-3? Fantastically Ordered Prompts and Where to Find Them: Overcoming Few-Shot Prompt Order Sensitivity, Data Distributional Properties Drive Emergent In-Context Learning in Transformers	**10**	**L2**



Calibration of prompting LLMs: Noisy Channel Language Model Prompting for Few-Shot Text Classification, How Can We Know When Language Models Know? On the Calibration of Language Models for Question Answering **Reasoning:** Chain of Thought Prompting Elicits Reasoning in Large Language Models **Knowledge:** Language Models as Knowledge Bases?		
Module 4		
Dissecting LLMs: **Data: The Pile:** An 800GB Dataset of Diverse Text for Language Modeling, Deduplicating Training Data Makes Language Models Better **Model Scaling:** Scaling Laws for Neural Language Models, Scale Efficiently: Insights from Pre-training and Fine-tuning Transformers **Risks :** Quantifying Memorization Across Neural Language Models, Deduplicating Training Data Mitigates Privacy Risks in Language Models, RealToxicityPrompts: Evaluating Neural Toxic Degeneration in Language Models, Self-Diagnosis and Self-Debiasing: A Proposal for Reducing Corpus-Based Bias in NLP.	**10**	**L2**
Module 5		
Beyond Current LLMs: Models and Applications : Sparse models, Retrieval-based LMs, Training LMs with human feedback, Code LMs, Multimodal LMs.	**10**	**L3**

Course Outcomes:

Upon successful completion of this course, student will be able to

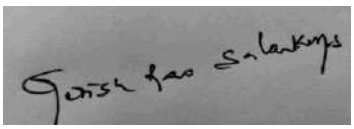
CO1	Understand fundamentals of LLMs.
CO2	Apply LLM and adapt LLMs in practical applications.
CO3	Perform Dissection of LLMs in terms of Data, Model Scaling and Risks.
CO4	Understand the different Models and Applications of LLMs

CO / PO Mapping														
CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO-10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	1	2	2	3					3	2	
CO2	3	2	2	1	2	2	3					3	3	
CO3	3	2	2	1	2	2	3					3	3	
CO4	3	2	2	1	2	2	3					3	3	
Average	3	2	2	1	2	2	3					3	3	

High-3: Medium-2: Low-1

Text Books:

1) J & M, slp3 is an NLP textbook On the Opportunities and Risks of Foundation Models - (published by Stanford researchers in July 2021) surveys a range of topics on foundational models (large langauge models are a large part of them).



2) A Primer in BERTology: What we know about how BERT works provides an excellent overview of what we understand about BERT (last update: Nov 2020).

E-Books / Web References:

- https://www.cs.princeton.edu/courses/archive/fall22/cos597G/

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

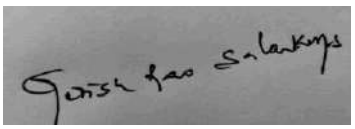
Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

Table 1: CIE Evaluation

Components	Marks	Total
CIE TEST 1	40	50
CIE TEST 2	40	
CIE TEST 2	40	
Quiz 1 / AAT	05	
Quiz 2 / AAT	05	
SEE	50	50
Total		100

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respective Board of Studies and can be given here.



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

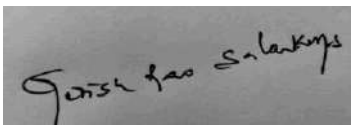
SEMESTER –VIII

INTERNSHIP

Course Code:	**22ADS83**	**CIE Marks:**	**100**
Hours/Week (L: T: P):	**0:0:12**	**SEE Marks:**	**100**
Credits:	**10**	**SEE Duration:**	**3 Hrs**
Type of Course:			

Guidelines for Internship

1. The duration of the internship shall be for a period of 14-20 weeks on full time basis after VII semester final exams.
2. The student must submit letters from the industry clearly specifying his / her name and the duration of the internship on the company letter head with authorized signature.
3. Internship must be related to the field of specialization of the respective UG programme in which the student has enrolled.
4. Students undergoing internship training are advised to report their progress and submit periodic progress reports to their respective guides.
5. Students have to present the internship activities carried out to the departmental committee and only upon approval by the committee, the student can proceed to prepare and submit the hard copy of the final internship report. However, interim or periodic reports as required by the industry / organization can be submitted as per the format acceptable to the respective industry /organizations.
6. The reports shall be printed on A4 size with 1.5 spacing and Times New Roman with font size 12, outer cover of the report (wrapper) has to be Ivory color for UG circuit Programs and Light Blue for Non-Circuit Programs.
7. The broad format of the internship final report shall be as follows
    - Cover Page
    - Certificate from College
    - Certificate from Industry / Organization
    - Acknowledgement
    - Synopsis
    - Table of Contents
    - Chapter 1 - Profile of the Organization: Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices,
    - Chapter 2 - Activities of the Department
    - Chapter 3 - Tasks Performed: summaries the tasks performed during 8-week period
    - Chapter 4 – Reflections: Highlight specific technical and soft skills that you acquired during internship
    - References & Annexure



Course Outcomes:

Upon successful completion of internship the student will be able to

CO1	Apply engineering and management principles
CO2	Analyze real-time problems and suggest alternate solutions
CO3	Communicate effectively and work in teams
CO4	Imbibe the practice of professional ethics and need for lifelong learning.

CO / PO Mapping														
CO / PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	2	1	2	2	2	2	2	3	1
CO2	3	3	3	3	2	2	1	2	2	2	2	2	3	1
CO3	3	3	3	3	2	2	1	2	2	2	2	2	3	1
CO4	1	1	1	1	1	1	1	2	1	2	1	1	1	1
Average	3	3	3	3	2	2	1	2	2	2	2	2	3	1

High-3: Medium-2: Low-1

Scheme of Evaluation:

The evaluation committee shall consist of Guide, Professor/Associate Professor and Assistant Professor. The committee shall assess the presentation and the progress reports in two reviews.

The evaluation criteria shall be as per the rubrics given below:

Continuous Internal Evaluation (CIE):

Reviews	**Activity**	**Weightage**
Review-I	Explanation of the application of engineering knowledge in industries, ability to comprehend the functioning of the organization/ departments	45%
Review- II	Importance of resource management, environment and sustainability presentation skills and report writing	55%

Semester End Evaluation (SEE):

The SEE examination shall be conducted by an external examiner (domain expert) and an internal examiner. Evaluation shall be done in batches, not exceeding 6 students per batch.