

# 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

2021 BATCH  
3<sup>RD</sup> TO 8<sup>TH</sup> SEMESTER  
SCHEME & SYLLABUS



  
**Head of the Department**  
Dept. of Artificial Intelligence & Data Scie  
Global Academy of Technology  
Bengaluru - 560 098.

  
**Dean Academic**  
Global Academy of Technology,  
Raja Rajeshwari Nagar, Bengaluru-98

## B.E. in Artificial Intelligence and Data Science Scheme of UG Autonomous Program – 2021batch

### III SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	21MAT31A	Discrete Mathematics – I	BS	MAT	2	2	0	50	50	100	3
2	21ADS32	Data Structures using C	IPC	Respective Department	3	0	2	50	50	100	4
3	21ADS33	Database Management System	IPC		3	0	2	50	50	100	4
4	21ADS34	Python for Data Science	PC		2	2	0	50	50	100	3
5	21ADS35	Foundations of Artificial Intelligence	PC		2	2	0	50	50	100	3
7	21KSK36/46	Sanskritika Kannada	HSM	Any Department	1	0	0	50	50	100	1
	21KBK36/46	Balake Kannada									
	<b>OR</b>										
	21CPH36/46	Constitution of India and Professional Ethics									
8	21ADS3X	Ability Enhancement Course - I	AEC	Respective Department	1	0	0	50	50	100	1
<b>Total</b>								<b>350</b>	<b>350</b>	<b>700</b>	<b>19</b>

9	21MATDIP31	Additional Mathematics (For Lateral Entry Students)	BS	MAT	2	2	0	100	--	100	0
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### Ability Enhancement Course - I

Sl. No.	Course Code	Course Title
1	21ADS371	Computer Organization

## B.E. in Artificial Intelligence and Data Science Scheme of UG Autonomous Program – 2021batch

### IV SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	21MAT41A	Discrete Mathematics – II	BS	MAT	2	2	0	50	50	100	3
2	21ADS42	Design and Analysis of Algorithms	IPC	Respective Department	3	0	2	50	50	100	4
3	21ADS43	Machine Learning – I	IPC		3	0	2	50	50	100	4
4	21ADS44	Foundations of Data Science	PC		2	2	0	50	50	100	3
5	21ADS45	Fuzzy Systems and Applications	PC		2	2	0	50	50	100	3
7	21KSK36/46	Samskrutika Kannada	HSM	Any Department	1	0	0	50	50	100	1
	21KBK36/46	Balake Kannada									
	<b>OR</b>										
	21CPH36/46	Constitution of India and Professional Ethics									
8	21ADS47X	Ability Enhancement Course - II	AEC	Respective Department	1	0	0	50	50	100	1
9	21INT48	Inter/Intra Institutional Internship	INT	Respective Department	0	0	3	100	-	100	2
<b>Total</b>								<b>450</b>	<b>350</b>	<b>800</b>	<b>21</b>

### Ability Enhancement Course - II

Sl. No.	Course Code	Course Title
1	21ADS471	Operating System

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**SEMESTER – III**

**DISCRETE MATHEMATICS – I**

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

<b>Course Code:</b>	<b>21MAT31A</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>2:2:0</b>	<b>SEE Marks:</b>	<b>50</b>
<b>No. of Credits:</b>	<b>03</b>	<b>Examination Hours:</b>	<b>03</b>

**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.

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

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### 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 below 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	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER – III**  
**DATA STRUCTURES USING C**

<b>Semester:</b>	<b>03</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS32</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>3:0:2</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>IPC</b>	<b>Credits:</b>	<b>04</b>

**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
<b>Introduction:</b> Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations <b>Sorting:</b> Insertion Sort, Radix sort, Address Calculation Sort.  <b>Dynamic Memory Allocation:</b> 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.	<b>10</b>	<b>L2</b>
Module 2		
<b>The Stack:</b> Definition and Examples— Primitive operations, examples  <b>Representing Stacks in C:</b> Implementing the POP operation, testing for exceptional conditions, implementing the PUSH operation An Example: Infix, Postfix, and Prefix – Basic definitions and examples  <b>Stack Applications</b> – Recursive Definition and Processes, Tower of Hanoi, conversion of infix to prefix and postfix, Evaluating a postfix expression	<b>10</b>	<b>L2</b>
Module 3		
<b>Queues:</b> 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	<b>10</b>	<b>L2</b>
Module 4		
<b>Linked Lists:</b> 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  <b>Other list structures</b> - 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.  <b>Hashing:</b> Hash tables, Hash function, Overflow handling: Open Addressing, Chaining.	<b>10</b>	<b>L2</b>

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Module 5			
<b>Binary Trees:</b> 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

<b>CO1</b>	Explain different types of data structures along with couple of sorting techniques.
<b>CO2</b>	Explain and implement the operational aspects of stacks in problem solving.
<b>CO3</b>	Explain and implement the operational aspects of queues in problem solving.
<b>CO4</b>	Explain and implement operations on linked lists and demonstrate their applications
<b>CO5</b>	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
<b>CO1</b>	3	3	3		2				2	1		2	3	
<b>CO2</b>	3	3	3		2				3	1		2	3	
<b>CO3</b>	3	3	3		2				2	1		2	3	
<b>CO4</b>	3	3	3		2				2	1	2	2	3	
<b>CO5</b>	3	3	3		2				2	1	2	2	3	
<b>Average</b>	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](https://en.wikipedia.org/wiki/Book:Fundamental_Data_Structures)
3. Algorithms and Data Structures <http://www.inr.ac.ru/~info21/ADen/>

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## 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	03 L3
2	Write a program to demonstrate: a) Tower of Hanoi problem and b) Ackermann's function	03 L3
3	Develop a program to convert INFIX notation to POSTFIX	03 L3
4	Develop a program for evaluation of POSTFIX notation.	03 L3
5	Develop a menu driven program for QUEUE that performs following primitive operations: insert, delete and display	03 L3
6	Develop a menu driven program for CIRCULAR QUEUE that performs following primitive operations: insert, delete and display	03 L3
7	Develop a menu driven program to perform primitive operations on single linked list	03 L3
8	Develop a program to reverse a single linked list	03 L3
9	Develop a program to traverse a tree using in-order, pre-order and post-order.	03 L3
10	Develop a program to perform insertion, deletion and traversal of a binary search tree	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

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER –III**  
**DATABASE MANAGEMENT SYSTEM**

<b>Semester:</b>	<b>03</b>	<b>CIE Marks</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS33</b>	<b>SEE Marks</b>	<b>50</b>
<b>Hours/Week (L: T: P)</b>	<b>3:0:2</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course</b>	<b>IPC</b>	<b>Credits</b>	<b>04</b>

**Prerequisites (if any):** NA

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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 real-world scenarios.
3	Write structured query language (SQL) statements.
4	Normalize a database using Normalization Rules.
5	Describe database design concepts and algorithms.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<p><b>Databases and Database Users</b> - 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.</p> <p><b>Database System Concepts and Architecture</b> - 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.</p> <p><b>Data Modeling Using the Entity – Relationship (ER) Model</b> - 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</p> <p><b>The Relational Data Model and Relational Database Constraints</b> - Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations.</p>	<b>10</b>	<b>L3</b>
<b>Module 2</b>		
<p><b>The Relational Algebra and Relational Calculus</b> - 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.</p> <p><b>Relational Database Design by ER- and EER-to-Relational Mapping</b> - Relational Database Design Using ER-to-Relational Mapping, Mapping EER Model Constructs to Relations.</p> <p><b>Basic SQL</b> - 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.</p>	<b>10</b>	<b>L3</b>

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<b>More SQL: Complex Queries, Triggers, Views, and Schema Modification</b> - More Complex SQL Retrieval Queries, Specifying Constraints as Assertions and Actions as Triggers, Views (Virtual Tables) in SQL, Schema Change Statements in SQL.		
<b>Module 3</b>		
<b>Basics of Functional Dependencies and Normalization for Relational Databases</b> - 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. <b>Relational Database Design Algorithms and Further Dependencies</b> - 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.	<b>10</b>	<b>L3</b>
<b>Module 4</b>		
<b>Overview of Transaction Management</b> - 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. <b>Concurrency Control</b> - 2PL, Serializability, and Recoverability, Introduction to Lock Management, Lock Conversions, Dealing With Deadlocks, Specialized Locking Techniques, ConClurency Control without Locking. <b>Crash Recovery</b> - 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.	<b>10</b>	<b>L3</b>
<b>Module 5</b>		
<b>Disk Storage, Basic File Structures, Hashing, and Modern Storage Architectures:</b> 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.	<b>10</b>	<b>L3</b>

**Course Outcomes:**

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

<b>CO1</b>	Identify and Apply the concept of databases, database management systems, ER modeling for designing simple databases.
<b>CO2</b>	Solve database queries using relational algebra.
<b>CO3</b>	Write database queries using Structured Query Language (SQL).
<b>CO4</b>	Design and develop databases from the real world by applying the concepts of Normalization.
<b>CO5</b>	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
<b>CO1</b>	3	3	3		2					2		2	3	
<b>CO2</b>	3	3	3		2		2			2		2	3	
<b>CO3</b>	3	3	3		2		2			2		2	3	
<b>CO4</b>	3	3	3		2		2			2		2	3	
<b>CO5</b>	3	3	3		2		2			2		2	3	
<b>Average</b>	3	3	3		2		2			2		2	3	

High-3: Medium-2: Low-1

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**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](https://onlinecourses.nptel.ac.in/noc19_cs46/preview)

Prog. No.	Lab Programs	No. of Hours/ RBT levels																				
1	<p><b>Creation of Tables:</b></p> <p>1. Create a table called Employee with the following structure.</p> <table border="1"> <thead> <tr> <th>Name</th> <th>Type</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>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 is 19.</p> <p>2. Create a table called reserves table</p> <table border="1"> <thead> <tr> <th>Name</th> <th>Type</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>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</p>	Name	Type	Empno	Number	Ename	Varchar2(20)	Job	Varchar2(20)	Mgr	Number	Sal	Number	Name	Type	Boat id	Integer	Sid	Integer	Day	Integer	<p style="text-align: center;"><b>03</b> <b>L3</b></p>
Name	Type																					
Empno	Number																					
Ename	Varchar2(20)																					
Job	Varchar2(20)																					
Mgr	Number																					
Sal	Number																					
Name	Type																					
Boat id	Integer																					
Sid	Integer																					
Day	Integer																					
2	<p><b>Queries using DDL and DML.</b></p> <p>1.</p> <p>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.</p> <p>2.</p> <p>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.</p>	<p style="text-align: center;"><b>03</b> <b>L3</b></p> <p style="text-align: right;"><i>AShuini</i></p>																				

3	<p><b>Queries using aggregate functions.</b></p> <p>1.</p> <p>a. By using the group by clause, display the enames who belongs to deptno 10 along with average salary.</p> <p><b>b. Display lowest paid employee details under each department.</b></p> <p>c. Display number of employees working in each department and their department number.</p> <p>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.</p> <p>e. List all employees which start with either B or C.</p> <p>f. Display only these ename of employees where the maximum salary is greater than or equal to 5000.</p> <p>2.</p> <p>a. List the Vendors who have delivered products within 6 months from order date.</p> <p>b. Display the Vendor details who have supplied both Assembled and Subparts.</p> <p>c. Display the Sub parts by grouping the Vendor type (Local or Non-Local).</p> <p><b>d. Display the Vendor details in ascending order.</b></p> <p>e. Display the Sub part which costs more than any of the Assembled parts.</p> <p>f. Display the second maximum cost Assembled part.</p>	02 L3																																			
4	<p><b>Programs on Pl/Sql</b></p> <p>1. a. Write a PL/SQL program to swap two numbers.</p> <p>b. Write a PL/SQL program to find the largest of three numbers.</p> <p>2. a. Write a PL/SQL program to find the total and average of 6 subjects and display the grade.</p> <p>b. Write a PL/SQL program to find the sum of digits in a given number.</p>	02 L3																																			
5	<p><b>Functions</b></p> <p>1. Write a function to accept employee number as parameter and return Basic +HRA together as single column.</p> <p>2. Accept year as parameter and write a Function to return the total net salary spent for a given year.</p>	02 L3																																			
6	<p><b>Triggers</b></p> <p>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:</p> <p><b>CUSTOMERS table:</b></p> <table border="1"> <thead> <tr> <th>ID</th> <th>NAME</th> <th>AGE</th> <th>ADDRESS</th> <th>SALARY</th> </tr> </thead> <tbody> <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> </tbody> </table>	ID	NAME	AGE	ADDRESS	SALARY	1	Alive	24	Khammam	2000	2	Bob	27	Kadapa	3000	3	Cantri	25	Guntur	4000	4	Dena	28	Bangalore	5000	5	Eeshwar	27	Mysore	6000	6	Farooq	28	Belagavi	7000	02 L3
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7	<p><b>Procedures</b></p> <p>1. Write the PL/SQL programs to create the procedure for factorial of given number.</p> <p>2. Write the PL/SQL programs to create the procedure to find sum of N natural number.</p>	02 L3																																			
8	<p><b>Cursors</b></p> <p>1. Write a PL/SQL block that will display the employee details along with salary using cursors.</p> <p>2. To write a Cursor to display the list of employees who are working as a managers or Analyst.</p>	02 L3																																			

*AShwin*

<p>9</p>	<p><b>Case Study: Book Publishing Company</b>  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 an 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.</p> <p>Create the logical data model using E-R diagrams.</p>	<p>03 L3</p>
<p>10</p>	<p><b>Case Study: General Hospital</b>  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.</p> <p>Create the logical data model using E-R diagrams.</p>	<p>03 L3</p>
<p>11</p>	<p><b>Case Study: Car Rental Company</b>  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 a deposit 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, telephone number, 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.</p> <p>Create the logical data model using E-R diagrams.</p>	<p>03 L3</p> <p><i>AShwin</i></p>
<p>12</p>	<p><b>Case Study: Student Progress Monitoring System</b>  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</p>	<p>03 L3</p>

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. |

Retrieve the Prerequisite Courses offered by every Department (with Department names).

### 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
<b>CIE</b>	CIE Test-1	<b>30</b>	<b>50</b>
	CIE Test-2	<b>30</b>	
	CIE Test-3	<b>30</b>	
	Laboratory	<b>20</b>	
<b>SEE</b>	Semester End Examination	<b>100</b>	<b>50</b>
<b>Grand Total</b>			<b>100</b>

*AShivani*

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER –III**  
**PYTHON FOR DATA SCIENCE**

<b>Semester:</b>	<b>03</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS34</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>2:2:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** Programming with Python.

**Course Learning Objectives:**

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

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<p><b>NumPy Basics:</b> Arrays and Vectorized Computation</p> <p><b>Basics of Numpy Arrays:</b> NumPy Array Attributes</p> <p><b>The NumPy nd array:</b> 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.</p>	<b>08</b>	<b>L2</b>
<b>Module 2</b>		
<p><b>Pandas:</b> Installing and using Pandas, Introducing Pandas Objects, Operating on data in pandas.</p> <p><b>Introduction to pandas Data Structures:</b> Series, DataFrame, Index Objects</p> <p><b>Essential Functionality:</b> 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.</p> <p><b>Combining Datasets:</b> Concat, Append, Merge and Join. Working with Time Series.</p>	<b>08</b>	<b>L2</b>
<b>Module 3</b>		
<p><b>Plotting and Visualization:</b> 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.</p> <p><b>Plotting with pandas and seaborn:</b> Three-Dimensional Plotting in Matplotlib, Python Visualization Tools for categorical Variables and Continuous Variables.</p>	<b>08</b>	<b>L2</b>

*A. Shrivastava*

<b>Module 4</b>		
<p><b>Data Cleaning and Preparation:</b> 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.</p> <p><b>Data Wrangling:</b> 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</p>	<b>08</b>	<b>L2</b>
<b>Module 5</b>		
<p><b>Use cases:</b> 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.</p>	<b>08</b>	<b>L3</b>

**Course Outcomes:**

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

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

<b>CO / PO Mapping</b>														
<b>CO / PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>CO1</b>	3	3	3		2	2			2			2	3	
<b>CO2</b>	3	3	3		2	3					2	2	3	
<b>CO3</b>	3	2	3		2					3		2	2	
<b>CO4</b>	2	3	3		3	2			3	3		2	3	
<b>CO5</b>	3	3	3		2				2		3	3	2	
<b>Average</b>	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, 2<sup>nd</sup> Edition, O’Reilly.
3. Bharti Motwani, Data Analytics using Python, Wiley.





**Reference Books:**

1. Gowrishankar S, Veena A, —Introduction to Python Programming, 1<sup>st</sup> 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 Systemsl, 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](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 below 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	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

*Ashwin*

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**SEMESTER –III**

**FOUNDATIONS OF ARTIFICIAL INTELLIGENCE**

<b>Semester:</b>	<b>03</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS35</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>2:2:0</b>	<b>Duration of SEE (hours):</b>	<b>04</b>
<b>Type of Course:</b>	<b>PC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** None

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
1	To search and discover intelligent characteristics of existing AI projects.
2	Identify the problems where AI is required and the different methods available.
3	Compare and contrast different AI techniques available.
4	Evaluate different Knowledge Representation schemes for typical AI problems, design and Implement a typical AI problem to be solved Using Machine Learning Techniques.
5	Design and implement a futuristic AI application of expert system.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<p><b>Introduction to AI:</b> What is AI, Foundation and History of AI, State of the art, level of model, criteria for success, Turing test.</p> <p><b>Intelligent agents:</b> Agents and Environments, Good Behaviour, the concepts of Rationality, Nature of Environments, Structure of Agents, Reactive, deliberative, goal-driven, utility-driven, and learning agents.</p>	<b>10</b>	<b>L3</b>
<p align="center"><b>Module 2</b></p> <p><b>Problem-solving:</b> Problem-solving agents, Example problems, Searching for Solutions.</p> <p><b>Uninformed search:</b> Breadth-First Search, Depth-First Search, Depth-Limited Search, Iterative Deepening Search, and Bidirectional search, Uniform-Cost Search, Sensor less problems, Contingency problems.</p> <p><b>Informed search:</b> Informed/Heuristic Search, Heuristic Search, A* Search, Memory bounded heuristic search, heuristic functions, local search and optimization, hill climbing, simulated annealing, local beam search, online search, online depth first search.</p>	<b>10</b>	<b>L3</b>
<p align="center"><b>Module 3</b></p> <p><b>Adversarial Search And Constraint Satisfaction Problems:</b> Games, Optional Decisions in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-of-the-Art Game Programs.</p> <p><b>Constraint Satisfaction Problems (CSP):</b> Defining CSP, Inference in CSP, Backtracking Search for CSP, Local search for CSP, Structure of Problems.</p>	<b>10</b>	<b>L3</b>
<p align="center"><b>Module 4</b></p> <p><b>Knowledge Representation Logic Agents:</b> Logic, Propositional Logic, Propositional Theorem Proving, First-Order logic, Knowledge representation issues, Using predicate logic.</p> <p><b>Inference in First Order Logic:</b> Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.</p>	<b>10</b>	<b>L3</b>

*AShivani*

Module 5		
<p><b>Expert Systems:</b> Introduction to Prolog, what an expert system is; how it works and how it is built, Basic components of an expert system, Expert System Architectures, Building Expert Systems. Rule-based Expert systems: Structure of rule based expert system, Conflict resolution, Uncertainty Management, Advantages &amp; disadvantages of rule-based expert systems, Example, Introduction to JESS.</p> <p><b>Frame-based Expert systems:</b> Inheritance in frame-based expert systems, Methods and demons, Interactions of frames and rules, Example. Artificial Neural Network and Neural Expert Systems.</p>	<b>10</b>	<b>L3</b>

**Course Outcomes:**

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

<b>CO1</b>	Identify appropriate idealizations for converting real world problems into AI search problems formulated using the appropriate search algorithm.
<b>CO2</b>	Explain important search concepts, such as the difference between informed and uninformed search
<b>CO3</b>	Implement A* and iterative deepening search. Derive heuristic functions for A* search that are appropriate for a given problem.
<b>CO4</b>	Implement proofs in first order and propositional logic using techniques such as resolution, unification, backward and forward chaining.
<b>CO5</b>	Design an expert system that would solve the real-world problems.

High-3: Medium-2: Low-1

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

**Text Books:**

1. Artificial Intelligence – A Modern Approach, by Stuart J. Russell and Peter Norvig, 3rd Edition Pearson 2015.
2. Artificial Intelligence, by E. Rich and Knight, 3rd Edition, McGraw Hill International, 2016.
3. Artificial Intelligence: A Guide to Intelligent Systems, by M. Negnevitsky, Addison Wesley.

**Reference Books:**

1. Logic Programming with Prolog, by Max Bramer, Springer, 2005.
2. Principles of Artificial Intelligence, by N.J. Nilsson, Narosa, 2002.

**E-Books / Web References:**

1. NPTEL Lecture <https://nptel.ac.in/courses/112/103/112103280/>

**MOOCs:**

1. <https://online.stanford.edu/courses/cs221-artificial-intelligence-principles-and-techniques>
2. <https://www.edx.org/course/cs50s-introduction-to-artificial-intelligence-with-python?index=product&queryID=074f81e5b869895899f1b3989470f1c5&position=1>

*AShwin*

**Scheme of Examination:**

**Semester End Examination (SEE):**

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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.

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CIE	CIE Test-1	40	50
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	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100



<b>ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ</b>			
ವಿಷಯ ಸಂಕೇತ (Course Code)	21KSK36/46	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಶಗಳು	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P: S))	0:2:0:1	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಶಗಳು	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	25 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಶಗಳು	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ	01 ಗಂಟೆ
<p><b>ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:</b></p> <ol style="list-style-type: none"> <li>1. ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.</li> <li>2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಪರಿಚಯಿಸಿ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.</li> <li>3. ತಾಂತ್ರಿಕ ವೃತ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.</li> <li>4. ಕನ್ನಡ ಶಬ್ದಸಂಪತ್ತಿನ ಪರಿಚಯ ಮತ್ತು ಕನ್ನಡ ಭಾಷೆಯ ಬಳಕೆ ಹಾಗೂ ಕನ್ನಡದಲ್ಲಿ ಪತ್ರ ವ್ಯವಹಾರವನ್ನು ತಿಳಿಸಿಕೊಡುವುದು.</li> </ol>			
<p><b>ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :</b></p> <p>These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.</p> <ol style="list-style-type: none"> <li>1. ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡವನ್ನು ಬೋಧಿಸಲು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧಾರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನು ಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.</li> <li>2. ಇತ್ತೀಚಿನ ತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು - ಅಂದರೆ ಕವಿ-ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆ ಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು, ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಟಿಪಿಟಿ, ಡಿಜಿಟಲ್ ಮಾಧ್ಯಮಗಳ ಮುಖಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು.</li> <li>3. ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಬಹುದು.</li> </ol>			
<p><b>ಘಟಕ -1 ಲೇಖನಗಳು</b></p> <ol style="list-style-type: none"> <li>1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ - ಹಂಪ ನಾಗರಾಜಯ್ಯ</li> <li>2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ : ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ</li> <li>3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ</li> </ol>			
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	<p>ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.</p>		

*Ashwin*

<b>ಘಟಕ -2 ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ</b>	
<ol style="list-style-type: none"> <li>1. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ.</li> <li>2. ಕೀರ್ತನೆಗಳು : ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ - ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ - ಕನಕದಾಸರು</li> <li>3. ತತ್ವಪದಗಳು : ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು - ಶಿಶುನಾಳ ಶರೀಫ</li> </ol>	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
<b>ಘಟಕ -3 ಆಧುನಿಕ ಕಾವ್ಯಭಾಗ</b>	
<ol style="list-style-type: none"> <li>1. ದಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಅಯ್ಯ ಕೆಲವು ಭಾಗಗಳು</li> <li>2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ.ರಾ. ಬೇಂದ್ರೆ</li> <li>3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು</li> </ol>	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
<b>ಘಟಕ -4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ</b>	
<ol style="list-style-type: none"> <li>1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ : ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ - ಎ ಎನ್ ಮೂರ್ತಿರಾವ್</li> <li>2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ : ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ</li> </ol>	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
<b>ಘಟಕ -5 ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ</b>	
<ol style="list-style-type: none"> <li>1. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ</li> <li>2. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ : ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ</li> </ol>	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

*AShivam*

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಪರಿಣಾಮಗಳು (course Outcomes):

1. ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳು ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.
4. ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.

ಮೌಲ್ಯಮಾಪನದ ವಿಧಾನ (Assessment Details- both CIE and SEE) :

(methods of CIE - MCQ, Quizzes, Open book test, Seminar or micro project)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain a minimum of 40% marks individually both in CIE and 35% marks in SEE to pass. Theory Semester End Exam (SEE) is conducted for 50 marks (01 hour duration). Based on this grading will be awarded.

**Continuous Internal Evaluation:**

Three Tests each of **20 Marks (duration 01 hour)**

- a. First test at the end of 5<sup>th</sup> week of the semester
- b. Second test at the end of the 10<sup>th</sup> week of the semester
- c. Third test at the end of the 15<sup>th</sup> week of the semester

Two assignments each of **10 Marks** : 1. First assignment at the end of 4<sup>th</sup> week of the semester

2. Second assignment at the end of 9<sup>th</sup> week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

3. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ - Semester End Exam (SEE):**

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

1. The question paper will have 50 questions. Each question is set for 01 mark.

SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 Hour.

**ಪಠ್ಯಪುಸ್ತಕ :**

**ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ**

ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ,

ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.



BE - III / IV Semester – Common to All

**ಬಳಕೆ ಕನ್ನಡ - baLake Kannada (Kannada for Usage)**

ಕನ್ನಡ ಕಲಿಕೆಗಾಗಿ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಪುಸ್ತಕ - (Prescribed Textbook to Learn Kannada)

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KBK36/46	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು (Continuous Internal Evaluation Marks)	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P: S))	0:2:0:1	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು (Semester End Examination Marks)	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	25 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು (Total Marks)	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ (Exam Hours)	01 ಗಂಟೆ

**ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು (Course Learning Objectives):**

- To Create the awareness regarding the necessity of learning local language for comfortable and healthy life.
- To enable learners to Listen and understand the Kannada language properly.
- To speak, read and write Kannada language as per requirement.
- To train the learners for correct and polite conversation.

**ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :**

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

1. ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಿಷಯ ಸೂಚಿಸಿರುವ ಪಠ್ಯಪುಸ್ತಕವನ್ನು ಉಪಯೋಗಿಸಬೇಕು.
2. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
3. ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನು ತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತಿ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟಂತೆ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸತಕ್ಕದ್ದು.
1. ಡಿಜಿಟಲ್ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರ ಇತ್ತೀಚೆಗೆ ಡಿಜಿಟಲೀಕರಣ ಗೊಂಡಿರುವ ಭಾಷೆ ಕಲಿಕೆಯ ವಿಧಾನಗಳನ್ನು ಪರಿಚಯಿಸಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ಮುಖಾಂತರ ಚರ್ಚಿಸಲು ಕ್ರಮಕೈಗೊಳ್ಳುವುದು. ಇದರಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ತರಗತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಏಕಾಗ್ರತೆಯಿಂದ ಪಾಠ ಕೇಳಲು ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ತೊಡಗಲು ಅನುಕೂಲವಾಗುತ್ತದೆ.
2. ಭಾಷಾಕಲಿಕೆಯ ಪ್ರಯೋಗಾಲಯದ ಮುಖಾಂತರ ಬಹುಬೇಗ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಕಲಿಯಲು ಅನುಕೂಲವಾಗುವಂತೆ ಕಾರ್ಯಚಟುವಟಿಕೆಗಳನ್ನು ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವುದು.

**Module-1**

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conversation, Listening and Speaking Activities
3. Key to Transcription.
4. ವೈಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ/ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - **Personal Pronouns, Possessive Forms, Interrogative words**

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
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## Module-2

1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - **Possessive forms of nouns, dubitive question and Relative nouns**
2. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು **Qualitative, Quantitative and Colour Adjectives, Numerals**
3. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು - ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ - (ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ)  
**Predictive Forms, Locative Case**

ಬೋಧನೆ ಮತ್ತು  
ಕಲಿಕಾ ವಿಧಾನ

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

## Module-3

1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು - **Dative Cases, and Numerals**
4. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು - **Ordinal numerals and Plural markers**
5. ನ್ಯೂನ / ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು  
**Defective / Negative Verbs and Colour Adjectives**

ಬೋಧನೆ ಮತ್ತು  
ಕಲಿಕಾ ವಿಧಾನ

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

## Module-4

1. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯ ಆರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು  
**Permission, Commands, encouraging and Urging words (Imperative words and sentences)**
2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು  
**Accusative Cases and Potential Forms used in General Communication**
3. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು - **Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs**
6. ಹೋಲಿಕೆ (ತರತಮ), ಸಂಬಂಧ ಸೂಚಕ ಮತ್ತು ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು  
**ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ- Comparative, Relationship, Identification and Negation Words**

ಬೋಧನೆ ಮತ್ತು  
ಕಲಿಕಾ ವಿಧಾನ

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

## Module-5

1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು - **ifferent types of forms of Tense, Time and Verbs**
2. ದ್, -ತ್, -ತು, -ಇತು, -ಆಗಿ, -ಅಲ್ಲ, -ಗ್, -ಕ್, ಇದೆ, ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ - **Formation of Past, Future and Present Tense Sentences with Verb Forms**
3. **Kannada Vocabulary List : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು - Kannada Words in Conversation**

ಬೋಧನೆ ಮತ್ತು  
ಕಲಿಕಾ ವಿಧಾನ

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

*AShwin*

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು: **course Outcomes (Course**

**Skill Set):** At the end of the Course, The Students will be able

1. To understand the necessity of learning of local language for comfortable life.
2. To Listen and understand the Kannada language properly.
3. To speak, read and write Kannada language as per requirement.
4. To communicate (converse) in Kannada language in their daily life with kannada speakers.
5. To speak in polite conversation.

### **Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% ( 18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

#### **Continuous Internal Evaluation:**

Three Tests each of **20 Marks (duration 01 hour)**

- a. First test at the end of 5<sup>th</sup> week of the semester
- b. Second test at the end of the 10<sup>th</sup> week of the semester
- c. Third test at the end of the 15<sup>th</sup> week of the semester

Two assignments each of **10 Marks** : 1. First assignment at the end of 4<sup>th</sup> week of the semester

7. Second assignment at the end of 9<sup>th</sup> week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

8. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ - Semester End Exam (SEE):**

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

2. The question paper will have 50 questions. Each question is set for 01 mark.
3. SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 Hour.

### **Textbook :**

**ಬಳಕೆ ಕನ್ನಡ**

ಲೇಖಕರು : ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.



## SEMESTER – III/IV

### Course: Constitution of India, Professional Ethics

Course Code	21CPH36/46	CIE Marks	100
Hours/Week (L: T: P)	1:0:0	SEE Marks	-
No. of Credits	01	Examination Hours	-

#### Course Learning Objectives:

<b>CLO1</b>	Know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens.
<b>CLO2</b>	Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.
<b>CLO3</b>	Know about the cybercrimes and cyber laws for cyber safety measures.

Content	No. of Hours
<b>Module 1</b> Introduction to Indian Constitution: The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.	03 Hours
<b>Module 2</b> Union Executive and State Executive: Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370,371,371J) for some States.	03 Hours
<b>Module 3</b> Elections, Amendments and Emergency Provisions: Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74,75, 86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and its consequences. Constitutional special provisions: Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.	03 Hours

*AShivani*

<b>Module 4</b>	
Professional / Engineering Ethics: Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering	
<b>Module 5</b>	<b>03 Hours</b>
Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies.	

### COURSE OUTCOMES:

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

<b>21CPH36.1</b>	Have constitutional knowledge and legal literacy.
<b>21CPH36.2</b>	Understand Engineering and Professional ethics and responsibilities of Engineers.
<b>21CPH36.3</b>	Understand the cybercrimes and cyber laws for cyber safety measures.

### TEXTBOOKS:

1. Constitution of India, Professional Ethics and Human, O Shubham Singles, Charles E. Haries, and et. al., Cengage Learning India, 2018.
2. Cyber Security and Cyber Laws, Alfred Basta and et. al., Cengage Learning India, 2018

### REFERENCE BOOKS:

1. Introduction to the Constitution of India, Durga Das Basu, Prentice –Hall, 2008.
2. Engineering Ethics, M. Govindarajan, S. Natarajan, V. S. Senthilkumar, Prentice –Hall, 2004

### Scheme of Examination:

There is no Semester End Examination for this course. The assessment is based on Continuous Internal Evaluation only.

### Continuous Internal Evaluation (CIE):

CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two 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. Typical Evaluation pattern for this course is shown in Table 2.

*Ashwin*

**Table 2: Distribution of weightage for CIE**

	Component	Marks	Total Marks
CIE	CIE Test-1	40	100
	CIE Test-2	40	
	Quiz 1/AAT	10	
	Quiz 2/AAT	10	
<b>Grand Total</b>			<b>100</b>

<b>CO/PO Mapping</b>																
<b>CO/PO</b>	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
<b>21CPH36.1</b>	-	-	-	-	-	3	-	3	1	-	-	3	-	-	-	-
<b>21CPH36.2</b>	-	-	-	-	-	3	-	3	1	-	-	3	-	-	-	-
<b>21CPH36.3</b>	-	-	-	-	-	3	-	3	1	-	-	3	-	-	-	-

**Low-1: Medium-2: High-3**



**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER – III**  
**COMPUTER ORGANIZATION**  
**Ability Enhancement Course – I**

<b>Semester:</b>	<b>03</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS371</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>1:0:0</b>	<b>Duration of SEE (hours):</b>	<b>04</b>
<b>Type of Course:</b>	<b>AEC</b>	<b>Credits:</b>	<b>01</b>

**Course Objectives:** The course will enable students to:

<b>CLO1</b>	Learn how to introduce students to the computer organization's systems aspects.
<b>CLO2</b>	Give the learner the knowledge necessary to comprehend how issues with computer architecture impact the functionality and character of software.
<b>CLO3</b>	To enable students to assess and correlate the high-level software performance with its system-level features.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Basic Structure of Computers:</b> Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.	<b>2</b>	<b>L2</b>
<b>Module 2</b>		
<b>Machine Instructions and Programs:</b> Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions	<b>2</b>	<b>L2</b>
<b>Module 3</b>		
<b>Introduction to Computer Systems:</b> Hardware Organization of a uniprocessor computer, Basic uniprocessor Architecture, Instruction Cycle State Diagram, Operating System role in Managing Hardware, Running a Hello Program: Processes, Threads, Virtual Memory, Files, Performance Assessment: MIPS Rate, Amdahl's Law	<b>2</b>	<b>L2</b>
<b>Module 4</b>		
<b>Computer Organization and Design:</b> Memory Organization : Internal Memory : Semiconductor Main Memory (SRAM and DRAM), DDR – DRAM, Error Correction – Hamming Code, External Memory: Magnetic Disk ( Not in very detail), RAID, SSD - Solid State Memory Technologies (Types)	<b>2</b>	<b>L2</b>
<b>Module 5</b>		
Computer Architecture and Organization: Von-Neumann Architecture vs Harvard Architecture, <b>RISC Vs CISC:</b> Machine Instruction Characteristics, Types of Operands, Operations and Addressing Modes, Instruction Formats, Hardwired vs microprogrammed control unit <b>Case study :</b> MIPS Single cycle implementation	<b>2</b>	<b>L2</b>

*AShwin*

### Course Outcomes:

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

<b>CO1</b>	Explain the basic organization of a computer system.
<b>CO2</b>	Demonstrate the functioning of different sub-systems, such as processor, Input/output, and memory.
<b>CO3</b>	Students will Analyse and Compare various memory management techniques
<b>CO4</b>	Students will apply the knowledge of performance metrics to find the performance of systems.
<b>CO5</b>	Students will Examine different computer architectures and hardware

CO / PO Mapping														
CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
<b>CO1</b>	2	3			2							3		
<b>CO2</b>	3	3			2							2		
<b>CO3</b>	2	3			2							3		
<b>CO4</b>	3	3			2							3		
<b>CO5</b>	3	3			2							2		
<b>Average</b>														

High-3: Medium-2: Low-1

### Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002.
2. Stallings William, *Computer Organization & Architecture*, Pearson Education, 10<sup>th</sup> Ed. 2013

### Reference Books:

1. Patterson, David A & J L Hennenssy, Computer Organization and Design – The Hardware/Software Interface, Elsevier, Revised 4th Ed.
2. Randal E. Bryant, David R. O'Hallaron, Computer Systems – A Programmer's Perspective, Pearson, 2<sup>nd</sup> Ed, 2016.
3. Kai Hwang and Briggs, Computer Architecture and Parallel Processing, Tata McGrawHill Edition

### E-Books / Web References:

1. <https://www.pdfdrive.com/fundamentals-of-computer-organization-and-architecture-2005pdf-e12294655.html>
2. <https://www.pdfdrive.com/computer-organization-and-design-fourth-edition-the-hardware-software-interface-the-morgan-kaufmann-series-in-computer-architecture-and-design-e186092607.html>

### MOOCs:

1. <https://nptel.ac.in/courses/106105163>
2. <https://www.coursera.org/learn/comparch>



**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 below Table .

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

	<b>Component</b>	<b>Marks</b>	<b>Total Marks</b>
<b>CIE</b>	CIE Test-1	<b>40</b>	<b>50</b>
	CIE Test-2	<b>40</b>	
	CIE Test-3	<b>40</b>	
	Assignments	<b>10</b>	
<b>SEE</b>	Semester End Examination	<b>50</b>	<b>50</b>
<b>Grand Total</b>			<b>100</b>





## SEMESTER – III

### Course: Additional Mathematics

(For Lateral Entry students – Common to all branches)

Course Code	21MATDIP31	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
No. of Credits	00	Examination Hours	03

**Course Learning Objectives:** To enable students to apply the knowledge of Mathematics in various fields of engineering by making them to learn:

<b>CLO1</b>	Derivatives, Polar curves and Radius of curvature
<b>CLO2</b>	Partial Derivatives and Jacobians
<b>CLO3</b>	Multiple integrals, beta & gamma functions
<b>CLO4</b>	Ordinary and Partial differential equations

Content	No. of Hours/ RBT levels
<b>Module 1</b> Successive differentiation - simple problems. Polar Curves - angle between radius vector and tangent, angle between two curves, Pedal equation. Taylor's and Maclaurin's series for function of one variable.	<b>8 Hours</b> <b>L2, L3</b>
<b>Module 2</b> Evaluation of Indeterminate forms. Partial derivatives, Differentiation of implicit and composite functions. Jacobians. Taylor's series for functions of two variables.	<b>8 Hours</b> <b>L2, L3</b>
<b>Module 3</b> Multiple Integrals-Double integrals- direct evaluation, change of order of integration, change of variables. Triple integrals-direct evaluation. Beta and Gamma functions, relation between beta and gamma function.	<b>8 Hours</b> <b>L2, L3</b>
<b>Module 4</b> Solution of first order and first degree differential equations – Variable Separable, Exact and Bernoulli's differential equations. Second order linear differential equation with constant Coefficients-Inverse differential operators. Cauchy's and Legendre's Linear differential equations.	<b>8 Hours</b> <b>L2, L3</b>
<b>Module 5</b> Formation of partial differential equations by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration, homogeneous PDEs involving derivative with respect to one independent variable only.	<b>8 Hours</b> <b>L2, L3</b>

*A. Shrivastava*

**COURSE OUTCOMES:**

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

<b>21MATDIP31.1</b>	Apply the knowledge of differential calculus to solve problems related to curvature, maxima & minima of a function and Jacobians
<b>21MATDIP31.2</b>	Evaluate double and triple integrals
<b>21MATDIP31.3</b>	Evaluate definite integrals using beta and gamma functions
<b>21MATDIP31.4</b>	Solve linear differential equations of first and second order with constant/variable coefficients
<b>21MATDIP31.5</b>	Solve partial differential equations.

**Textbooks:**

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers 44th Edition, 2017
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2006

**Reference books:**

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons 10th Edition, 2016
2. N.P.Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications 6th Edition, 2014

**Scheme of Examination:****Semester End Examination (SEE):**

There will be no SEE examination for this course.

**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	
<b>Grand Total (Final CIE x 2)</b>			<b>100</b>

<b>CO/PO Mapping</b>																
<b>CO/PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
<b>21MATDIP31.1</b>	3	2	1	-	-	-	-	-	-	-	-	2	-	-	-	-
<b>21MATDIP31.2</b>	3	2	1	-	-	-	-	-	-	-	-	2	-	-	-	-
<b>21MATDIP31.3</b>	3	2	1	-	-	-	-	-	-	-	-	2	-	-	-	-
<b>21MATDIP31.4</b>	3	2	1	-	-	-	-	-	-	-	-	2	-	-	-	-
<b>21MATDIP31.5</b>	3	2	1	-	-	-	-	-	-	-	-	2	-	-	-	-
<b>Average</b>	3	2	1	-	-	-	-	-	-	-	-	2	-	-	-	-

Low-1: Medium-2: High-3

## SEMESTER – IV

### Course: Discrete Mathematics – II (Common for CSE/ISE/AI&DS/AIML)

Course Code	21MAT41A	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

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

<b>CLO1</b>	Relations and Functions
<b>CLO2</b>	Generating functions and Recurrence relations
<b>CLO3</b>	Groups and Subgroups
<b>CLO4</b>	Graph Theory

Content	No. of Hours/ RBT levels
<b>Module 1</b> Relations and properties of relations, Representation of relations. Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions. Functions, Types of Functions, Function Composition and Inverse Functions.	<b>08 Hours</b> <b>L3</b>
<b>Module 2</b> The Principle of Inclusion and Exclusion, Derangements, Rooks polynomials and arrangements with forbidden positions. Generating function and first order recurrence relation.	<b>08 Hours</b> <b>L3</b>
<b>Module 3</b> Groups, subgroups, homomorphism, Isomorphism and cyclic groups. Cosets and Lagrange Theorem.	<b>08 Hours</b> <b>L3</b>
<b>Module 4</b> Graphs, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits. Planar Graphs, Hamiltonian paths and Cycles.	<b>08 Hours</b> <b>L3</b>
<b>Module 5</b> Trees, Rooted Trees, Trees and Sorting, Weighted Trees and Prefix Codes. Dijkstra's Shortest Path Algorithm, Minimal Spanning Trees: The algorithms of Kruskal and Prim.	<b>08 Hours</b> <b>L3</b>



## COURSE OUTCOMES:

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

<b>21MAT41A.1</b>	Use computational techniques essential for the study of relations and functions, generating function, recurrence relations and groups.
<b>21MAT41A.2</b>	Solve problems using basic graph theory

### Textbooks:

1. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education. 2020.

### Reference books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007

### 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	<b>40</b>	<b>50</b>
	CIE Test-2	<b>40</b>	
	CIE Test-3	<b>40</b>	
	Assignments	<b>10</b>	
SEE	Semester End Examination	<b>50</b>	<b>50</b>
<b>Grand Total</b>			<b>100</b>

<b>CO/PO Mapping</b>																
<b>CO/PO</b>	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03	PS04
<b>21MAT41A.1</b>	3	2	1	-	-	-	-	-	-	-	-	3	-	-	-	-
<b>21MAT41A.2</b>	3	2	1	-	-	-	-	-	-	-	-	3	-	-	-	-
<b>Average</b>	3	2	1	-	-	-	-	-	-	-	-	3	-	-	-	-

Low-1: Medium-2: High-3

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**SEMESTER - IV**

**DESIGN AND ANALYSIS OF ALGORITHMS**

<b>Semester:</b>	<b>04</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS42</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week(L:T:P):</b>	<b>3: 0: 2</b>	<b>Duration of SEE(Hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>IPC</b>	<b>Credits:</b>	<b>04</b>

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

**Course Learning Objectives:**

<b>Sl. No.</b>	<b>Course Learning Objectives (CLO)</b>
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.

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

*AShwin*

Module 4		
<p><b>Algorithm Design Techniques – III:</b></p> <p><b>Dynamic Programming:</b> Introduction, Computing Binomial Coefficients, Transitive closure - Warshall's and Floyd's algorithm, Bellman Ford algorithm, Knapsack problem &amp; memory functions.</p> <p><b>Decrease &amp; Conquer: Introduction</b> – 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.</p>	<b>10</b>	<b>L3</b>
Module 5		
<p><b>Algorithm Design Techniques – IV:</b></p> <p><b>Backtracking:</b> Introduction, N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles.</p> <p><b>Branch &amp; Bound:</b> Introduction, Travelling Salesman problem, Knapsack problem, Assignment problem.</p> <p><b>Limitations Of Algorithm Power:</b> Decision Trees for sorting and searching,</p> <p><b>Approximation Algorithms for NP-Hard Problems</b> – Traveling Salesperson Problem, Knapsack Problem.</p>	<b>10</b>	<b>L3</b>

**Course Outcomes:**

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

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

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

High-3: Medium-2: Low-1

*AShwin*

**Text Books:**

1. Introduction to the Design and Analysis of Algorithms, by AnanyLevitin., 2<sup>nd</sup> 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](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](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 the time 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 graph using 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 Dynamic programming.	03 L3
8	Write programs to: a. Print all the nodes reachable from a given starting node in a digraph using BFS 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 $S = \{S_1, S_2, \dots, S_n\}$ 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
<b>CIE</b>	CIE Test-1	<b>30</b>	<b>50</b>
	CIE Test-2	<b>30</b>	
	CIE Test-3	<b>30</b>	
	Laboratory	<b>20</b>	
<b>SEE</b>	Semester End Examination	<b>100</b>	<b>50</b>
<b>Grand Total</b>			<b>100</b>





**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER –IV**  
**MACHINE LEARNING - I**

<b>Semester:</b>	<b>04</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS43</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week(L:T:P):</b>	<b>3: 0: 2</b>	<b>Duration of SEE(Hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>IPC</b>	<b>Credits:</b>	<b>04</b>

**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 problem they 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 Inductive Bias.
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
<p><b>Introduction to Machine Learning:</b> Basic steps of ML, Perspectives and Issues, Designing learning systems, Concepts of hypotheses.</p> <p><b>Datasets and Partitions, Data Pre-processing and Scaling:</b> 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.</p>	<b>10</b>	<b>L2</b>
Module 2		
<p><b>Dealing With Missing Values:</b> 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.</p> <p><b>Data Reduction:</b> Curse of Dimensionality, PCA, LDA, Data sampling, Binning.</p>	<b>10</b>	<b>L2</b>
Module 3		
<p><b>Feature Engineering:</b> Feature Extraction, Feature Ranking, Best Features, Feature Selection</p>	<b>10</b>	<b>L2</b>
Module 4		
<p><b>Introduction to Supervised learning - Regression Algorithms:</b> Linear Regression, Polynomial Regression, Lasso, Ridge and Elastic nets Regression, Regularization methods, Categorical Variables in Regression, Loss functions, Risk functions.</p> <p><b>Use Case:</b> 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.</p>	<b>10</b>	<b>L2</b>

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Module 5			
<p><b>Supervised Learning:</b> Classification Algorithms: Supervised Machine Learning Algorithms: Sample Datasets, logistic regression, k-Nearest Neighbors (Regression and Classification)</p> <p><b>Linear Models</b> - Naive Bayes, Decision Trees.</p> <p><b>Use Case:</b> 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</p>	10	L3	

**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](https://www.tensorflow.org/resources/learnml?gclid=Cj0KCQjw29CRBhCUARIsAOboZbJrDLSTHJKj8iIDKyhQzv9srD_TMSSGpXRigtJAIysLYcGH_x2GC4UaAj7NEALw_wcB)
3. [https://www.udemy.com/course/machine-learning-one-hour/?ranMID=39197&ranEAID=JVFXdTr9V80&ranSiteID=JVFXdTr9V80-CGdwe6MbhMFzQeBY4coFwx&LSNPUBID=JVFXdTr9V80&utm\\_source=aff-campaign&utm\\_medium=udemyads](https://www.udemy.com/course/machine-learning-one-hour/?ranMID=39197&ranEAID=JVFXdTr9V80&ranSiteID=JVFXdTr9V80-CGdwe6MbhMFzQeBY4coFwx&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](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**

	<b>Component</b>	<b>Marks</b>	<b>Total Marks</b>
<b>CIE</b>	CIE Test-1	<b>30</b>	<b>50</b>
	CIE Test-2	<b>30</b>	
	CIE Test-3	<b>30</b>	
	Laboratory	<b>20</b>	
<b>SEE</b>	Semester End Examination	<b>100</b>	<b>50</b>
<b>Grand Total</b>			<b>100</b>



**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER – IV**

**FOUNDATIONS OF DATA SCIENCE**

<b>Semester:</b>	<b>04</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS44</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L:T:P):</b>	<b>2:2:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PC</b>	<b>Credits;</b>	<b>03</b>

**Prerequisites (if any):** Basics of Probability

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
CLO1	To understand the problems solvable with data science
CLO2	Ability to solve problems from a statistical perspective.
CLO3	To build the skills to create data analytical pipelines
CLO4	To bring the familiarity with the data science ecosystem and the various tools needed to continue developing as a data scientist.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<p><b>Introduction to Data Science:</b> Evolution of Data Science, Data Science Roles, Lifecycle of Data Science, Representation of Data Science as a Venn Diagram, Technologies revolving around Data Science.</p> <p><b>Types of Data:</b> Structured and Unstructured Data, Quantitative and Qualitative Data, Four Levels of data (Nominal, Ordinal, Interval, Ratio Level).</p> <p><b>Data Pre-processing:</b> Asking interesting question, Obtaining of data, Exploration of data, Modeling of data, Communication and visualization.</p>	<b>08</b>	<b>L2</b>
<b>Module 2</b>		
<p><b>Data Mining:</b> What is Data Mining? Types of Data Mining, Challenges of implementation in Data Mining, Advantages and Disadvantages, Applications of Data Mining.</p> <p><b>Overview of Basic Data Mining Tasks:</b> Classification, Regression, Time Series Analysis, Prediction, Clustering, Sequence Discovery.</p>	<b>08</b>	<b>L3</b>
<b>Module 3</b>		
<p><b>Basics of Statistics:</b> Introduction to Statistics, Terminologies in Statistics, Measures of center, variance and relative standing, Normalization of data using the z-score, Empirical rule, Categories in Statistics (Descriptive and Inferential Statistics).</p> <p><b>Descriptive Statistics:</b> 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.</p>	<b>08</b>	<b>L3</b>
<b>Module 4</b>		
<p><b>Inferential Statistics:</b> 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.</p>	<b>08</b>	<b>L3</b>

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Module 5			
<b>Hypothesis Testing:</b> Testing simple hypotheses, Uniform tests, Two-sided alternatives, t-Test, F-Distribution, Bayes Test Procedures, Case studies based on Hypothesis Testing.		<b>08</b>	<b>L3</b>

### Course Outcomes:

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

<b>CO1</b>	Understand the basics of data science, data mining techniques.
<b>CO2</b>	Apply the advanced mining concepts.
<b>CO3</b>	Interpret the basic statistical description of data.
<b>CO4</b>	Implement Data sampling Techniques.
<b>CO5</b>	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
<b>CO1</b>	3	3	3		2			2		2		2	3	
<b>CO2</b>	3	3	3		2			2		2		2	3	
<b>CO3</b>	3	3	3		2			2		2		2	3	
<b>CO4</b>	3	3	3		2			2		2		2	3	
<b>CO5</b>	3	3	3		2			2		2		2	3	
<b>Average</b>	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, 2<sup>nd</sup> Edition, 2018
2. Probability and Statistics, by Morris H Degroot, Mark J Schervish, Pearson, 4<sup>th</sup> Edition, 2012.

### Reference Books:

1. Data Mining Concepts and Techniques by Jiawei Han and Micheline Kamber, Morgan Kaufmann, 3<sup>rd</sup> Edition, 2011.
2. Machine Learning: A probabilistic perspective, by Murphy, Kevin P, 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 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:**

<b>Table 1: CIE Evaluation</b>			
	<b>Components</b>	<b>Marks</b>	<b>Total</b>
<b>CIE</b>	CIE TEST 1	40	50
	CIE TEST 2	40	
	CIE TEST 3	40	
	Quiz 1 / AAT	05	
	Quiz 2 / AAT	05	
<b>SEE</b>	SEE	50	50
<b>Grand Total</b>			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**

**FUZZY SYSTEMS AND APPLICATIONS**

<b>Semester:</b>	<b>04</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS45</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week(L:T:P):</b>	<b>2: 2: 0</b>	<b>Duration of SEE(Hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** Discrete Mathematics.

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<p><b>Classical Sets and Fuzzy Sets:</b> 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.</p> <p><b>Classical Relations and Fuzzy Relations:</b> 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.</p>	<b>10</b>	<b>L2</b>
<b>Module 2</b>		
<p><b>Properties of Membership Functions, Fuzzification, and Defuzzification:</b> Features of the Membership Function, Various Forms, Fuzzification, Defuzzification to Crisp Sets, <math>\lambda</math>-Cuts for Fuzzy Relations, Defuzzification to Scalars.</p> <p><b>Development of Membership Functions:</b> Membership Value Assignments, Intuition, Inference, Inductive Reasoning.</p>	<b>10</b>	<b>L3</b>
<b>Module 3</b>		
<p><b>Fuzzy Classification:</b> 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.</p>	<b>10</b>	<b>L3</b>
<b>Module 4</b>		
<p><b>Decision Making with Fuzzy Information:</b> Fuzzy Synthetic Evaluation, Fuzzy Ordering, Nontransitive Ranking Preference and Consensus, Multiobjective Decision Making, Fuzzy Bayesian Decision Method, Decision Making Under Fuzzy States and Fuzzy Actions.</p>	<b>10</b>	<b>L3</b>

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Module 5			
<b>Applications of Fuzzy Systems:</b> 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

<b>CO1</b>	Understand basic knowledge of fuzzy sets and fuzzy logic.
<b>CO2</b>	Apply basic fuzzy inference and approximate reasoning.
<b>CO3</b>	Apply fuzzy classification algorithms on the real data
<b>CO4</b>	Apply basic fuzzy system modeling methods.
<b>CO5</b>	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
<b>CO1</b>	2	2	2	3	3	2					3	2	3	
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<b>CO3</b>	3	2	3	3	3	2			3		3	2	2	
<b>CO4</b>	3	2	3	3	3	2			3		3	2	3	
<b>CO5</b>	3	3	3	3	3	3			3		3	2	2	
<b>Average</b>	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](https://onlinecourses.nptel.ac.in/noc20_ge09/preview)
4. <https://www.coursera.org/lecture/children-literacy/fuzzy-logical-model-of-perception-ZT8ZJ>

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	CIE TEST 2	40	
	CIE TEST 3	40	
	Quiz 1 / AAT	05	
	Quiz 2 / AAT	05	
<b>SEE</b>	SEE	50	50
<b>Grand Total</b>			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):**

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<b>ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ</b>			
ವಿಷಯ ಸಂಕೇತ (Course Code)	21KSK36/46	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಶಗಳು	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P: S))	0:2:0:1	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಶಗಳು	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	25 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಶಗಳು	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ	01 ಗಂಟೆ
<p><b>ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:</b></p> <ol style="list-style-type: none"> <li>1. ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.</li> <li>2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಪರಿಚಯಿಸಿ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.</li> <li>3. ತಾಂತ್ರಿಕ ವೃತ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.</li> <li>4. ಕನ್ನಡ ಶಬ್ದಸಂಪತ್ತಿನ ಪರಿಚಯ ಮತ್ತು ಕನ್ನಡ ಭಾಷೆಯ ಬಳಕೆ ಹಾಗೂ ಕನ್ನಡದಲ್ಲಿ ಪತ್ರ ವ್ಯವಹಾರವನ್ನು ತಿಳಿಸಿಕೊಡುವುದು.</li> </ol>			
<p><b>ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :</b></p> <p>These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.</p> <ol style="list-style-type: none"> <li>1. ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡವನ್ನು ಬೋಧಿಸಲು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧಾರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನು ಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.</li> <li>2. ಇತ್ತೀಚಿನ ತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು - ಅಂದರೆ ಕವಿ-ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆ ಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು, ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಟಿಪಿಟಿ, ಡಿಜಿಟಲ್ ಮಾಧ್ಯಮಗಳ ಮುಖಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು.</li> <li>3. ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಬಹುದು.</li> </ol>			
<p><b>ಘಟಕ -1 ಲೇಖನಗಳು</b></p> <ol style="list-style-type: none"> <li>1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ - ಹಂಪ ನಾಗರಾಜಯ್ಯ</li> <li>2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ : ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ</li> <li>3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ</li> </ol>			
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	<p>ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.</p>		

*Ashwin*

<b>ಘಟಕ -2 ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ</b>	
<ol style="list-style-type: none"> <li>1. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ.</li> <li>2. ಕೀರ್ತನೆಗಳು : ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ - ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ - ಕನಕದಾಸರು</li> <li>3. ತತ್ವಪದಗಳು : ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು - ಶಿಶುನಾಳ ಶರೀಫ</li> </ol>	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
<b>ಘಟಕ -3 ಆಧುನಿಕ ಕಾವ್ಯಭಾಗ</b>	
<ol style="list-style-type: none"> <li>1. ದಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಅಯ್ಯ ಕೆಲವು ಭಾಗಗಳು</li> <li>2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ.ರಾ. ಬೇಂದ್ರೆ</li> <li>3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು</li> </ol>	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
<b>ಘಟಕ -4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ</b>	
<ol style="list-style-type: none"> <li>1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ : ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ - ಎ ಎನ್ ಮೂರ್ತಿರಾವ್</li> <li>2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ : ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ</li> </ol>	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
<b>ಘಟಕ -5 ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ</b>	
<ol style="list-style-type: none"> <li>1. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ</li> <li>2. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ : ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ</li> </ol>	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

*AShivam*

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಪರಿಣಾಮಗಳು (course Outcomes):

1. ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳು ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.
4. ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.

ಮೌಲ್ಯಮಾಪನದ ವಿಧಾನ (Assessment Details- both CIE and SEE) :

(methods of CIE - MCQ, Quizzes, Open book test, Seminar or micro project)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain a minimum of 40% marks individually both in CIE and 35% marks in SEE to pass. Theory Semester End Exam (SEE) is conducted for 50 marks (01 hour duration). Based on this grading will be awarded.

**Continuous Internal Evaluation:**

Three Tests each of **20 Marks (duration 01 hour)**

- a. First test at the end of 5<sup>th</sup> week of the semester
- b. Second test at the end of the 10<sup>th</sup> week of the semester
- c. Third test at the end of the 15<sup>th</sup> week of the semester

Two assignments each of **10 Marks** : 1. First assignment at the end of 4<sup>th</sup> week of the semester

2. Second assignment at the end of 9<sup>th</sup> week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

3. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ - Semester End Exam (SEE):**

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

1. The question paper will have 50 questions. Each question is set for 01 mark.

SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 Hour.

**ಪಠ್ಯಪುಸ್ತಕ :**

**ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ**

ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ,

ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.



BE - III / IV Semester – Common to All

**ಬಳಕೆ ಕನ್ನಡ - baLake Kannada (Kannada for Usage)**

ಕನ್ನಡ ಕಲಿಕೆಗಾಗಿ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಪುಸ್ತಕ - (Prescribed Textbook to Learn Kannada)

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KBK36/46	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು (Continuous Internal Evaluation Marks)	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P: S))	0:2:0:1	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು (Semester End Examination Marks)	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	25 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು (Total Marks)	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ (Exam Hours)	01 ಗಂಟೆ

**ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು (Course Learning Objectives):**

- To Create the awareness regarding the necessity of learning local language for comfortable and healthy life.
- To enable learners to Listen and understand the Kannada language properly.
- To speak, read and write Kannada language as per requirement.
- To train the learners for correct and polite conversation.

**ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :**

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

1. ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಿಷಯ ಸೂಚಿಸಿರುವ ಪಠ್ಯಪುಸ್ತಕವನ್ನು ಉಪಯೋಗಿಸಬೇಕು.
2. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
3. ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನು ತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತಿ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟಂತೆ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸತಕ್ಕದ್ದು.
1. ಡಿಜಿಟಲ್ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರ ಇತ್ತೀಚೆಗೆ ಡಿಜಿಟಲೀಕರಣ ಗೊಂಡಿರುವ ಭಾಷೆ ಕಲಿಕೆಯ ವಿಧಾನಗಳನ್ನು ಪರಿಚಯಿಸಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ಮುಖಾಂತರ ಚರ್ಚಿಸಲು ಕ್ರಮಕೈಗೊಳ್ಳುವುದು. ಇದರಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ತರಗತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಏಕಾಗ್ರತೆಯಿಂದ ಪಾಠ ಕೇಳಲು ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ತೊಡಗಲು ಅನುಕೂಲವಾಗುತ್ತದೆ.
2. ಭಾಷಾಕಲಿಕೆಯ ಪ್ರಯೋಗಾಲಯದ ಮುಖಾಂತರ ಬಹುಬೇಗ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಕಲಿಯಲು ಅನುಕೂಲವಾಗುವಂತೆ ಕಾರ್ಯಚಟುವಟಿಕೆಗಳನ್ನು ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವುದು.

**Module-1**

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conversation, Listening and Speaking Activities
3. Key to Transcription.
4. ವೈಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ/ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - **Personal Pronouns, Possessive Forms, Interrogative words**

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
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*AShwin*

## Module-2

1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - **Possessive forms of nouns, dubitive question and Relative nouns**
2. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು **Qualitative, Quantitative and Colour Adjectives, Numerals**
3. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು - ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ - (ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ)  
**Predictive Forms, Locative Case**

ಬೋಧನೆ ಮತ್ತು  
ಕಲಿಕಾ ವಿಧಾನ

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

## Module-3

1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು - **Dative Cases, and Numerals**
4. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು - **Ordinal numerals and Plural markers**
5. ನ್ಯೂನ / ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು  
**Defective / Negative Verbs and Colour Adjectives**

ಬೋಧನೆ ಮತ್ತು  
ಕಲಿಕಾ ವಿಧಾನ

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

## Module-4

1. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯ ಆರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು  
**Permission, Commands, encouraging and Urging words (Imperative words and sentences)**
2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು  
**Accusative Cases and Potential Forms used in General Communication**
3. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು - **Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs**
6. ಹೋಲಿಕೆ (ತರತಮ), ಸಂಬಂಧ ಸೂಚಕ ಮತ್ತು ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು  
**ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ- Comparative, Relationship, Identification and Negation Words**

ಬೋಧನೆ ಮತ್ತು  
ಕಲಿಕಾ ವಿಧಾನ

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

## Module-5

1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು - **ifferent types of forms of Tense, Time and Verbs**
2. ದ್, -ತ್, -ತು, -ಇತು, -ಆಗಿ, -ಅಲ್ಲ, -ಗ್, -ಕ್, ಇದೆ, ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ - **Formation of Past, Future and Present Tense Sentences with Verb Forms**
3. **Kannada Vocabulary List : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು - Kannada Words in Conversation**

ಬೋಧನೆ ಮತ್ತು  
ಕಲಿಕಾ ವಿಧಾನ

ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

*AShwin*

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು: **course Outcomes (Course**

**Skill Set):** At the end of the Course, The Students will be able

1. To understand the necessity of learning of local language for comfortable life.
2. To Listen and understand the Kannada language properly.
3. To speak, read and write Kannada language as per requirement.
4. To communicate (converse) in Kannada language in their daily life with kannada speakers.
5. To speak in polite conversation.

### **Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% ( 18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

#### **Continuous Internal Evaluation:**

Three Tests each of **20 Marks (duration 01 hour)**

- a. First test at the end of 5<sup>th</sup> week of the semester
- b. Second test at the end of the 10<sup>th</sup> week of the semester
- c. Third test at the end of the 15<sup>th</sup> week of the semester

Two assignments each of **10 Marks** : 1. First assignment at the end of 4<sup>th</sup> week of the semester

7. Second assignment at the end of 9<sup>th</sup> week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

8. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ - Semester End Exam (SEE):**

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

2. The question paper will have 50 questions. Each question is set for 01 mark.
3. SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 Hour.

### **Textbook :**

**ಬಳಕೆ ಕನ್ನಡ**

ಲೇಖಕರು : ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.





## SEMESTER – III/IV

### Course: Constitution of India, Professional Ethics

Course Code	21CPH36/46	CIE Marks	100
Hours/Week (L: T: P)	1:0:0	SEE Marks	-
No. of Credits	01	Examination Hours	-

#### Course Learning Objectives:

<b>CLO1</b>	Know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens.
<b>CLO2</b>	Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.
<b>CLO3</b>	Know about the cybercrimes and cyber laws for cyber safety measures.

Content	No. of Hours
<b>Module 1</b> Introduction to Indian Constitution: The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building.	03 Hours
<b>Module 2</b> Union Executive and State Executive: Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370,371,371J) for some States.	03 Hours
<b>Module 3</b> Elections, Amendments and Emergency Provisions: Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44, 61, 73,74,75, 86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and its consequences. Constitutional special provisions: Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.	03 Hours

*AShivani*

<b>Module 4</b>	
Professional / Engineering Ethics: Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering	
<b>Module 5</b>	<b>03 Hours</b>
Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies.	

### COURSE OUTCOMES:

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

<b>21CPH46.1</b>	Have constitutional knowledge and legal literacy.
<b>21CPH46.2</b>	Understand Engineering and Professional ethics and responsibilities of Engineers.
<b>21CPH46.3</b>	Understand the cybercrimes and cyber laws for cyber safety measures.

### TEXTBOOKS:

1. Constitution of India, Professional Ethics and Human,0 Shubham Singles, Charles E. Haries, and et. al., Cengage Learning India, 2018.
2. Cyber Security and Cyber Laws, Alfred Basta and et. al., Cengage Learning India, 2018

### REFERENCE BOOKS:

1. Introduction to the Constitution of India, Durga Das Basu, Prentice –Hall, 2008.
2. Engineering Ethics, M. Govindarajan, S. Natarajan, V. S. Senthilkumar, Prentice –Hall, 2004

### Scheme of Examination:

There is no Semester End Examination for this course. The assessment is based on Continuous Internal Evaluation only.

### Continuous Internal Evaluation (CIE):

CIE is executed by way of two quizzes / Alternate Assessment Tools (AATs), and two 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. Typical Evaluation pattern for this course is shown in Table 2.

*Ashwin*

**Table 2: Distribution of weightage for CIE**

	Component	Marks	Total Marks
CIE	CIE Test-1	40	100
	CIE Test-2	40	
	Quiz 1/AAT	10	
	Quiz 2/AAT	10	
<b>Grand Total</b>			<b>100</b>

<b>CO/PO Mapping</b>																
<b>CO/PO</b>	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
21CPH46.1	-	-	-	-	-	3	-	3	1	-	-	3	-	-	-	-
21CPH46.2	-	-	-	-	-	3	-	3	1	-	-	3	-	-	-	-
21CPH46.3	-	-	-	-	-	3	-	3	1	-	-	3	-	-	-	-

**Low-1: Medium-2: High-3**



**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER –IV**  
**OPERATING SYSTEM**

**Ability Enhancement Course - II**

<b>Semester:</b>	<b>04</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS471</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>1:0:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>AEC</b>	<b>Credits:</b>	<b>01</b>

**Prerequisites (if any):** NA

**Course Learning Objectives:**

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

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

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**Course Outcomes:**

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

<b>CO1</b>	Understand the Operating system functionality with system calls and computing environment.
<b>CO2</b>	Discuss the different process scheduling mechanisms and multithreading models.
<b>CO3</b>	Interpret the optimization of resource utilization using different scheduling algorithms.
<b>CO4</b>	Identify root causes of deadlock and provide the solution for deadlock elimination
<b>CO5</b>	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
<b>CO1</b>	3											2		
<b>CO2</b>	3											2		
<b>CO3</b>	3	2	2									2	3	
<b>CO4</b>	3	2	2									2	3	
<b>CO5</b>	3	2	2									2	3	
<b>Average</b>	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](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](https://en.wikipedia.org/wiki/Operating_system)
4. [https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk\\_OQAeuVcp2O](https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O)
5. [https://www.youtube.com/watch?v=a2B69vCtjOU&list=PL3-wYxbt4yCjpcfUDz-TgD\\_ainZ2K3MUZ&index=2](https://www.youtube.com/watch?v=a2B69vCtjOU&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 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:**

	<b>Components</b>	<b>Marks</b>	<b>Total</b>
<b>CIE</b>	CIE TEST 1	40	50
	CIE TEST 2	40	
	CIE TEST 3	40	
	Quiz 1 / AAT	05	
	Quiz 2 / AAT	05	
<b>SEE</b>	SEE	50	50
<b>Grand Total</b>			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.



## B.E. in Artificial Intelligence and Data Science Scheme of UG Autonomous Program – 2021batch

### V SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	21MAT51	Linear Algebra for Machine Learning	PC	Respective Department	2	2	0	50	50	100	3
2	21ADS52	Machine Learning – II	IPC		3	0	2	50	50	100	4
3	21ADS53	Big Data Analytics	IPC		3	0	2	50	50	100	4
4	21ADS54X	Program Elective I	PEC		2	2	0	50	50	100	3
5	21ADS55	Research Methodology	PC		3	0	0	50	50	100	3
6	21ADS56X	Ability Enhancement Course – III	AEC		1	0	0	50	50	100	1
7	21CIV57	Environmental Science	HSM	Civil	1	0	0	50	50	100	1
	<b>OR</b>										
	21UHV57	Universal Human Values	HSM	Any Department							
<b>TOTAL</b>								<b>350</b>	<b>350</b>	<b>700</b>	<b>19</b>

### Program Elective I

Sl. No.	Course Code	Course Title
1	21ADS541	Introduction to NOSQL
2	21ADS542	Web Technologies

### Ability Enhancement Course – III

Sl. No.	Course Code	Course Title
1	21ADS561	Management Entrepreneurship
2	21ADS562	Software Engineering

## B.E. in Artificial Intelligence and Data Science Scheme of UG Autonomous Program – 2021batch

### VI SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	21ADS61	Neural Networks & Deep Learning	PC	Respective Department	2	2	0	50	50	100	3
2	21ADS62	Full Stack Web Development	IPC		3	0	2	50	50	100	4
3	21ADS63	Data Analytics and Visualization using Tableau	IPC		3	0	2	50	50	100	4
4	21ADS64X	Program Elective II	PEC		2	2	0	50	50	100	3
5	21ADS65X	Open Elective I	OEC	Respective Offering Department	3	0	0	50	50	100	3
6	21ADS66X	Ability Enhancement Course – IV	AEC	Respective Department	1	0	0	50	50	100	1
7	21CIV67	Environmental Science	HSM	Civil	1	0	0	50	50	100	1
	<b>OR</b>										
	21UHV67	Universal Human Values	HSM	Any Department							
8	21MPT68	Mini Project	MP	Respective Department	Two Contact hours per week			50	50	100	2
<b>TOTAL</b>								<b>400</b>	<b>400</b>	<b>800</b>	<b>21</b>

### Program Elective II

Sl. No.	Course Code	Course Title
1	21ADS641	Introduction to Quantum Computing
3	21ADS642	Computer Networks

### Open Elective I

Sl. No.	Course Code	Course Title
1	21ADS651	Big Data Analytics
2	21ADS652	Foundations of Data Science

### Ability Enhancement Course – IV

Sl. No.	Course Code	Course Title
1	21ADS661	Object-Oriented Modelling & Designing



**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER V**  
**LINEAR ALGEBRA FOR MACHINE LEARNING**

<b>Semester:</b>	<b>05</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21MAT51</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Teaching hours/Week (L:T:P):</b>	<b>2:2:0</b>	<b>Exam Hours:</b>	<b>03</b>
<b>Type of Course:</b>	<b>PC</b>	<b>Credits:</b>	<b>03</b>

To enable students to apply the knowledge of Linear Algebra in Artificial Intelligence and Machine Learning by making them to learn:

- System of linear equations.
- Vector spaces, linear transformations.
- Eigenvalues, Eigenvectors, diagonalization and Singular value decomposition

**Module 1**

System of linear equations, row reduction and echelon form, vector equations, The matrix equation  $AX = b$ . Linear independence and introduction to linear transformations.

**Module 2**

Matrix of linear transformation, matrix operations, invertible matrix, inverse of a matrix by Gauss Jordan method. Vector space, subspaces, linearly independent sets, Bases.

**Module 3**

Coordinate systems, The dimensions of a vector space, Rank, Change of basis. Eigen vectors and Eigen values, diagonalization, Eigen vectors and linear transformations.

**Module 4**

Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization.

**Module 5**

Least square solutions and fittings, diagonalization of symmetric matrices, quadratic forms, constrained optimization; Singular value decomposition.

**Course Outcomes**

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

CO51.1	Solve systems of linear equations.
CO51.2	Work within vector spaces.
CO51.3	Manipulate matrices and do matrix algebra
CO51.4	Use computational techniques for the study of Eigenvalues, Eigenvectors, and diagonalization

**Text Books:**

1. David C Lay, Linear Algebra and its applications, Pearson, 4<sup>th</sup> Edition, 2012.
2. Gilbert Strang, Linear Algebra and its Applications, Cengage Learning, 4th Edition, 2006

**Reference Book:**

1. K. Hoffman and R. Kunze, Linear Algebra, Prentice Hall, 2nd Edition, 2004.

*AShwin*

**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. Assignment marks for 10 is based on the execution of laboratory programs communicated by the course instructor.

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
<b>Grand Total</b>			<b>100</b>

CO/PO Mapping																
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO1	PSO2	PSO3	PSO4
CO51.1	3	2	1									3				
CO51.2	3	2	1									3				
CO51.3	3	2	1									3				
CO51.4	3	2	1									3				
Average	3	2	1									3				

Low-1: Medium-2: High-3

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER –V**  
**MACHINE LEARNING II**

<b>Semester:</b>	<b>05</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS52</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>3:0:2</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>IPC</b>	<b>Credits:</b>	<b>04</b>

**Prerequisites (if any):** Machine Learning I

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Supervised Learning (Classification):</b> Support Vector Machine (SVC and SVR), Kernel Methods, Random Forest, Ensemble classification methods (Bagging and Boosting Techniques).	<b>10</b>	<b>L3</b>
<b>Module 2</b>		
<b>Multiclass Classification:</b> Multiclass classification problem, Generalization bounds, Uncombined multi-class algorithms, aggregated multi-class algorithms, Performance Metrics <b>Explainable AI:</b> Introduction to XAI, LIME, SHAP. <b>Introduction to Data Annotation:</b> Images and Text.	<b>10</b>	<b>L3</b>
<b>Module 3</b>		
<b>Unsupervised Learning:</b> 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.	<b>10</b>	<b>L3</b>
<b>Module 4</b>		
<b>Hyperparameter Tuning:</b> Overview, Manual Search, Grid Search, Random Search, Random Search with Hyperopt, Bayesian Optimization, Multi-fidelity Optimization, Optuna.	<b>10</b>	<b>L3</b>
<b>Module 5</b>		
<b>Reinforcement Learning(RL):</b> 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.	<b>10</b>	<b>L3</b>

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## Course Outcomes:

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

<b>CO1</b>	Apply supervised learning techniques to real data using classification algorithms
<b>CO2</b>	Apply multiclass classification learning techniques to real data
<b>CO3</b>	Apply unsupervised learning algorithms for prediction.
<b>CO4</b>	Apply hyperparameter tuning techniques to improve the performance of the model
<b>CO5</b>	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	PS01	PS02
<b>CO1</b>	2	2	2	3	3	2					3	2	3	
<b>CO2</b>	2	2	2	3	3	2					3	2	3	
<b>CO3</b>	3	2	3	3	3	2			3		3	2	2	
<b>CO4</b>	3	2	3	3	3	2			3		3	2	3	
<b>CO5</b>	3	3	3	3	3	3			3		3	2	2	
<b>Average</b>	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 – 2<sup>nd</sup> 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, 3<sup>rd</sup> Edition, Wiley.
2. Introduction to Machine Learning|, by Ethem Alpaydin, PHI Learning, 2<sup>nd</sup> 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

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Prog. No.	Lab Programs	No. of Hours/ RBT levels
1	Write a program to demonstrate Support Vector Machine using different Kernelfunctions.	02 L3
2	Write a program to implement Bagging and Boosting classifiers.	02 L3
3	Write a program to demonstrate pipeline in Machine Learning.	02 L3
4	Write a program to classify the data using Multiclass classification algorithm 1.	02 L3
5	Write a program to classify the data using Multiclass classification algorithm 2.	02 L3
6	Write a program to cluster the data using K-Means clustering algorithm.	02 L3
7	Write a program to implement Label Propagation algorithm ( Semi – Supervised Learning)	02 L3
8	Write a program to demonstrate Random Forest algorithm and improve the performance using different Hyper Parameter Tuning Techniques (Randomized and Grid search CV).	02 L3
9	Write a program to demonstrate on classification algorithm and improve the performance using different Hyper Parameter Tuning Techniques (Bayesian and Optuna).	02 L3
10	Write a program to implement Q-Learning.	02 L3

#### 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	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Lab	20	
SEE	Semester End Examination	50	50
<b>Grand Total</b>			<b>100</b>

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER –V**  
**BIG DATA ANALYTICS**

<b>Semester:</b>	<b>05</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS53</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>3:0:2</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>IPC</b>	<b>Credits:</b>	<b>04</b>

**Prerequisites (if any):** None

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Introduction to Big Data:</b> 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.	<b>10</b>	<b>L2</b>
<b>Module 2</b>		
<b>HADOOP:</b> 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.	<b>10</b>	<b>L3</b>
<b>Module 3</b>		
<b>Hive</b> – 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. <b>Pig</b> -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.	<b>10</b>	<b>L3</b>

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<b>Module 4</b>			
<b>Essential Hadoop Tools:</b> 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.	<b>10</b>	<b>L3</b>	
<b>Module 5</b>			
<b>NoSQL Big Data Management, MongoDB and Cassandra:</b> Introduction, NoSQL DataStore, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data. Shared- Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.			
<b>Overview and History of NoSQL Databases:</b> 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.	<b>10</b>	<b>L3</b>	

### Course Outcomes:

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

<b>CO1</b>	Explain fundamentals of Big Data analytics.
<b>CO2</b>	Investigate Hadoop framework and Hadoop Distributed File system
<b>CO3</b>	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
<b>CO4</b>	Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.
<b>CO5</b>	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
<b>CO1</b>	3	2	1		2			1		2		2	3	
<b>CO2</b>	2	3	1		2			1		2		2	3	
<b>CO3</b>	1	2	3		2			1		2		2	3	
<b>CO4</b>	1	2	3		2			1		2		2	3	
<b>CO5</b>	3	3	3		2			1		2		2	3	
<b>Average</b>	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, 1<sup>st</sup> Edition, 2016
3. Seema Acharya, Subhashini Chellappan, Big data and Analytics, Wiley publications, 2<sup>nd</sup> Edition, 2019.

*AShwin*

**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](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/>

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**

	<b>Component</b>	<b>Marks</b>	<b>Total Marks</b>
<b>CIE</b>	CIE Test-1	<b>30</b>	<b>50</b>
	CIE Test-2	<b>30</b>	
	CIE Test-3	<b>30</b>	
	Laboratory	<b>20</b>	
<b>SEE</b>	Semester End Examination	<b>100</b>	<b>50</b>
<b>Grand Total</b>			<b>100</b>

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**SEMESTER –V**

**INTRODUCTION TO NOSQL**

**Program Elective - I**

<b>Semester:</b>	<b>05</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS541</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>2:2:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type o Course:</b>	<b>PEC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any): Basic Knowledge about DBMS.**

**Course Learning Objectives:**

<b>Sl. No.</b>	<b>Course Learning Objectives (CLO)</b>
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.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<p><b>Overview and History of NoSQL Databases:</b> 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.</p>	<b>08</b>	<b>L3</b>
<b>Module 2</b>		
<p><b>Comparison of relational databases to new NoSQL stores:</b> 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.</p> <p><b>Distribution Models:</b> Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.</p>	<b>08</b>	<b>L3</b>
<b>Module 3</b>		
<p><b>Map-Reduce on databases:</b> Basics, Partitioning and Combining, Composing Map-Reduce Calculations.</p> <p><b>NoSQL Key/Value databases using MongoDB:</b> 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.</p>	<b>08</b>	<b>L3</b>
<b>Module 4</b>		
<p><b>Column- oriented NoSQL databases using Apache HBASE and Cassandra:</b> 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.</p>	<b>08</b>	<b>L3</b>

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Module 5			
<b>NoSQL Key/Value databases using Riak:</b> 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.		<b>08</b>	<b>L3</b>
<b>Graph NoSQL databases using Neo4(Graph Databases):</b> Graph structure, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.			

### Course Outcomes:

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

<b>CO1</b>	Explain and compare different types of NoSQL Databases
<b>CO2</b>	Compare and contrast RDBMS with different NoSQL databases.
<b>CO3</b>	Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.
<b>CO4</b>	Explain performance tune of Key-Value Pair NoSQL databases.
<b>CO5</b>	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
<b>CO1</b>	3	2	1		2			1		2		2	3	
<b>CO2</b>	2	3	1		2			1		2		2	3	
<b>CO3</b>	1	2	3		2			1		2		2	3	
<b>CO4</b>	1	2	3		2			1		2		2	3	
<b>CO5</b>	3	3	3		2			1		2		2	3	
<b>Average</b>	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, 1<sup>st</sup> Edition, 2012.

### Reference Books:

1. Making Sense of NoSQL, Dan McCreary and Ann Kelly, Manning publications, 1<sup>st</sup> 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/>

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## 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

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER –V**  
**WEB TECHNOLOGIES**  
**Program Elective - I**

<b>Semester:</b>	<b>05</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS542</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>2:2:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PEC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** None

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Website Basics:</b> Clients, Servers and communication, The Internet, World wide web, HTTP Request message, HTTP response message, Web Clients, Web Servers	<b>08</b>	<b>L2</b>
<b>Introduction to HTML:</b> 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.		
<b>Module 2</b>		
<b>Introduction to CSS:</b> What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.	<b>08</b>	<b>L2</b>
<b>HTML Tables and Forms:</b> Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility		
<b>Module 3</b>		
<b>Advanced CSS:</b> Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design	<b>08</b>	<b>L2</b>
<b>Module 4</b>		
<b>JavaScript:</b> 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	<b>08</b>	<b>L3</b>
<b>Module 5</b>		
<b>PHP:</b> 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.	<b>08</b>	<b>L3</b>

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## Course Outcomes:

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

<b>CO1</b>	Adapt HTML syntax and semantics to build web pages.
<b>CO2</b>	Construct and visually format tables and forms using HTML and CSS
<b>CO3</b>	Construct complex layouts to build web pages.
<b>CO4</b>	Develop Client-Side Scripts using JavaScript to display the contents dynamically
<b>CO5</b>	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
<b>CO1</b>	2	2	2									3	3	
<b>CO2</b>	2	2	2									3	3	
<b>CO3</b>	2	2	2									3	3	
<b>CO4</b>	3	3	3									3	3	
<b>CO5</b>	3	3	3									3	3	
<b>Average</b>	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'Reilly Publications (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](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://www.w3schools.com/xml/ajax_intro.asp) <https://jquery.com>

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## 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 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
<b>CIE</b>	CIE Test-1	<b>40</b>	<b>50</b>
	CIE Test-2	<b>40</b>	
	CIE Test-3	<b>40</b>	
	Quiz 1/AAT	<b>05</b>	
	Quiz 2/AAT	<b>05</b>	
<b>SEE</b>	Semester End Examination	<b>50</b>	<b>50</b>
<b>Grand Total</b>			<b>100</b>



**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER V**  
**RESEARCH METHODOLOGY**

<b>Semester:</b>	<b>05</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS55</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>3:0:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** None

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
1	To orient the student to make an informed choice from the large number of alternative methods and experimental designs available
2	It enable the student to present a good research paper and familiarize the student with the nature of research and scientific writing skills
3	Helps the student to undertake a research project, to present a conference COURSE and to write a scientific article.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Research Methodology</b> An Introduction Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, and Importance of Knowing How Research is Done, Research Process, Criteria of Good Research. <b>Defining the Research Problem:</b> Definition of Research Problem, Selecting the Problem, Necessity of Defining the Problem Technique Involved in Defining a Problem.	<b>8</b>	<b>L3</b>
<b>Module 2</b>		
<b>Literature Review:</b> Review concepts and Theories. <b>Formulation of Hypothesis:</b> Source of Hypothesis, Characteristic of Hypothesis, Role and Test of Hypothesis. <b>Research Design, Sampling Design:</b> Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques. <b>Data Collection:</b> Observation Method, Interview Method, Questionnaires, Case Study Method	<b>8</b>	<b>L3</b>
<b>Module 3</b>		
<b>Models of Research:</b> Evolutive and Evaluative, Identificatory and Impact studies, Projective and Predictive, Collative, Historical, Comparative.	<b>8</b>	<b>L3</b>
<b>Module 4</b>		
<b>Writing:</b> Article, Essay, Research Paper, Research Project, Thesis, Book, Reviews - Book Review; Case Review, Research Ethics <b>Citation Methods:</b> Foot Note, Text Note, End Note, Bibliography.	<b>8</b>	<b>L3</b>
<b>Module 5</b>		
<b>Use of tools/techniques for Research:</b> Software for paper formatting like LaTeX/MS Office, and Software for detection of Plagiarism.	<b>8</b>	<b>L3</b>

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### Course Outcomes:

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

<b>CO1</b>	Define research and discuss the research process and research methods.
<b>CO2</b>	Apply knowledge gained from the research process in order to plan and execute a research project.
<b>CO3</b>	Effectively and efficiently use the library and its resources in gathering information related to the learners' research project.
<b>CO4</b>	Experiment methods to perform basic operations with Excel spreadsheets and to sketch graphs and diagrams using Excel and insert these graphs and diagrams into Word
<b>CO5</b>	Interpret ideas to present a conference COURSE/poster at a national/international level

### CO / PO Mapping

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

High-3: Medium-2: Low-1

### Text Books:

1. Kothari C.R., "Research Methodology – Methods and Techniques", New Age International, New Delhi, (reprint 2011).

### Reference Books:

1. Krishnaswamy, K.N. Sivkumar , Appa Iyer and Mathiranjana M., "Management Research Methodology: Integration of Principles, Method and Techniques", Pearson Education, New Delhi, 2006.

### E-Books / Web References:

1. NPTEL Lecture: <https://nptel.ac.in/courses/>

### 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-athon/ 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:

<b>Table 1: CIE Evaluation</b>		
<b>Components</b>	<b>Marks</b>	<b>Total</b>
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.**

**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 – V**  
**MANAGEMENT ENTREPRENEURSHIP**  
**Ability Enhancement Course III**

<b>Semester:</b>	<b>05</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS561</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>1:0:0</b>	<b>Examination Hours:</b>	<b>01</b>
<b>Type of Course:</b>	<b>AEC</b>	<b>Credits:</b>	<b>01</b>

**Prerequisites: NIL**

**Course Objectives:**

This Course will enable the students to:

1	Explain the principles of management, organization and entrepreneur.
2	Understand the importance of planning, organizing, staffing, directing and controlling and gain the leadership qualities required to run an enterprise.
3	Illustrate the ability to recognize a business opportunity either locally or globally.
4	Infer the importance of ERP, intellectual property rights and understand the significance of institutional support
5	Elucidate how to launch an entrepreneurial career.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<p><b>Introduction:</b> 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.</p> <p><b>Case Study:</b> The Bangalore International Airport</p>	<b>02</b>	<b>L2</b>
<b>Module 2</b>		
<p><b>Directing and controlling-</b> Meaning and Nature of Directing, Leadership Styles, Motivation Theories (Maslows Need Hierarchy Theory, ERG Herberg's two factor theory), Communication- Meaning and importance, Coordination meaning and importance, Controlling- meaning, steps in controlling- meaning, steps in controlling, Methods of establishing control.</p> <p><b>Case Study:</b> True Lies in Satyam</p>	<b>02</b>	<b>L2</b>
<b>Module 3</b>		
<p><b>Entrepreneur</b> – 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.</p> <p><b>Case Study:</b> Mokshagundam Visvesvaraya, Mohan Singh Oberoi: From Homeless to Hotelier</p>	<b>02</b>	<b>L2</b>
<b>Module 4</b>		
<p><b>Preparation of project and ERP</b> - 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- ERP and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation.</p> <p><b>Case Study:</b> Naresh Goyal &amp; Jet Airways</p>	<b>02</b>	<b>L2</b>

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<b>Module 5</b>			
<b>Micro and Small Enterprises:</b> Definition of micro and small enterprises, Classification of MSMED, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises, Government of India industrial policy 2007 on micro and small enterprises.	<b>02</b>	<b>L2</b>	
<b>Case Study:</b> Shahnaz Husain- The Ayurveda Entrepreneur			

**COURSE OUTCOMES:**

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

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

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

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 Entrepreneurship- Kanishka Bedi- Oxford University Press-2017.

**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.

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## MOOCs

1. <http://nptel.ac.in>
2. <https://www.khanacademy.org/>
3. <https://www.class-central.com> (MOOCs)
4. E-learning: [www.vtu.ac.in](http://www.vtu.ac.in)

## 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 below Table .**

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

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

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER – V**  
**SOFTWARE ENGINEERING**  
**Ability Enhancement Course III**

<b>Semester:</b>	<b>05</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS562</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>1:0:0</b>	<b>Examination Hours:</b>	<b>01</b>
<b>Type of Course:</b>	<b>AEC</b>	<b>Credits:</b>	<b>01</b>

**Prerequisites: NIL**

**Course Objectives:**

This Course will enable the students to:

1	Outline software engineering principles and activities involved in building large software programs. Identify ethical and professional issues and explain why they are of concern to software engineers.
2	Explain the fundamentals of object oriented concepts.
3	Describe the process of requirements gathering, requirements classification, requirements specification and requirements validation. Differentiate system models, use UML diagrams and apply design patterns.
4	Discuss the distinctions between validation testing and defect testing.
5	Recognize the importance of software maintenance and describe the intricacies involved in software evolution. Apply estimation techniques, schedule project activities and compute pricing

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Introduction:</b> Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. <b>Software Processes: Models:</b> Waterfall Model, Incremental Model and Spiral Model. Process activities. <b>Requirements Engineering:</b> Requirements Engineering Processes. Requirements Elicitation and Analysis. Functional and non-functional requirements. The software Requirements Document. Requirements Specification. Requirements validation. Requirements Management.	<b>02</b>	<b>L2</b>
<b>Module 2</b>		
<b>Object Oriented Concepts:</b> What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models.	<b>02</b>	<b>L2</b>
<b>Module 3</b>		
<b>System Models:</b> Context models. Interaction models. Structural models. Behavioral models. Model-driven engineering. <b>Design and Implementation:</b> Introduction to RUP, Design Principles. Object-oriented design using the UML. Design patterns. Implementation issues. Open source development.	<b>02</b>	<b>L2</b>

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<b>Module 4</b>		
<b>Software Testing:</b> Development testing, Test-driven development, Release testing, User testing. Test Automation.	<b>02</b>	<b>L2</b>
<b>Module 5</b>		
<b>Project Planning:</b> Software pricing. Plan-driven development. <b>Project scheduling:</b> Estimation techniques. <b>Quality management:</b> Software quality, Reviews and inspections, Software measurement and metrics, Software standards.	<b>02</b>	<b>L2</b>

**COURSE OUTCOMES:**

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

<b>CO1</b>	Design a software system, component, or process to meet desired needs within realistic constraints.
<b>CO2</b>	Assess professional and ethical responsibility.
<b>CO3</b>	Function on multi-disciplinary teams.
<b>CO4</b>	Use the techniques, skills, and modern engineering tools necessary for engineering practice.
<b>CO5</b>	Analyze, design, implement, verify, validate, implement, apply, and maintain software systems or parts of software systems.

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

Low-1: Medium-2: High-3

**Text Books:**

1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.
2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005.

**Reference Books:**

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India

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**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**

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





**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER – V**  
**ENVIRONMENTAL SCIENCE**

<b>Semester:</b>	<b>05</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21CIV57</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>1:0:0</b>	<b>Examination Hours:</b>	<b>01</b>
<b>Type of Course:</b>	<b>HSM</b>	<b>Credits:</b>	<b>01</b>

**Prerequisites: NIL**

**Course Objectives:**

This Course will enable the students to:

1	The fundamentals of environmental science.
2	The types of natural resources
3	The various global environmental concerns.
4	The types of wastes generated and their handling at a basic level
5	The area of environmental law and policies with a few important acts in the field

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Environment:</b> <ul style="list-style-type: none"> <li>• Definition, scope &amp; importance</li> <li>• Components of Environment Ecosystem: Structure and function of various types of ecosystems</li> <li>• Human Activities – Food, Shelter, and Economic &amp; Social Security.</li> <li>• Population - Growth, variation among nations – population explosion and impact on environment</li> </ul> <b>Biodiversity:</b> Types, Value; Hot spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.	<b>04</b>	<b>L2</b>
<b>Module 2</b>		
<b>Natural Resources:</b> Forest, Water, Mineral, Food, Energy, Land Environmental Pollution - Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards.	<b>04</b>	<b>L2</b>
<b>Module 3</b>		
<b>Global Environmental Concerns</b> (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.	<b>04</b>	<b>L2</b>
<b>Module 4</b>		
<b>Sources:</b> Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Solid Waste Management Rules in India Sources and management of E – Waste, Biomedical Waste, Hazardous waste, and construction waste at individual and community level. Socio-economic aspect of waste management Environmental Toxicology.	<b>04</b>	<b>L2</b>
<b>Module 5</b>		
<b>Latest Developments in Environmental Pollution Mitigation Tools</b> (Concept and Applications): Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship, NGOs.	<b>04</b>	<b>L2</b>

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## COURSE OUTCOMES:

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

CO1	Understand holistically the key concepts “Environment”, and “Biodiversity”.
CO2	Classify the types of natural resources available and the effects of anthropogenic interventions.
CO3	Express the gravity of various global environmental concerns.
CO4	Categorize the types of wastes generated and their handling at a basic level.
CO5	Understand the importance of environmental law and policies.

### 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
3. Gilbert M.Masters, Introduction to Environmental Engineering and Science, 2nd edition, Pearson Education, 2004

### Reference books:

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 References:

1. <https://www.hzu.edu.in/bed/E%20V%20S.pdf>
2. [https://onlinecourses.nptel.ac.in/noc23\\_hs155/preview](https://onlinecourses.nptel.ac.in/noc23_hs155/preview)
3. [https://onlinecourses.swayam2.ac.in/cec19\\_bt03/preview](https://onlinecourses.swayam2.ac.in/cec19_bt03/preview)

### Scheme of Examination:

**Semester End Examination (SEE):** SEE Question paper is to be set for 50 marks with multiple choice questions of 1 mark each covering all aspects of the syllabus.

**Continuous Internal Evaluation (CIE):** Three Tests are to be conducted for 50 marks each. The average of the three tests are taken for computation of CIE. Question paper for each of the CIE is to be of the multiple-choice type with 50 question each.

Typical Evaluation pattern for regular courses is shown in Table.

**Table 1: Distribution of weightage for CIE & SEE for 1 credit course**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	50
	CIE Test-2	50	
	CIE Test-2	50	
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
21CIV57.1/67.1	2	-	-	-	-	-	3	-	-	-	-	-	1	-	-
21CIV57.2/67.2	2	1	-	-	-	-	3	-	-	-	-	1	1	-	1
21CIV57.3/67.3	2	-	2	-	-	2	3	1	-	-	-	1	1	-	1
21CIV57.4/67.4	2	2	-	-	-	2	3	-	-	-	-	-	-	-	1
21CIV57.5/67.5	2	-	-	-	-	2	3	-	-	-	-	-	-	1	1
Average	2	1.5	2	-	-	2	3	1	-	-	-	1	1	1	1

Low-1: Medium-2: High-3

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER – V**  
**UNIVERSAL HUMAN VALUES**

<b>Semester:</b>	<b>05</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21UHV57</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>1:0:0</b>	<b>Examination Hours:</b>	<b>01</b>
<b>Type of Course:</b>	<b>HSM</b>	<b>Credits:</b>	<b>01</b>

**Prerequisites: NIL**

**Course Objectives:**

This Course will enable the students to:

1	To create an awareness on Engineering Ethics and Human Values.
2	To understand social responsibility of an engineer.
3	To appreciate ethical dilemma while discharging duties in professional life.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Introduction to Value Education</b> <ul style="list-style-type: none"> <li>• Value Education, Definition, Concept and Need for Value Education.</li> <li>• The Content and Process of Value Education.</li> <li>• Basic Guidelines for Value Education,</li> <li>• Self-exploration as a means of Value Education.</li> <li>• Happiness and Prosperity as parts of Value Education.</li> </ul>	<b>05</b>	<b>L2</b>
<b>Module 2</b>		
<b>Harmony in the Human Being</b> <ul style="list-style-type: none"> <li>• Human Being is more than just the Body.</li> <li>• Harmony of the Self ('I') with the Body.</li> <li>• Understanding Myself as Co-existence of the Self and the Body.</li> <li>• Understanding Needs of the Self and the needs of the Body.</li> <li>• Understanding the activities in the Self and the activities in the Body.</li> </ul>	<b>05</b>	<b>L2</b>
<b>Module 3</b>		
<b>Harmony in the Family and Society and Harmony in the Nature</b> <ul style="list-style-type: none"> <li>• Family as a basic unit of Human Interaction and Values in Relationships.</li> <li>• The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love,</li> <li>• Comprehensive Human Goal: The Five Dimensions of Human Endeavour.</li> <li>• Harmony in Nature: The Four Orders in Nature.</li> <li>• The Holistic Perception of Harmony in Existence.</li> </ul>	<b>05</b>	<b>L2</b>
<b>Module 4</b>		
<b>Social Ethics</b> <ul style="list-style-type: none"> <li>• The Basics for Ethical Human Conduct, Defects in Ethical Human Conduct.</li> <li>• Holistic Alternative and Universal Order,</li> <li>• Universal Human Order and Ethical Conduct.</li> <li>• Human Rights violation and Social Disparities.</li> </ul>	<b>05</b>	<b>L2</b>
<b>Module 5</b>		
<b>Professional Ethics</b> <ul style="list-style-type: none"> <li>• Value based Life and Profession., Professional Ethics and Right Understanding.</li> <li>• Competence in Professional Ethics.</li> <li>• Issues in Professional Ethics – The Current Scenario.</li> <li>• Vision for Holistic Technologies</li> <li>• Production System and Management Models.</li> </ul>	<b>05</b>	<b>L2</b>

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**COURSE OUTCOMES:**

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

<b>CO1</b>	Understand the significance of value inputs in a classroom and start applying them in their life and profession
<b>CO2</b>	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
<b>CO3</b>	Understand the role of a human being in ensuring harmony in society and nature.
<b>CO4</b>	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

**Textbooks:**

1.A.N Tripathy, New Age International Publishers, 2003. 2.Bajpai. B. L, New Royal Book Co, Lucknow, Reprinted, 2004 3.Bertrand Russell Human Society in Ethics & Politics

**Reference books:**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Corliss Lamont, Philosophy of Humanism.
4. Gaur. R.R. , Sangal. R, Bagari G.P, A Foundation Course in Value Education,Excel Books, 2009.
5. Gaur. R.R. , Sangal R , Bagaria G.P, Teachers Manual, Excel Books, 2009.
6. I.C. Sharma, Ethical Philosophy of India, Nagin & co, Julundhar
7. William Lilly- Introduction to Ethics -Allied Publisher

**Scheme of Examination:**

Semester End Examination (SEE): SEE Question paper is to be set for 50 marks with multiple choice questions of 1 mark each covering all aspects of the syllabus.

**Continuous Internal Evaluation (CIE):** Three Tests are to be conducted for 50 marks each. The average of the three tests are taken for computation of CIE. Question paper for each of the CIE is to be of the multiple-choice type with 50 question each.

Typical Evaluation pattern for regular courses is shown in Table.

**Table 1: Distribution of weightage for CIE & SEE for 1 credit course**

	Component	Marks	Total Marks
<b>CIE</b>	CIE Test-1	<b>50</b>	<b>50</b>
	CIE Test-2	<b>50</b>	
	CIE Test-2	<b>50</b>	
<b>SEE</b>	Semester End Examination	<b>50</b>	<b>50</b>
<b>Grand Total</b>			<b>100</b>

<b>CO/PO Mapping</b>																
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
21UHV57.1/67.1	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
21UHV57.2/67.2	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
21UHV57.3/67.3	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
21UHV57.4/67.4	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
<b>Average</b>	-	-	-	-	-	-	-	<b>2</b>	-	-	-	<b>1</b>	-	-	-	-

**Low-1: Medium-2: High-3**

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER –VI**  
**NEURAL NETWORKS & DEEP LEARNING**

<b>Semester:</b>	<b>06</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS61</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>2:2:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PC</b>	<b>Credits:</b>	<b>03</b>

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

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Introduction:</b> 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.	<b>10</b>	<b>L2</b>
<b>Module 2</b>		
<b>Convolutional Neural Networks:</b> Mathematics behind CNN, Layers, Architectures of CNN, ILSVRC winner architectures, Implementation of CNN, Building the model from the scratch	<b>10</b>	<b>L3</b>
<b>Module 3</b>		
<b>Introduction:</b> Gradient based approaches, Visualizing gradients, Saliency map, Class Model, SmoothGRAD, DeConvolution, Guided Back Propagation Grad-CAM, Occlusion sensitivity	<b>10</b>	<b>L3</b>
<b>Module 4</b>		
<b>Recurrent Neural Networks:</b> Types of RNN, Challenges in training RNN: Exploding and Vanishing Gradients, Networks with Memory <b>Long Short-Term Memory (LSTM):</b> 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	<b>10</b>	<b>L3</b>

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Module 5		
<b>Other Deep Learning Architectures:</b> Encoder-Decoder Architecture, Attention Mechanism, Transformer Architecture, Generative Adversarial Networks, Unet.	<b>10</b>	<b>L3</b>

### Course Outcomes:

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

<b>CO1</b>	Understand the fundamental concepts in the neural networks.
<b>CO2</b>	Apply deep neural models to various learning problems.
<b>CO3</b>	Develop insight behind the theory of deep learning methods (CNN, RNN, etc.).
<b>CO4</b>	Design Deep Learning Methods for working with sequential data.
<b>CO5</b>	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
<b>CO1</b>	2	2	2	3	3	2					3	2	3	
<b>CO2</b>	2	2	2	3	3	2					3	2	3	
<b>CO3</b>	3	2	3	3	3	2			3		3	2	2	
<b>CO4</b>	3	2	3	3	3	2			3		3	2	3	
<b>CO5</b>	3	3	3	3	3	3			3		3	2	2	
<b>Average</b>	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, 1<sup>st</sup> 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/>

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### **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:

<b>Table 1: CIE Evaluation</b>		
<b>Components</b>	<b>Marks</b>	<b>Total</b>
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**  
**FULL STACK WEB DEVELOPMENT**

<b>Semester:</b>	<b>06</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS62</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L:T:P):</b>	<b>3: 0 :2</b>	<b>Duration of SEE(Hours):</b>	<b>03</b>
<b>Type of Course</b>	<b>IPC</b>	<b>Credits</b>	<b>04</b>

**Prerequisites:** HTML, CSS and JavaScript

**Course Learning Objectives:**

1	To independently set up a React project, create React components, and apply styling techniques
2	To effectively manage component state, pass and utilize props for data flow, and implement parent-child communication within React applications.
3	To design and implement dynamic forms, applying form validation techniques, and configuring routing for multi-page React applications
4	To independently set up a Node.js web server, manage packages with NPM, implement routing, and utilize middleware in Express.js.
5	To design MongoDB schemas and seamlessly connecting a Node.js application to a MongoDB database for efficient data management and retrieval

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Introduction to React JS:</b> Why React? What is React? Features of React, setting up a React Project, Hello React, React Component, React JSX, styling react components.	<b>8</b>	<b>L3</b>
<b>Module 2</b>		
<b>State and Props:</b> Why Props and State? How to work with state?, useState, how to use props, passing methods as Props, Accessing Child Nodes	<b>8</b>	<b>L3</b>
<b>Module 3</b>		
<b>React Forms and Router:</b> Why Forms? React Form Elements, React refs, Routing in React styling forms, Form Validation, Routing in React: Why Router? Router Configuration	<b>8</b>	<b>L3</b>
<b>Module 4</b>		
<b>Node.js and Express.js:</b> What is node.js? Getting started with Node.js, create web server in Node.js, Node package Manager (NPM), Express Development Environment, Routing, Middleware's.	<b>8</b>	<b>L3</b>
<b>Module 5</b>		
<b>Connecting to MongoDB:</b> Introduction, Schema, Validation and defaults, Models. CRUD Operations - Create, Read, Update and Delete	<b>8</b>	<b>L3</b>

*A. Shrinidhi*



**COURSE OUTCOMES (CO): Upon completion of this course, student will be able to:**

<b>CO1</b>	Design, and style React applications, incorporating components, JSX, and basic project structure for effective user interface development
<b>CO2</b>	Demonstrate proficiency in managing component state, passing and utilizing props, and implementing parent-child component communication within React applications.
<b>CO3</b>	Design and implement dynamic forms, handle form data and events, apply form validation techniques, and configure routing for multi-page React applications.
<b>CO4</b>	Demonstrate proficiency in applying Node.js to set up a web server, utilizing NPM for package management, implementing routing and middleware in Express.js
<b>CO5</b>	Design MongoDB schemas, performing CRUD operations, and effectively connecting and interacting with MongoDB databases in web applications.

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

High-3: Medium-2: Low-1

**Textbooks:**

1. FullStack React: The Complete Book on ReactJS and Friends by Anthony Accomazzo, Nate Murray, Ari Lerner, Clay Allsopp, David Gutman, and Tyler McGinnis
2. Get Programming with Node.js by Jonathan Wexler

**Reference Books:**

1. Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB by Azat Mardan
2. Full-Stack JavaScript Development by Eric Bush.
3. Mastering Full Stack React Web Development Paperback – April 28, 2017 by TomaszDyl , Kamil Przeorski, Maciej Czarnecki

**MOOC and Online Material:**

1. Learning Full Stack Development - [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_0130944255397642242299\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944255397642242299_shared/overview)
2. IBM Full Stack Software Developer Professional Certificate – <https://www.coursera.org/professional-certificates/ibm-full-stack-cloud-developer>
3. Beginner Full Stack Web Development: HTML, CSS, React & Node – <https://www.udemy.com/course/ultimate-web/>



## 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
<b>CIE</b>	CIE Test-1	<b>30</b>	<b>50</b>
	CIE Test-2	<b>30</b>	
	CIE Test-3	<b>30</b>	
	Laboratory	<b>20</b>	
<b>SEE</b>	Semester End Examination	<b>100</b>	<b>50</b>
<b>Grand Total</b>			<b>100</b>



**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER –VI**  
**DATA ANALYTICS AND VISUALIZATION USING TABLEAU**

<b>Semester:</b>	<b>06</b>	<b>CIE Marks</b>	<b>50</b>
<b>Course Code</b>	<b>21ADS63</b>	<b>SEE Marks</b>	<b>50</b>
<b>Hours/Week (L: T: P)</b>	<b>3:0:2</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course</b>	<b>IPC</b>	<b>Credits</b>	<b>04</b>

**Prerequisites (if any):** None

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<p><b>Data Visualization:</b> Introduction to the Art and Science of Data Visualization, What is Data Visualization? Importance of Data Visualization, Data Visualization Tools, Four Pillars of Visualization, History of Data Visualization.</p> <p><b>Design Fundamentals:</b> Design Principles, Colors, and “Chart Junk”, The Shaffer 4C’s of Data Visualization, Best practices (examples).</p>	<b>08</b>	<b>L3</b>
<b>Module 2</b>		
<p><b>Storytelling with Data:</b> Creating a good data set for analysis, Selecting data for your KPIs, Approaches to storytelling with data, Dashboards, Storyboards and Infographics, The Duell Rules for Actionable Visualizations.</p> <p><b>Tableau:</b> What is Tableau? Features of Tableau, Tableau architecture, Tools of Tableau, Workspace, Connecting to data source, Files and folders, Tableau navigation, Terminologies, Data types, Data roles, Data aggregation, File types.</p>	<b>08</b>	<b>L3</b>
<b>Module 3</b>		
<p><b>Data connection:</b> Extracting data, Joining, Blending, Splits, Sorting, Fields operations.</p> <p><b>Tableau calculations:</b> Operators, Functions, Numeric, string, date, table calculations.</p>	<b>08</b>	<b>L3</b>
<b>Module 4</b>		
<p><b>Sort and filter:</b> Basic filters, Filter operations, Extract filters, Quick filters, Context filters, Condition filters, Data source filters, Top filters, Build groups, hierarchy, sets.</p> <p><b>Charts:</b> 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.</p>	<b>08</b>	<b>L3</b>

*AShuvin*

<b>Module 5</b>			
<b>Advanced Tableau:</b> Formatting, Forecasting, Trend Lines, Clustering, Regression. <b>Power BI:</b> Introduction, Features, Architecture, Visualization options, Data Analysis Expressions.		<b>08</b>	<b>L3</b>

### Course Outcomes:

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

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

### CO / PO Mapping

CO / PO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
<b>CO1</b>	2	1	3		2	2			2		2	2	3	3
<b>CO2</b>	2	1	2		2	2			2		3	2	3	2
<b>CO3</b>	1	2	3		3	2			2		2	2	3	2
<b>CO4</b>	2	1	3		3	2			2		3	2	3	3
<b>CO5</b>	2	1	3		3	2			2		3	2	3	3
<b>Average</b>	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,

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**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, 2<sup>nd</sup> 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/>

**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
<b>CIE</b>	CIE Test-1	<b>30</b>	<b>50</b>
	CIE Test-2	<b>30</b>	
	CIE Test-3	<b>30</b>	
	Laboratory	<b>20</b>	
<b>SEE</b>	Semester End Examination	<b>100</b>	<b>50</b>
<b>Grand Total</b>			<b>100</b>

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**INTRODUCTION TO QUANTUM COMPUTING**

**Program Elective II**

<b>Semester:</b>	<b>06</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS641</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P)</b>	<b>2:2:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PEC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** None

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<p><b>Introduction to Quantum Computing:</b> 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.</p>	<b>08</b>	<b>L2</b>
<b>Module 2</b>		
<p><b>Quantum bits (qubits) &amp; Quantum logic gates:</b> Quantum State Transformation, Introduction to Logic Gates, Quantum gates &amp; Circuits – Single Qubit Gates and Operations, Multiple Qubit Gates and Operations, Introduction to Quantum Simulator.</p> <p><b>Textbook:</b> Learn Quantum Computing with Python and IBM Quantum Experience by Robert Lored.</p>	<b>08</b>	<b>L2</b>
<b>Module 3</b>		
<p><b>Practical Implementation:</b> 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.</p>	<b>08</b>	<b>L3</b>
<b>Module 4</b>		
<p><b>Quantum Algorithms I:</b> No cloning theorem, Quantum Teleportation, Deutsch's-Jozsa Algorithm, Bernstein Vazirani, practical implementation of the algorithms using Qiskit.</p> <p><b>Textbook:</b> Fundamentals of Quantum Computing Theory and Practice, Venkateswaran Kasirajan, Springer, 1st Edn., 2021.</p>	<b>08</b>	<b>L3</b>
<b>Module 5</b>		
<p><b>Quantum Algorithms II:</b> Quantum Fourier transformation, Simon, Shor's, Grover's algorithm &amp; generalization, practical implementation of the algorithms using Qiskit, Introduction to Quantum Machine Learning</p> <p><b>Textbook:</b> QISKIT textbook: <a href="https://qiskit.org/textbook/content/ch-ex/">https://qiskit.org/textbook/content/ch-ex/</a>  <a href="https://medium.com/@SPX701/quantum-machine-learning-a-beginners-guide-7c7f1d349693">https://medium.com/@SPX701/quantum-machine-learning-a-beginners-guide-7c7f1d349693</a></p>	<b>08</b>	<b>L3</b>

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**Course Outcomes:**

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

<b>CO1</b>	Understand Quantum Machine Learning – What Quantum Computing Means To Data Mining.
<b>CO2</b>	Understand the basics of quantum machine learning
<b>CO3</b>	Apply by implementing quantum classification algorithms on the real dataset
<b>CO4</b>	Apply by implementing regression on the real dataset
<b>CO5</b>	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
<b>CO1</b>	3	2	1		2	2	2	1		2		2	3	
<b>CO2</b>	3	3	2	2	3	2	2	1		2		2	3	
<b>CO3</b>	3	3	3	2	3	2	2	1	2	2		3	3	
<b>CO4</b>	3	3	3	2	3	2	2	1	2	2	2	3	3	
<b>CO5</b>	3	3	3	2	3	2	2	2	2	2	2	3	3	
<b>Average</b>	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 Robert Loredó.
2. Fundamentals of Quantum Computing Theory and Practice, Venkateswaran Kasirajan, 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.

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**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):**

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 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 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**  
**COMPUTER NETWORKS**  
**Program Elective II**

<b>Semester:</b>	<b>06</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS642</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>2:2:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PEC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** Basics of Computer Networks.

**Course Learning Objectives:** The course will enable students to:

<b>Sl. No.</b>	<b>Course Learning Objectives (CLO)</b>
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

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
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.	<b>08</b>	<b>L2</b>
<b>Module 2</b>		
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	<b>08</b>	<b>L2</b>
<b>Module 3</b>		
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	<b>08</b>	<b>L2</b>
<b>Module 4</b>		
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	<b>08</b>	<b>L2</b>
<b>Module 5</b>		
Mobile AdHoc Networks and Wireless Sensor Networks: 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.	<b>08</b>	<b>L2</b>

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**Course Outcomes:**

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

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

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

High-3: Medium-2: Low-1

**Text Books:**

1. Behrouz A Forouzan, Data and 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 Bruce 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 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. CIEs 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 1.

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

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



**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**SEMESTER –VI**

**BIG DATA ANALYTICS**

**Open Elective I**

<b>Semester:</b>	<b>06</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS651</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>3:0:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>OEC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** None

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Introduction to Big Data:</b> 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.	<b>08</b>	<b>L2</b>
<b>Module 2</b>		
<b>HADOOP:</b> 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.	<b>08</b>	<b>L3</b>
<b>Module 3</b>		
<b>Hive</b> – 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. <b>Pig</b> -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.	<b>08</b>	<b>L3</b>

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<b>Module 4</b>			
<b>Essential Hadoop Tools:</b> 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.	<b>08</b>	<b>L3</b>	
<b>Module 5</b>			
<b>NoSQL Big Data Management, MongoDB and Cassandra:</b> Introduction, NoSQL DataStore, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.  <b>Overview and History of NoSQL Databases:</b> 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.	<b>08</b>	<b>L3</b>	

### Course Outcomes:

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

<b>CO1</b>	Explain fundamentals of Big Data analytics.
<b>CO2</b>	Investigate Hadoop framework and Hadoop Distributed File system
<b>CO3</b>	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
<b>CO4</b>	Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.
<b>CO5</b>	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
<b>CO1</b>	3	2	1		2			1		2		2	3	
<b>CO2</b>	2	3	1		2			1		2		2	3	
<b>CO3</b>	1	2	3		2			1		2		2	3	
<b>CO4</b>	1	2	3		2			1		2		2	3	
<b>CO5</b>	3	3	3		2			1		2		2	3	
<b>Average</b>	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, 1<sup>st</sup> Edition, 2016
3. Seema Acharya, Subhashini Chellappan, Big data and Analytics, Wiley publications, 2<sup>nd</sup> Edition, 2019.

*AShivani*

**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](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
<b>CIE</b>	CIE Test-1	<b>40</b>	<b>50</b>
	CIE Test-2	<b>40</b>	
	CIE Test-3	<b>40</b>	
	Quiz 1/AAT	<b>05</b>	
	Quiz 2/AAT	<b>05</b>	
<b>SEE</b>	Semester End Examination	<b>50</b>	<b>50</b>
<b>Grand Total</b>			<b>100</b>

*Ashwin*

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER – VI**  
**FOUNDATIONS OF DATA SCIENCE**

**Open Elective I**

<b>Semester:</b>	<b>06</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS652</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L:T:P):</b>	<b>3:0:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>OEC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** Basics of Probability

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<p><b>Introduction to Data Science:</b> Evolution of Data Science, Data Science Roles, Lifecycle of Data Science, Representation of Data Science as a Venn Diagram, Technologies revolving around Data Science.</p> <p><b>Types of Data:</b> Structured and Unstructured Data, Quantitative and Qualitative Data, Four Levels of data (Nominal, Ordinal, Interval, Ratio Level).</p> <p><b>Data Pre-processing:</b> Asking interesting question, Obtaining of data, Exploration of data, Modeling of data, Communication and visualization.</p>	<b>08</b>	<b>L2</b>
<p style="text-align: center;"><b>Module 2</b></p> <p><b>Data Mining:</b> What is Data Mining? Types of Data Mining, Challenges of implementation in Data Mining, Advantages and Disadvantages, Applications of Data Mining.</p> <p><b>Overview of Basic Data Mining Tasks:</b> Classification, Regression, Time Series Analysis, Prediction, Clustering, Sequence Discovery.</p>	<b>08</b>	<b>L3</b>
<p style="text-align: center;"><b>Module 3</b></p> <p><b>Basics of Statistics:</b> Introduction to Statistics, Terminologies in Statistics, Measures of center, variance and relative standing, Normalization of data using the z-score, Empirical rule, Categories in Statistics (Descriptive and Inferential Statistics).</p> <p><b>Descriptive Statistics:</b> 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.</p>	<b>08</b>	<b>L3</b>
<p style="text-align: center;"><b>Module 4</b></p> <p><b>Inferential Statistics:</b> 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.</p>	<b>08</b>	<b>L3</b>

*AShuin*

Module 5			
<b>Hypothesis Testing:</b> Testing simple hypotheses, Uniform tests, Two-sided alternatives, t-Test, F-Distribution, Bayes Test Procedures, Case studies based on Hypothesis Testing.		<b>08</b>	<b>L3</b>

### Course Outcomes:

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

<b>CO1</b>	Understand the basics of data science, data mining techniques.
<b>CO2</b>	Apply the advanced mining concepts.
<b>CO3</b>	Interpret the basic statistical description of data.
<b>CO4</b>	Implement Data sampling Techniques.
<b>CO5</b>	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
<b>CO1</b>	3	3	3		2			2		2		2	3	
<b>CO2</b>	3	3	3		2			2		2		2	3	
<b>CO3</b>	3	3	3		2			2		2		2	3	
<b>CO4</b>	3	3	3		2			2		2		2	3	
<b>CO5</b>	3	3	3		2			2		2		2	3	
<b>Average</b>	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, 2<sup>nd</sup> Edition, 2018
2. Probability and Statistics, by Morris H Degroot, Mark J Schervish, Pearson, 4<sup>th</sup> Edition, 2012.

### Reference Books:

1. Data Mining Concepts and Techniques by Jiawei Han and Micheline Kamber, Morgan Kaufmann, 3<sup>rd</sup> Edition, 2011.
2. Machine Learning: A probabilistic perspective, by Murphy, Kevin P, 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>

*AShwin*



### 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:

<b>Components</b>	<b>Marks</b>	<b>Total</b>
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**

**OBJECT ORIENTED MODELLING & DESIGNING**

**Ability Enhancement Course IV**

<b>Semester:</b>	<b>06</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS661</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L:T:P):</b>	<b>1:0:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>AEC</b>	<b>Credits:</b>	<b>01</b>

**Course Learning Objectives:** The students will be able to

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
1	Understand the concepts of object-oriented and basic class modelling.
2	Illustrate the class diagrams, sequence diagrams and interaction diagrams for the given problems.
3	To choose and apply a befitting design pattern for the given problem.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Advanced object and class concepts:</b> Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. State Modeling: Events, States, Transitions and Conditions, State Diagrams, State diagram behaviour.	<b>06</b>	<b>L2</b>
<b>Module 2</b>		
<b>UseCase Modelling and Detailed Requirements:</b> Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models.	<b>06</b>	<b>L3</b>
<b>Module 3</b>		
<b>Process Overview, System Conception and Domain Analysis:</b> Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model; Domain state model; Domain interaction model; Iterating the analysis.	<b>06</b>	<b>L3</b>
<b>Module 4</b>		
<b>Use case Realization:</b> The Design Discipline within up iterations: Object Oriented Design The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams Structuring the Major Components; Implementation Issues for Three-Layer Design.	<b>06</b>	<b>L3</b>
<b>Module 5</b>		
<b>Design Patterns:</b> Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only).	<b>06</b>	<b>L3</b>

*AShwin*

**Course Outcomes:**

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

<b>CO1</b>	Describe the concepts of object-oriented and basic class modelling.
<b>CO2</b>	Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
<b>CO3</b>	Choose and apply a befitting design pattern for the given problem.

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

High-3: Medium-2: Low-1

**Text Books:**

1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005
2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005.
3. Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides: Design Patterns – Elements of Reusable Object-Oriented Software, Pearson Education, 2007.

**Reference Books:**

1. Grady Booch et. al.: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson Education, 2007.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern – Oriented Software Architecture. A system of patterns, Volume 1, John Wiley and Sons, 2007.
3. Booch, Jacobson, Rumbaugh: Object-Oriented Analysis and Design with Applications, 3rd edition, Pearson, Reprint 2013

**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.

*A. Shrivastava*

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

<b>Components</b>	<b>Marks</b>	<b>Total</b>
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.

*AShivani*

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER – VI**  
**ENVIRONMENTAL SCIENCE**

<b>Semester:</b>	<b>06</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21CIV67</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>1:0:0</b>	<b>Examination Hours:</b>	<b>01</b>
<b>Type of Course:</b>	<b>HSM</b>	<b>Credits:</b>	<b>01</b>

**Prerequisites: NIL Course**

**Objectives:**

This Course will enable the students to:

1	The fundamentals of environmental science.
2	The types of natural resources
3	The various global environmental concerns.
4	The types of wastes generated and their handling at a basic level
5	The area of environmental law and policies with a few important acts in the field

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Environment:</b> <ul style="list-style-type: none"> <li>• Definition, scope &amp; importance</li> <li>• Components of Environment Ecosystem: Structure and function of various types of ecosystems</li> <li>• Human Activities – Food, Shelter, and Economic &amp; Social Security.</li> <li>• Population - Growth, variation among nations – population explosion and impact on environment</li> </ul> <b>Biodiversity:</b> Types, Value; Hot spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.	<b>04</b>	<b>L2</b>
<b>Module 2</b>		
<b>Natural Resources:</b> Forest, Water, Mineral, Food, Energy, Land Environmental Pollution - Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards.	<b>04</b>	<b>L2</b>
<b>Module 3</b>		
<b>Global Environmental Concerns</b> (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.	<b>04</b>	<b>L2</b>
<b>Module 4</b>		
<b>Sources:</b> Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Solid Waste Management Rules in India Sources and management of E – Waste, Biomedical Waste, Hazardous waste, and construction waste at individual and community level. Socio-economic aspect of waste management Environmental Toxicology.	<b>04</b>	<b>L2</b>
<b>Module 5</b>		
<b>Latest Developments in Environmental Pollution Mitigation Tools</b> (Concept and Applications): Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship, NGOs.	<b>04</b>	<b>L2</b>

*AShivam*

## COURSE OUTCOMES:

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

<b>CO1</b>	Understand holistically the key concepts “Environment”, and “Biodiversity”.
<b>CO2</b>	Classify the types of natural resources available and the effects of anthropogenic interventions.
<b>CO3</b>	Express the gravity of various global environmental concerns.
<b>CO4</b>	Categorize the types of wastes generated and their handling at a basic level.
<b>CO5</b>	Understand the importance of environmental law and policies.

### 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
3. Gilbert M.Masters, Introduction to Environmental Engineering and Science, 2nd edition, Pearson Education, 2004

### Reference books:

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 References:

- <https://www.hzu.edu.in/bed/E%20V%20S.pdf>  
[https://onlinecourses.nptel.ac.in/noc23\\_hs155/preview](https://onlinecourses.nptel.ac.in/noc23_hs155/preview)  
[https://onlinecourses.swayam2.ac.in/cec19\\_bt03/preview](https://onlinecourses.swayam2.ac.in/cec19_bt03/preview)

### **Scheme of Examination:**

**Semester End Examination (SEE):** SEE Question paper is to be set for 50 marks with multiple choice questions of 1 mark each covering all aspects of the syllabus.

**Continuous Internal Evaluation (CIE):** Three Tests are to be conducted for 50 marks each. The average of the three tests are taken for computation of CIE. Question paper for each of the CIE is to be of the multiple-choice type with 50 question each.

Typical Evaluation pattern for regular courses is shown in Table.

**Table 1: Distribution of weightage for CIE & SEE for 1 credit course**

	<b>Component</b>	<b>Marks</b>	<b>Total Marks</b>
<b>CIE</b>	CIE Test-1	<b>50</b>	<b>50</b>
	CIE Test-2	<b>50</b>	
	CIE Test-2	<b>50</b>	
<b>SEE</b>	Semester End Examination	<b>50</b>	<b>50</b>
<b>Grand Total</b>			<b>100</b>

*AShivani*

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CIV57.1/67.1	2	-	-	-	-	-	3	-	-	-	-	-	1	-	-
21CIV57.2/67.2	2	1	-	-	-	-	3	-	-	-	-	1	1	-	1
21CIV57.3/67.3	2	-	2	-	-	2	3	1	-	-	-	1	1	-	1
21CIV57.4/67.4	2	2	-	-	-	2	3	-	-	-	-	-	-	-	1
21CIV57.5/67.5	2	-	-	-	-	2	3	-	-	-	-	-	-	1	1
<b>Average</b>	<b>2</b>	<b>1.5</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>

**Low-1: Medium-2: High-3**

*A. Shrivastava*

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER – VI**  
**UNIVERSAL HUMAN VALUES**

<b>Semester:</b>	<b>06</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21UHV67</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>1:0:0</b>	<b>Examination Hours:</b>	<b>01</b>
<b>Type of Course:</b>	<b>HSM</b>	<b>Credits:</b>	<b>01</b>

**Prerequisites: NIL Course**

**Objectives:**

This Course will enable the students to:

1	To create an awareness on Engineering Ethics and Human Values.
2	To understand social responsibility of an engineer.
3	To appreciate ethical dilemma while discharging duties in professional life.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Introduction to Value Education</b> <ul style="list-style-type: none"> <li>• Value Education, Definition, Concept and Need for Value Education.</li> <li>• The Content and Process of Value Education.</li> <li>• Basic Guidelines for Value Education,</li> <li>• Self-exploration as a means of Value Education.</li> <li>• Happiness and Prosperity as parts of Value Education.</li> </ul>	<b>05</b>	<b>L2</b>
<b>Module 2</b>		
<b>Harmony in the Human Being</b> <ul style="list-style-type: none"> <li>• Human Being is more than just the Body.</li> <li>• Harmony of the Self ('I') with the Body.</li> <li>• Understanding Myself as Co-existence of the Self and the Body.</li> <li>• Understanding Needs of the Self and the needs of the Body.</li> <li>• Understanding the activities in the Self and the activities in the Body.</li> </ul>	<b>05</b>	<b>L2</b>
<b>Module 3</b>		
<b>Harmony in the Family and Society and Harmony in the Nature</b> <ul style="list-style-type: none"> <li>• Family as a basic unit of Human Interaction and Values in Relationships.</li> <li>• The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love,</li> <li>• Comprehensive Human Goal: The Five Dimensions of Human Endeavour.</li> <li>• Harmony in Nature: The Four Orders in Nature.</li> <li>• The Holistic Perception of Harmony in Existence.</li> </ul>	<b>05</b>	<b>L2</b>
<b>Module 4</b>		
<b>Social Ethics</b> <ul style="list-style-type: none"> <li>• The Basics for Ethical Human Conduct, Defects in Ethical Human Conduct.</li> <li>• Holistic Alternative and Universal Order,</li> <li>• Universal Human Order and Ethical Conduct.</li> <li>• Human Rights violation and Social Disparities.</li> </ul>	<b>05</b>	<b>L2</b>
<b>Module 5</b>		
<b>Professional Ethics</b> <ul style="list-style-type: none"> <li>• Value based Life and Profession., Professional Ethics and Right Understanding.</li> <li>• Competence in Professional Ethics.</li> <li>• Issues in Professional Ethics – The Current Scenario.</li> <li>• Vision for Holistic Technologies</li> <li>• Production System and Management Models.</li> </ul>	<b>05</b>	<b>L2</b>

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**COURSE OUTCOMES:**

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

<b>CO1</b>	Understand the significance of value inputs in a classroom and start applying them in their life and profession
<b>CO2</b>	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
<b>CO3</b>	Understand the role of a human being in ensuring harmony in society and nature.
<b>CO4</b>	Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

**Textbooks:**

1.A.N Tripathy, New Age International Publishers, 2003. 2.Bajpai. B. L, New Royal Book Co, Lucknow, Reprinted, 2004 3.Bertrand Russell Human Society in Ethics & Politics

**Reference books:**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Corliss Lamont, Philosophy of Humanism.
4. Gaur. R.R. , Sangal. R, Bagari G.P, A Foundation Course in Value Education,Excel Books, 2009.
5. Gaur. R.R. , Sangal R , Bagaria G.P, Teachers Manual, Excel Books, 2009.
6. I.C. Sharma, Ethical Philosophy of India, Nagin & co, Julundhar
7. William Lilly- Introduction to Ethics -Allied Publisher

**Scheme of Examination:**

**Semester End Examination (SEE):** SEE Question paper is to be set for 50 marks with multiple choice questions of 1 mark each covering all aspects of the syllabus.

**Continuous Internal Evaluation (CIE):** Three Tests are to be conducted for 50 marks each. The average of the three tests are taken for computation of CIE. Question paper for each of the CIE is to be of the multiple-choice type with 50 question each.

Typical Evaluation pattern for regular courses is shown in Table.

**Table 1: Distribution of weightage for CIE & SEE for 1 credit course**

	Component	Marks	Total Marks
<b>CIE</b>	CIE Test-1	50	50
	CIE Test-2	50	
	CIE Test-2	50	
<b>SEE</b>	Semester End Examination	50	50
<b>Grand Total</b>			<b>100</b>

<b>CO/PO Mapping</b>																
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
21UHV57.1/67.1	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
21UHV57.2/67.2	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
21UHV57.3/67.3	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
21UHV57.4/67.4	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-
<b>Average</b>	-	-	-	-	-	-	-	<b>2</b>	-	-	-	<b>1</b>	-	-	-	-

Low-1: Medium-2: High-3

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**SEMESTER – VI**  
**MINI PROJECT**

<b>Semester:</b>	<b>06</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21MPT68</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L:T:P):</b>	<b>0:0:2</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>MP</b>	<b>Credits:</b>	<b>02</b>

**Mini-project work:** Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

**CIE procedure for Mini-Project:**

- a. Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
- b. Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini- Project shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

**SEE for Mini-Project:**

- a. Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.
- b. Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong.

**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	Review-1	50	50
	Review-2		
SEE	Semester End Examination	50	50
<b>Grand Total</b>			<b>100</b>

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## B.E. in Artificial Intelligence and Data Science Scheme of UG Autonomous Program – 2021batch

### VII SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	21ADS71	Deep Learning for Computer Vision	PC	Respective Department	2	2	0	50	50	100	3
2	21ADS72	Natural Language Processing	IPC		3	0	2	50	50	100	4
3	21ADS73	Advanced Data Visualization	IPC		3	0	2	50	50	100	4
4	21ADS74X	Program Elective III	PEC		2	2	0	50	50	100	3
5	21ADS75X	Open Elective II	OEC	Respective Offering Department	3	0	0	50	50	100	3
6	21ADS76	Project Phase 1	MP	Two Contact hours per week			100	-	100	2	
<b>TOTAL</b>							<b>350</b>	<b>250</b>	<b>600</b>	<b>19</b>	

### Program Elective III

Sl. No.	Course Code	Course Title
1	21ADS741	Mobile Application Development
2	21ADS742	Cyber Security

### Open Elective II

Sl. No.	Course Code	Course Title
1	21ADS751	Neural Networks and Deep Learning
2	21ADS752	Data Visualization

## B.E. in Artificial Intelligence and Data Science Scheme of UG Autonomous Program – 2021batch

### VIII SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			CREDITS
					L	T	P	CIE	SEE	Total	
1	21ADS81X	Program Elective IV	PEC	Respective Department	3	0	0	50	50	100	3
2	21ADS82X	Program Elective- V	PEC		3	0	0	50	50	100	3
3	21ADS83	Project work phase – II	MP	Two Contact hours per week			100	100	200	12	
4	21ADS84	Technical Seminar	MP	One Contact hours per week			100	--	100	1	
5	21ADS85	Internship	INT	Completed during the intervening period of VI and VII Semester			100	--	100	2	
<b>TOTAL</b>							<b>400</b>	<b>200</b>	<b>600</b>	<b>21</b>	

### Program Elective IV

Sl. No.	Course Code	Course Title
1	21ADS811	Explainable Artificial Intelligence
2	21ADS812	Predictive and Time Series Analysis

### Program Elective V

Sl. No.	Course Code	Course Title
1	21ADS821	Quantum Machine Learning 2
2	21ADS822	Data Science for Security

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**SEMESTER-VII**

**DEEP LEARNING FOR COMPUTER VISION**

<b>Semester:</b>	<b>07</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS71</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>2:2:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** Image Processing & Deep Learning

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Introduction to Computer Vision</b> 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.	<b>8</b>	<b>L2</b>
<b>Module 2</b>		
<b>Object Detection</b> Basic concepts: bounding box representation, sliding window methods, anchor boxes, grid cells, and non-maximum suppression (NMS). State-of-the-art architectures: R-CNN and YOLO. Evaluation metrics: Intersection over Union (IoU) and Mean Average Precision (mAP), Practical use case.	<b>10</b>	<b>L3</b>
<b>Module 3</b>		
<b>Generative AI Models</b> Introduction to Gen AI, Types, Variational Autoencoders and GANs (Variations of GANs – cGAN, wGAN, cyclic GAN, style transfers using GAN), difference between VAEs & GANs, Image Captioning – LSTMs based, Transformers based.	<b>12</b>	<b>L3</b>
<b>Module 4</b>		
<b>Normalizing Flows and Diffusion Models</b> Diffusion process, Forward Diffusion, Reverse Diffusion, Training a diffusion model, Architecture, Guided Diffusion, Stable diffusion, Sampling Procedure, Practical Implementation.	<b>12</b>	<b>L3</b>
<b>Module 5</b>		
<b>Face Recognition</b> 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, lighting, and occlusion.	<b>8</b>	<b>L3</b>

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## Course Outcomes:

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

<b>CO1</b>	Understand the basic concepts, terminology, theories, models, and methods in the field of computer vision.
<b>CO2</b>	Apply Generative AI for text and image applications.
<b>CO3</b>	Apply diffusion models to understand the working of removal of noise.
<b>CO4</b>	Apply state-of-the-art architectures such as R-CNN and YOLO for object detection.
<b>CO5</b>	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
<b>CO1</b>	2	2	2	3	3	2					3	2	3	
<b>CO2</b>	2	2	2	3	3	2					3	2	3	
<b>CO3</b>	3	2	3	3	3	2			3		3	2	2	
<b>CO4</b>	3	2	3	3	3	2			3		3	2	3	
<b>CO5</b>	3	3	3	3	3	3			3		3	2	2	
<b>Average</b>	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 enable 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 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:

<b>Components</b>	<b>Marks</b>	<b>Total</b>
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**  
**NATURAL LANGUAGE PROCESSING**

<b>Semester:</b>	<b>07</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS72</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>3:0:2</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>IPC</b>	<b>Credits:</b>	<b>04</b>

**Prerequisites (if any):** Machine Learning and Deep Learning

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Introduction to NLP and Text Processing:</b> 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	<b>10</b>	<b>L2</b>
<b>Module 2</b>		
<b>Language Modeling:</b> 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 <b>Word embeddings:</b> 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	<b>10</b>	<b>L3</b>
<b>Module 3</b>		
<b>Syntax, Parsing:</b> Part-of-speech tagging, Dependency parsing and constituency parsing, Parsing algorithms and techniques <b>Named Entity Recognition:</b> Introduction to NER, NER techniques and tools, Applications of NER in information extraction	<b>10</b>	<b>L3</b>
<b>Module 4</b>		
<b>Applied NLP:</b> Classical NLP pipeline, Sentiment analysis applications in social media and reviews, Text classification methods, Interpreting Text Classification models, Text summarization.	<b>10</b>	<b>L3</b>

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Module 5		
<b>Machine Translation and Dialog Systems:</b> Introduction to machine translation, Statistical and neural machine translation, Types of dialog systems, Introduction to chatbots and virtual assistants	10	L3
<b>NLP Ethics and Bias:</b> Ethical considerations, Fairness, Accountability, Multilingual NLP		

### Course Outcomes:

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

<b>CO 1</b>	Understand NLP foundations, text processing techniques, and practical applications.
<b>CO 2</b>	Apply diverse language models, embeddings; adapt in practical applications.
<b>CO 3</b>	Implement tagging, parsing, Named Entity Recognition techniques.
<b>CO 4</b>	Perform classical NLP, sentiment analysis, text classification, and summarization.
<b>CO 5</b>	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	
<b>Average</b>	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 M.....
2. [file:///C:/Users/Admin/Downloads/Natural%20Language%20Processing%20in%20Action %20Understanding ,%20analyzing,%20and%20generating%20text%20with%20Python%20\(%20PDFDrive%20\).pdf](file:///C:/Users/Admin/Downloads/Natural%20Language%20Processing%20in%20Action%20Understanding,%20analyzing,%20and%20generating%20text%20with%20Python%20(%20PDFDrive%20).pdf)

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## MOOCs:

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

Prog. No.	Lab Programs
1	Write a Python program to demonstrate Lemmatization and Stemming.
2	Write a program to implement TF-IDF technique and demonstrate Word2vec embedding.
3	Write a program for implementing POS tagging and Named Entity Recognition using NLTK.
4	Write a program for spam detection using NLTK.
5	Write a program to demonstrate Neural machine translation with attention.
6	Write a program to build an NLP classifier which can use input text parameters to determine the label/s of the blog.
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.
8	Write a program to implement transfer learning, paraphrasing from iNLTK.

## 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

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**SEMESTER –VII  
ADVANCED DATA VISUALIZATION**

<b>Semester:</b>	<b>07</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS73</b>	<b>SEE Marks;</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>3:0:2</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>IPC</b>	<b>Credits:</b>	<b>04</b>

**Prerequisites (if any):** None

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<p><b>Data Modelling in Tableau:</b> 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.</p> <p>Table summary statistics – show percentage of values down and across the table.</p> <p>Dynamic population of Rows and columns with Parameterization.</p> <p>Students will Perform analysis on various datasets to understand the above concepts.</p>	<b>10</b>	<b>L3</b>
<p align="center"><b>Module 2</b></p> <p><b>Level of Details Expression (LOD) fundamentals:</b> 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.</p> <p>Ranking at multiple levels, Bringing Data on a dual Axis, Creating moving averages chart.</p> <p>Reference bands and distribution bands with parameterization.</p> <p>Students will Perform analysis on various datasets to understand the above concepts.</p>	<b>12</b>	<b>L3</b>
<b>Module 3</b>		
<p><b>Machine Learning using Tableau/Python:</b>Installation of TabPy server. Conne between Tableau and Python using TapPy.</p>	--	--

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<p>Passing Data from Tableau to Python, Simple and Multiple Linear regression in Tableau using TabPy server.</p> <p>Passing Data from Tableau to Python for Classification examples, executing Naïve Bayes, Random Forest, Decision Tree using, SVM etc. from Tableau through TabPy Server.</p> <p>Clustering.</p> <p>Dashboard creation and Fundamentals.</p> <p>Tableau Prep Builder Basics.</p> <p>Students will Perform analysis on various datasets to understand the above concepts.</p>		
<b>Module 4</b>		
<p><b>Importing Data into PowerBI:</b> 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.</p> <p>Sort and Filters, Slicing, Simple and multi-level Ranking.</p> <p>Data Modelling in PowerBI, Performing Data Analysis on a relational Model, Create Model Relationships, Building Visualizations using related data from the data Model.</p> <p>Students will Perform analysis on various datasets to understand the above concepts.</p>	<b>10</b>	<b>L3</b>
<b>Module 5</b>		
<p><b>The language of Power BI - Data Analysis Expressions (DAX) Engine Basics:</b> Aggregate functions – AVERAGE, AVERAGEX, AVERAGEA, COUNT, COUNTA, COUNTX, MAX, MAXA, MAXX, MIN, MINA, MINX, SUM, SUMA, SUMX.</p> <p>Date Functions – DATE, DAY, MONTH, YEAR, DATEDIFF</p> <p>Filter Functions – ALL, ALLEXCEPT, ALLSELECTED, CALCULATE, CALCULATETABLE, KEEPFILTERS, SELECTEDVALUE</p> <p>Table Manipulation functions – ADDCOLUMNS, CROSSJOIN, CURRENTGROUP, DATATABLE, GENERATE, GENERATEALL, GROUPBY, NATURALJOIN, NATURALOUTERJOIN, SELECTCOLUMNS, SUMMARIZE, SUMARIZECOLUMNS, TOPN, VALUES</p> <p>DAX statements – DEFINE, EVALUATE, ORDER BY, VAR</p> <p>Creating Measures, Calculated Columns and Tables. Problem solving Techniques using Measures and Calculated columns and Tables using above functions.</p> <p>Dashboard creation.</p> <p>Students will Perform analysis on various datasets to understand the above concepts.</p>	<b>10</b>	<b>L3</b>

*A. Shrivastava*

**Course Outcomes:**

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

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

<b>CO / PO Mapping</b>														
<b>CO / PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>CO1</b>	2	1	3		2	2			2		2	2	3	3
<b>CO2</b>	2	1	2		2	2			2		3	2	3	2
<b>CO3</b>	1	2	3		3	2			2		2	2	3	2
<b>CO4</b>	2	1	3		3	2			2		3	2	3	3
<b>CO5</b>	2	1	3		3	2			2		3	2	3	3
<b>Average</b>	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 1<sup>st</sup> 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. Microsoft Power BI Cookbook – Brett Powell, Packt Publishing, 2017 (Free online PDF download available)
4. Microsoft PowerBI web reference – [learn.microsoft.com/en-us/dax](http://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

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**SEMESTER –VII  
MOBILE APPLICATION DEVELOPMENT  
Program Elective III**

<b>Semester:</b>	<b>07</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS741</b>	<b>SEE Marks;</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>2:2:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PEC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** Web Application Development, Android, HTML, CSS

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
1	To facilitate students to understand android SDK
2	To help students to gain a basic understanding of Android application development
3	To inculcate working knowledge of Android Studio development tool

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Introduction to Android:</b> The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.	8	L3
<b>Module 2</b>		
<b>Android Application Design Essentials:</b> Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.	8	L3
<b>Module 3</b>		
<b>Android User Interface Design Essentials:</b> User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.	8	L3
<b>Module 4</b>		
<b>Testing and Publishing Android applications:</b> Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.	8	L3
<b>Module 5</b>		
<b>Using Common Android APIs:</b> Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.	8	L3

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**Course Outcomes:**

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

<b>CO1</b>	Identify various concepts of mobile programming that make it unique from programming for other platforms.
<b>CO2</b>	Critique mobile applications on their design pros and cons.
<b>CO3</b>	Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
<b>CO4</b>	Program mobile applications for the Android operating system that use basic and advanced phone features.
<b>CO5</b>	Deploy applications to the Android marketplace for distribution.

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

High-3: Medium-2: Low-1

#### Text Books:

1. T1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd ed. (2011)

#### Reference Books:

1. R1. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd
2. R2. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd
3. R3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

#### E-Books / Web References:

- 1) <https://www.pdfdrive.com/learning-mobile-app-development-a-hands-on-guide-to-building-apps-with-ios-and-android-e26950217.html>
- 2) <https://www.pdfdrive.com/android-app-development-in-android-studio-javaandroid-edition-for-beginners-e60596566.html>
- 3) <https://www.pdfdrive.com/beginning-android-web-apps-development-develop-for-android-using-html5-css3-and-javascript-e167050626.html>

#### MOOCs:

- 1) <https://www.coursera.org/courses?query=mobile%20app%20development>
- 2) <https://www.coursera.org/learn/intro-to-mobile-development>
- 3) <https://www.coursera.org/learn/html-css-javascript-for-web-developers>
- 4) [https://onlinecourses.nptel.ac.in/noc20\\_cs52/preview](https://onlinecourses.nptel.ac.in/noc20_cs52/preview)

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### **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:**

<b>Components</b>	<b>Marks</b>	<b>Total</b>
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**  
**Program Elective III**

<b>Semester:</b>	<b>07</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS742</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>2:2:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PEC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** Basics of Computer Networks.

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Understanding Cyber Crime:</b> 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,	<b>8</b>	<b>L2</b>
<b>Module 2</b>		
<b>Cyber Crime in Devices:</b> 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	<b>8</b>	<b>L2</b>
<b>Module 3</b>		
<b>Cyberspace and the Law &amp; Cyber Forensics:</b> 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	<b>8</b>	<b>L2</b>
<b>Module 4</b>		
<b>Tools and method used in Cybercrime:</b> 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	<b>8</b>	<b>L2</b>

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Module 5			
<b>Privacy Issues:</b> 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.		<b>8</b>	<b>L3</b>
<b>Cybercrime: Examples and Mini-Cases:</b> The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.			

### Course Outcomes:

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

<b>CO1</b>	Describe cybercrime, its classifications and various types of Cyber attacks
<b>CO2</b>	Describe the organizational methods and policies for cyber-crime handling in mobile and wireless devices
<b>CO3</b>	Understand Cyber Security Regulations and Roles of International Law and Learn, analyze and validate Forensics Data
<b>CO4</b>	Distinguish the different tools and methods used in cybercrime and discuss the impact of Phishing
<b>CO5</b>	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
<b>CO1</b>	1	2	1	1				1		1		1		1
<b>CO2</b>	2	2	1	1				1		1		1		1
<b>CO3</b>	2	2	1	1				1		1		1		1
<b>CO4</b>	2	2	1	1				1		1		1		1
<b>CO5</b>	2	2	1	1				1		1		1		1
<b>Average</b>	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 Intrusions", John Wiley, 2014.
4. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi,

### MOOCs:

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

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### **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:

<b>Table 1: CIE Evaluation</b>		
<b>Components</b>	<b>Marks</b>	<b>Total</b>
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**  
**NEURAL NETWORKS & DEEP LEARNING**

**Open Elective II**

<b>Semester:</b>	<b>07</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS751</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>3:0:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>OEC</b>	<b>Credits:</b>	<b>03</b>

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

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Introduction:</b> 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.	<b>10</b>	<b>L2</b>
<b>Module 2</b>		
<b>Convolutional Neural Networks:</b> Mathematics behind CNN, Layers, Architectures of CNN, ILSVRC winner architectures, Implementation of CNN, Building the model from the scratch	<b>10</b>	<b>L3</b>
<b>Module 3</b>		
<b>Gradient based approaches Introduction:</b> Gradient based approaches, Visualizing gradients, Saliency map, Class Model, SmoothGRAD, DeConvolution, Guided Back Propagation Grad-CAM, Occlusion sensitivity	<b>10</b>	<b>L3</b>
<b>Module 4</b>		
<b>Recurrent Neural Networks:</b> Types of RNN, Challenges in training RNN: Exploding and Vanishing Gradients, Networks with Memory <b>Long Short-Term Memory (LSTM):</b> Gated Recurrent Unit (GRU), Sequence Learning Architectures, Sequence Learning with one RNN Layer, Sequence Learning with multiple RNN Layers <b>Implementation example using Keras in Python:</b> sentiment analysis	<b>10</b>	<b>L3</b>
<b>Module 5</b>		
<b>Other Deep Learning Architectures:</b> Encoder-Decoder Architecture, Attention Mechanism, Transformer Architecture, Generative Adversarial Networks, Unet.	<b>10</b>	<b>L3</b>

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### Course Outcomes:

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

<b>CO1</b>	Understand the fundamental concepts in the neural networks.
<b>CO2</b>	Apply deep neural models to various learning problems.
<b>CO3</b>	Develop insight behind the theory of deep learning methods (CNN, RNN, etc.).
<b>CO4</b>	Design Deep Learning Methods for working with sequential data.
<b>CO5</b>	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
<b>CO1</b>	2	2	2	3	3	2					3	2	3	
<b>CO2</b>	2	2	2	3	3	2					3	2	3	
<b>CO3</b>	3	2	3	3	3	2			3		3	2	2	
<b>CO4</b>	3	2	3	3	3	2			3		3	2	3	
<b>CO5</b>	3	3	3	3	3	3			3		3	2	2	
<b>Average</b>	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, 1<sup>st</sup>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><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 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 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.

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**DATA VISUALIZATION**

**Open Elective II**

<b>Semester:</b>	<b>07</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS752</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>3:0:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>OEC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** None

**Course Learning Objectives:**

<b>Sl.No</b>	<b>Course Learning Objectives (CLO)</b>
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.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<p><b>Data Visualization:</b> 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.</p> <p><b>Design Fundamentals:</b> Design Principles, Colors, and “Chart Junk”, The Shaffer 4C’s of Data Visualization, Best practices (examples).</p>	<b>10</b>	<b>L3</b>
<b>Module 2</b>		
<p><b>Storytelling with Data:</b> 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.</p> <p><b>Tableau:</b> 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.</p>	<b>10</b>	<b>L3</b>
<b>Module 3</b>		
<p><b>Data connection:</b> Extracting data, Joining, Blending, Splits, Sorting, Fields operations.</p> <p><b>Tableau calculations:</b> Operators, Functions, Numeric, string, date, table calculations, Level of Details expressions.</p>	<b>10</b>	<b>L3</b>

*A. Shrivastava*



<b>Module 4</b>		
<b>Sort and filter:</b> Basic filters, Filter operations, Extract filters, Quick filters, Contextfilters, Condition filters, Data source filters, Top filters, Build groups, hierarchy, sets.	<b>10</b>	<b>L3</b>
<b>Charts:</b> 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.		
<b>Module 5</b>		
<b>Advanced Tableau:</b> Dashboard, Formatting, Forecasting, Trend Lines.	<b>10</b>	<b>L3</b>
<b>Power BI:</b> Introduction, Architecture, Tableau vs Power BI, Data modelling, Dashboard, Visualization options, Data Analysis Expressions.		

### Course Outcomes:

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

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

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

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### 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

### 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:

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

### 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:

Components	Marks	Total
CIE 1	40	50
CIE 2	40	
CIE 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.
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- 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**  
**PROJECT PHASE 1**

<b>Semester:</b>	<b>07</b>	<b>CIE Marks:</b>	<b>100</b>
<b>Course Code:</b>	<b>21ADS76</b>	<b>SEE Marks:</b>	<b>-</b>
<b>Hours/Week (L: T: P):</b>	<b>2Hous/Week</b>	<b>Duration of SEE (hours):</b>	<b>-</b>
<b>Type of Course:</b>	<b>MP</b>	<b>Credits:</b>	<b>02</b>

<b>Content</b>
<p><b>Project work phase - 1:</b></p> <p>Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.</p> <p><b>CIE procedure for Project Work Phase - 1:</b></p> <p><b>a. Single discipline:</b> The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.</p> <p>The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology) using Rubrics, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the Project report shall be the same for all the batch mates.</p> <p><b>b. Interdisciplinary:</b> Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.</p> <p>The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates as per Rubrics covering all Program Outcomes.</p>

Table 1: Distribution of weightage for CIE of Regular courses

	Component	Marks	Total Marks
CIE	Review-1	<b>100</b>	<b>100</b>
	Review-2		
SEE	Semester End Examination	--	--
<b>Grand Total</b>			<b>100</b>

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE**

**SEMESTER - VIII**

**EXPLAINABLE ARTIFICIAL INTELLIGENCE**

**Program Elective IV**

<b>Semester:</b>	<b>08</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS811</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week(L:T:P):</b>	<b>3: 0: 0</b>	<b>Duration of SEE(Hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PEC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites: Machine/Deep Learning**

**Course Learning Objectives:** The course will enable students to:

1	Understand the importance of explainability in AI systems.
2	Know the difference between ML, Interpretable ML, and Explainable AI.
3	Learn methods to achieve explainability.
4	Become conversant with the types of explanations for different kinds of datasets.
5	Apply and practice the knowledge by solving real-time problems.

CONTENTS	No. of Hours	RBT Levels
<b>Module 1</b>		
<b>Introduction:</b> What is model explainability, why explainability and why not? Principles of XAI, Features of XAI, Types of explainability, Stages of explainability, Evaluation Methods and Metrics for XAI, Properties of Explanations, Difference between Interpretability and Explainability, Demonstration of by Design Interpretable Models: Glass Box.	<b>08</b>	<b>L2</b>
<b>Module 2</b>		
<b>Model-agnostic methods:</b> Partial Dependence Plot, Individual Condition Expectation, Accumulated Local Effects Plots, Feature Interaction, Feature Importance, Global Surrogate, LIME, Shapley Values .	<b>08</b>	<b>L3</b>
<b>Module 3</b>		
<b>Counterfactual Explanations:</b> Working principle of counterfactual explanations, Mathematical modeling of counterfactual explanations, Global counterfactuals, Demonstration of counterfactual explanations on stroke dataset	<b>08</b>	<b>L3</b>
<b>Layer-wise Relevance Propagation (LRP):</b> Working principle of LRP, Mathematical modelling of LRP, Demonstration of LRP.		
<b>Module 4</b>		
<b>Explainability for Image Data:</b> Backpropagation-Based Approaches – DeepLIFT, Saliency, Guided Backpropagation, Occlusion, SHAP, SmoothGrad.	<b>08</b>	<b>L3</b>
<b>Module 5</b>		
<b>Advanced Techniques for Image Data:</b> Integrated Gradients (IG), Accumulating Gradients, Improvements on Integrated Gradients, Guided Integrated Gradients (Guided IG), XRAI: Working and the implementation of XRAI, XRAI with heatmaps, Grad-CAM	<b>08</b>	<b>L3</b>

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

<b>CO1</b>	Understand the methods, metrics to evaluate XAI.
<b>CO2</b>	Demonstrate LIME and SHAP explanations.
<b>CO3</b>	Demonstrate counterfactual explanations and LRP.
<b>CO4</b>	Understand and implement Gradient approach of explainability.
<b>CO5</b>	Implement XAI models to classify data on exemplary applications related to real world.

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

High-3: Medium-2: Low-1

**Text Books:**

- 1) Explainable Artificial Intelligence: An Introduction to Interpretable Machine Learning: An Introduction to Xai, Uday Kamath, December 2021.
- 2) Interpretable Machine Learning, Christoph Molnar, 2019.
- 3) <https://www.oreilly.com/library/view/explainable-ai-for/9781098119126/ch04.html>

**Reference Books:**

- 1) Practicable Explainable AI using Python, Pradeepta Mishra, 2022.
- 2) Hands-On Explainable AI (XAI) with Python, Dennis Rothman, July 2020.
- 3) Explainable AI with Python, Leonida Gianfagna, 2021.

**E-Books / Web References:**

- 1) <https://link.springer.com/book/10.1007/978-3-030-68640-6>
- 2) <https://towardsdatascience.com/using-shap-values-to-explain-how-your-machine-learning-model-works-732b3f40e137>
- 3) <https://analyttica.com/demystifying-lime-xai-through-leaps/>

**MOOCs:**

- 1) <https://www.udemy.com/course/xai-with-python/>



### Scheme of Examination (CIE):

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A typical evaluation pattern for regular courses is shown in Table 1:

<b>Table 1: CIE Evaluation</b>		
<b>Components</b>	<b>Marks</b>	<b>Total</b>
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



**DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE**  
**SEMESTER – VIII**  
**PREDICTIVE AND TIME SERIES ANALYSIS**  
**Program Elective IV**

<b>Semester:</b>	<b>08</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS812</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>3:0:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PEC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):** Foundations of Data Science

**]Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Introduction to Time Series and Trend:</b> <b>Time Series:</b> Introduction to times series data, Application of time series from various fields, Components of a time series, Decomposition of time series.  <b>Trend:</b> Estimation of trend by free hand curve method, Method of semi averages, Fitting a various mathematical curve, and growth curves.	<b>8</b>	<b>L2</b>
<b>Module 2</b>		
<b>Estimation of Trend and Seasonal Component:</b> <b>Estimation of Trend:</b> Method of moving averages, Detrending, Effect of elimination of trend on other components of the time series.  <b>Seasonal Component:</b> Estimation of seasonal component by Method of simple averages, Ratio to Trend, Ratio to moving average and Link relatives.	<b>8</b>	<b>L2</b>
<b>Module 3</b>		
<b>Forecasting:</b> <b>Stationary Time series:</b> Variate component method, Weak stationary, auto correlation function and correlogram of moving average. <b>Forecasting:</b> Exponential smoothing methods, Short-term forecasting methods: Brown's discounted regression, Box-Jenkins Method	<b>8</b>	<b>L2</b>
<b>Module 4</b>		
<b>Overview of Predictive Analytics:</b> 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.	<b>8</b>	<b>L2</b>
<b>Module 5</b>		
<b>Implementation of Predictive Analytics:</b> Data splitting, Balancing, Overfitting, Oversampling, Multiple Regression, Artificial neural networks (MLP), Variable importance, Profit/loss/prior probabilities, Model specification, Model selection, Multivariate Analysis.	<b>8</b>	<b>L3</b>

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**Course Outcomes:**

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

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

<b>CO / PO Mapping</b>														
<b>CO / PO</b>	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>	<b>PSO-1</b>	<b>PSO-2</b>
<b>CO1</b>	3	2	2	1	-	-	-	2	1	-	1	2	1	1
<b>CO2</b>	3	2	2	1	-	-	-	2	2	-	2	2	2	1
<b>CO3</b>	3	2	2	1	-	-	-	2	1	-	3	2	1	1
<b>CO4</b>	3	2	2	1	-	-	-	2	2	-	2	2	1	1
<b>CO5</b>	3	2	2	1	-	-	-	2	2	-	3	2	2	1
<b>Average</b>	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](https://onlinecourses.nptel.ac.in/noc21_ch28/preview)





### **Scheme of Examination (CIE):**

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

<b>Table 1: CIE Evaluation</b>		
<b>Components</b>	<b>Marks</b>	<b>Total</b>
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.**

A handwritten signature in black ink, appearing to read 'A. Shrivastava', is written in a cursive style with a horizontal line underneath.

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE**

**SEMESTER - VIII**

**QUANTUM MACHINE LEARNING 2**

**Program Elective V**

<b>Semester:</b>	<b>08</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS821</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>3:0:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PEC</b>	<b>Credits:</b>	<b>03</b>

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

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
1	To understand in detail the bagging and boosting algorithms
2	To enhance the understanding of basic principle of classical deep learning
3	To explore quantum Convolutional Neural Networks.
4	To understand sequence to sequence models in the quantum deep neural networks.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
<b>Boosting and Adiabatic Quantum Computing:</b> Quantum Annealing, Quadratic Unconstrained Binary Optimization, Ising Model, QBoost, Nonconvexity, Sparsity, Bit Depth, and Generalization Performance, Mapping to Hardware, Computational Complexity.	<b>8</b>	<b>L2</b>
<b>Module 2</b>		
<b>Basic principles of classical deep learning, principles of quantum computing, Quantum Neural Networks:</b> Representing the input, modeling the quantum network, observing the output, learning network parameters, QNN variants.	<b>8</b>	<b>L2</b>
<b>Module 3</b>		
<b>Quantum CNN:</b> Paradigm of QCNN, Build QCNN, BUILD ARSITEKTUR, Hybrid QCNN.	<b>8</b>	<b>L2</b>
<b>Module 4</b>		
<b>Quantum RNN, Quantum LSTM:</b> Quantum RNN, Quantum LSTM	<b>8</b>	<b>L2</b>
<b>Module 5</b>		
<b>Quantum deep neural networks :</b> Particle implementation of quantum deep neural networks	<b>8</b>	<b>L3</b>

**Course Outcomes:**

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

<b>CO1</b>	Understand the fundamental concepts of bagging and boosting algorithms.
<b>CO2</b>	Understand the working principle of deep neural networks.
<b>CO3</b>	Understand the Quantum convolutional neural networks to images.
<b>CO4</b>	Understand QRNN and QLSTM on time series data
<b>CO5</b>	Apply the knowledge obtained from the quantum deep neural networks on the real data

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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. “Quantum Machine Learning : An Applied Approach: The Theory and Application of Quantum Machine Learning in Science and Industry.” Santanu Ganguly, Ashford, UK, ISBN-13 (pbk): 978-1-4842-7097-4 <https://doi.org/10.1007/978-1-4842-7098-1> Copyright © 2021 by Santanu Ganguly.

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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	
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.

*AShukla*

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE**

**SEMESTER - VIII**

**DATA SCIENCE FOR SECURITY**

**Program Elective V**

<b>Semester:</b>	<b>08</b>	<b>CIE Marks:</b>	<b>50</b>
<b>Course Code:</b>	<b>21ADS822</b>	<b>SEE Marks:</b>	<b>50</b>
<b>Hours/Week (L: T: P):</b>	<b>3:0:0</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>PEC</b>	<b>Credits:</b>	<b>03</b>

**Prerequisites (if any):**None

**Course Learning Objectives:**

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
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.

<b>Module 1</b>	<b>No. of Hours</b>	<b>RBT Level</b>
Introduction to Data Science for Security, Threat 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.	<b>10</b>	<b>L3</b>
<b>Module 2</b>		
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.	<b>10</b>	<b>L3</b>
<b>Module 3</b>		
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.	<b>10</b>	<b>L3</b>
<b>Module 4</b>		
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.	<b>10</b>	<b>L3</b>
<b>Module 5</b>		
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.	<b>10</b>	<b>L3</b>

*Ashwin*

**Course Outcomes:**

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

<b>CO1</b>	Apply the knowledge gained in the class to illustrate the security challenges that exist today.
<b>CO2</b>	Apply the knowledge gained in the class to perform analysis on real-world case studies and datasets.
<b>CO3</b>	Build both fundamental and practical expertise.
<b>CO4</b>	Demonstrate the fundamental concepts on selecting the appropriate models in cyber security settings.
<b>CO5</b>	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	
<b>Average</b>	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 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.

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	<b>40</b>	<b>50</b>
	CIE Test-2	<b>40</b>	
	CIE Test-3	<b>40</b>	
	Quiz 1/AAT	<b>05</b>	
	Quiz 2/AAT	<b>05</b>	
SEE	Semester End Examination	<b>50</b>	<b>50</b>
<b>Grand Total</b>			<b>100</b>

*AShwin*

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE**

**SEMESTER – VIII**

**PROJECT WORK PHASE – II**

<b>Semester:</b>	<b>08</b>	<b>CIE Marks:</b>	<b>100</b>
<b>Course Code:</b>	<b>21ADS83</b>	<b>SEE Marks:</b>	<b>100</b>
<b>Hours/Week (L: T: P):</b>	<b>0:0:2</b>	<b>Duration of SEE (hours):</b>	<b>03</b>
<b>Type of Course:</b>	<b>MP</b>	<b>Credits:</b>	<b>12</b>

<b>Content</b>
<p><b>CIE procedure for Project Work Phase - II:</b></p> <p><b>a. Single discipline:</b> The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.</p> <p>The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates using Rubrics.</p> <p><b>b. Interdisciplinary:</b> Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.</p> <p>The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates as per Rubrics covering all Program Outcomes.</p> <p><b>SEE for Project Work Phase - II:</b></p> <p><b>a. Single discipline:</b> Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.</p> <p><b>b. Interdisciplinary:</b> Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong.</p>

Table 1: Distribution of weightage for CIE of Regular courses

	Component	Marks	Total Marks
CIE	Review-1	<b>100</b>	<b>100</b>
	Review-2		
SEE	Semester End Examination	<b>100</b>	<b>100</b>
<b>Grand Total</b>			<b>200</b>

*AShwin*

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE**  
**SEMESTER – VIII**  
**TECHNICAL SEMINAR**

<b>Semester:</b>	<b>08</b>	<b>CIE Marks:</b>	<b>100</b>
<b>Course Code:</b>	<b>21ADS84</b>	<b>SEE Marks:</b>	<b>-</b>
<b>Hours/Week (L: T: P):</b>	<b>1 Hour/Week</b>	<b>Duration of SEE (hours):</b>	<b>-</b>
<b>Type of Course:</b>	<b>MP</b>	<b>Credits:</b>	<b>01</b>

**Technical Seminar:**

All the students admitted to IV year of BE/B. Tech shall have to do power point presentation on any topic related to Artificial Intelligence and Data Science Engineering during VIII Semester and make a report of the presented topic referring to journals in that area. The prescribed credit shall be included in VIII Semester and shall be considered for the award of bachelor's degree. Those who do not present the Technical Seminar shall be declared fail and shall have to complete during subsequent University examination after satisfying the Technical Seminar requirements.

**CIE procedure for Seminar:**

The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Seminar shall be based on the evaluation of Seminar report, presentation skill and question and answer session in the ratio 50:25:25.

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

Table 1: Distribution of weightage for CIE of Regular courses

	Component	Marks	Total Marks
CIE	Review-1	<b>100</b>	<b>100</b>
	Review-2		
SEE	Semester End Examination	--	--
<b>Grand Total</b>			<b>100</b>

*AShivam*

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE**  
**SEMESTER – VIII**  
**INTERNSHIP**

<b>Semester:</b>	<b>08</b>	<b>CIE Marks:</b>	<b>100</b>
<b>Course Code:</b>	<b>21ADS85</b>	<b>SEE Marks:</b>	<b>-</b>
<b>Type of Course:</b>	<b>INT</b>	<b>Credits:</b>	<b>02</b>

All the students admitted to III year of BE/B Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters.

Internship examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

**CIE procedure for Internship:**


The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the Internship shall be based on the evaluation of Internship report, presentation skill and question and answer session in the ratio 50:25:25.

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

Table 1: Distribution of weightage for CIE of Regular courses

	Component	Marks	Total Marks
CIE	Review-1	100	100
	Review-2		
<b>Grand Total</b>			<b>100</b>

  
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