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

2023 BATCH

3RD TO 8TH SEMESTER SCHEME & SYLLABUS

Head of the Department
Dept. of Artificial Intelligence & Data Science
Global Academy of Technology
Rajarajeshwarinagar, Bengaluru - 560 098.

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

B.E. in Artificial Intelligence and Data Science
Scheme of UG Autonomous Program – 2023 batch

III SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Question Paper Setting Board (PSB)	Teaching Department (TD)	Teaching Hours/Week			Examination			CREDITS
						L	T	P	CIE	SEE	Total	
1	MAT23301X	Mathematics course (Branch Specific)	BS	MATHS	MATHS	2	2	0	50	50	100	3
2	CSE23302	Data Structures	PC	CSE	AI&DS	3	0	0	50	50	100	3
3	ADS23303	Python for Data Science (Integrated)	IPC	AI&DS		3	0	2	50	50	100	4
4	ADS23304	Computer Networks	PC			2	2	0	50	50	100	3
5	ADS23305X	ESC/ETC/PLC	ESC/ETC/PLC	AI&DS		3	0	0	50	50	100	3
6	SCK23306	**Social Connect and Responsibility**	Any Department			0	0	2	100	---	100	1
7	ADS23307X	Ability Enhancement Course	AEC			2	0	0	50	50	100	2
8	NSK23308	National Service Scheme (NSS)	MC	NSS coordinator	NSS coordinator	0	0	2	100	---	100	0
	PEK23308	Physical Education (PE) (Sports and Athletics)		Physical Education Director	Physical Education Director							
	YOK23308	Yoga		Yoga Teacher	Yoga Teacher							
9	CSEL23309	Data Structures Laboratory	PCL	CSE	AI&DS	0	0	2	50	50	100	1
					Total				550	350	900	20

Engineering Science Course (ESC/ETC/PLC)	
ADS233051	Fuzzy Systems
ADS233052	Object Oriented Programming with C++

Ability Enhancement Course – III	
ADS233071	Operating Systems
ADS233072	Ethics and Public Policy for AI

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IV SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Question Paper Setting Board (PSB)	Teaching Department (TD)	Teaching Hours/Week			Examination			CREDITS
						L	T	P	CIE	SEE	Total	
1	MAT23401X	Mathematics course (Branch Specific)	BS	MATHS	MATHS	2	2	0	50	50	100	3
2	CSE23402	Design and Analysis of Algorithms	PC	CSE	AI&DS	3	0	0	50	50	100	3
3	ADS23403	Statistical Machine Learning I (Integrated)	IPC	AI&DS		3	0	2	50	50	100	4
4	ADS23404	Database Management Systems	PC			2	2	0	50	50	100	3
5	ADS23405X	ESC	ESC/ETC/PLC	AI&DS		2	2	0	50	50	100	3
6	UHK23406	**Universal Human Values Course**	UHV	HSS		1	0	0	50	50	100	1
7	ADS23407X	Ability Enhancement Course	AEC	AI&DS		1	0	2	50	50	100	2
8	UHK23408	National Service Scheme (NSS)	MC	NSS coordinator	NSS coordinator	0	0	2	100	---	100	0
	PEK23408	Physical Education (PE) (Sports and Athletics)		Physical Education Director	Physical Education Director							
	YOK23408	Yoga		Yoga Teacher	Yoga Teacher							
9	CSEL23409	Algorithms Laboratory	PCL	CSE	AI&DS	0	0	2	50	50	100	1
								Total	500	400	900	20

Engineering Science Course (ESC/ETC/PLC)	
ADS234051	Image Processing
ADS234052	Optimization Technique

Ability Enhancement Course – III	
ADS234071	Object Oriented Programming with Java (**Integrated**)
ADS234072	Green IT and Sustainability

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –III

DISCRETE MATHEMATICS AND GRAPH THEORY (Mathematics for CSE Stream)

Course Code	**MAT23301A**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Type of Course:	**BS**	**Examination Hours**	**03**
No. of Credits	**3**		

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

CLO1	Counting Principles
CLO2	Mathematical Logic and Set Theory
CLO3	Relations and Functions
CLO4	Graph Theory

Content	No. of Hours/ RBT levels
Module 1 The Rules of Sum and Product, The Pigeon-hole Principle, Permutations, Combinations, The Binomial Theorem, Combinations with Repetition.	**08 Hours** **L2, L3**
Module 2 Sets and Subsets, Set operations and Laws of Set Theory. Counting and Venn Diagrams. Probability, Conditional probability and Bayes Theorem.	**08 Hours** **L2, L3**
Module 3 Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implications: Rules of Inference. Quantifiers, Definitions and the Proofs of Theorems.	**08 Hours** **L2, L3**
Module 4 Relations and properties of relations, Representation of relations. Equivalence Relations and Partitions. Functions, Types of Functions, Function Composition and Inverse Functions.	**08 Hours** **L2, L3**
Module 5 Graphs, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits. Planar Graphs, Trees and Rooted Trees.	**08 Hours** **L2, L3**

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

COURSE OUTCOMES:

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

CO31.1	• Understand the fundamental principles of counting, including the rules of sum and product. • Use the Pigeon-hole principle to solve problems involving the distribution of objects • Apply permutations and combinations to solve counting problems • Derive the formula for the binomial coefficients and understand their properties
CO31.2	• Solve problems involving the application of set operations and the use of laws of set theory • Solve counting problems using Venn diagrams and set-theoretic techniques. • Solve problems involving the calculation of probabilities and conditional probabilities • Apply Bayes' theorem to calculate the posterior probability of an event given the prior probability and conditional probabilities
CO31.3	• Solve problems involving the evaluation of logical statements using truth tables. • Solve problems that involve the use of logical equivalence and the laws of logic. • Apply the rules of inference to draw valid conclusions from logical premises. • Solve problems that involve the use of quantifiers and the manipulation of quantified statement • Establish the validity of mathematical and logical statements using different methods of proofs
CO31.4	• Solve problems involving the manipulation and analysis of relations and their properties • Solve problems that involve the determination of equivalence relations and the corresponding partitions. • Perform operations on functions, including function composition and the determination of inverse functions.
CO31.5	• Solve problems involving the analysis and manipulation of graphs, subgraphs, and their complements. • Understand the concepts of degree of a vertex, Euler trails and Euler circuits • Understand the properties of Planar graphs and also determine whether a given graph is planar. • Understand the concept of a trees and rooted tree and its related terminologies.

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**
Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.
Typical Evaluation pattern for regular courses is shown in Table 2.

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

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

CO/PO	PO1	PO2	PO3	PO12
CO31.1	3	2	1	3
CO31.2	3	2	1	3
CO31.3	3	2	1	3
CO31.4	3	2	1	3
CO31.5	3	2	1	3
Average	3	2	1	3

Low-1: Medium-2: High-3

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –III

DATA STRUCTURES

(Common to CSE /ISE/AD/AM/CI)

Course Code	**CSE23302**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Type of Course	**PC**	**Examination Hours**	**3 Hours**
No. of Credits	**3**		

Course Learning Objectives: The course will enable students to:

CLO1	To provide the knowledge of basic data structures and their implementations
CLO2	To develop skills to apply appropriate data structures in problem solving
CLO3	To efficiently implement the different data structures and solutions for specific problems
CLO4	Create and use appropriate data structures in C programs for solving real life problems

CONTENTS	# of Hours
MODULE 1 **Introduction:** Introduction to Data Structures, Review of Arrays, Types of Data Structures, Linear & non-linear Data Structures. **Stacks: Stack** definitions & concepts, Representing stacks in C, Operations on stacks, Applications of Stacks: Infix to Postfix, Infix to Prefix, Postfix expression evaluation, **Recursion:** Sample Programs.	**08**
MODULE 2 **Queues**: Representation of queue, operations, circular queues. Application of Queues, Priority Queues. **Dynamic Memory allocation:** malloc(), calloc(),free(), realloc(). **Linked Lists:** Definition and terminology, Singly Linked List (SLL), Various operations on SLL: insertion, deletion and display, Programming Examples Such as Polynomials and others., Header Node.	**08**
MODULE 3 **Circular Singly Linked List (CSLL):** Definition, Various operations, Application. **Doubly Linked List (DLL)** Definition, Various operations Applications: Sparse matrix and others. **Trees:** Definition, Terminology, Binary Trees (BT), Binary Search Trees (BST): Insertion, Deletion and Traversals : Preorder, Post order and In order.	**08**
MODULE 4 **Expression Trees (ET)**: Definition and Construction of Expression Tree. **Threaded Binary Tree:** Types and application. **Heap:** Definition, Construction, Applications of Heap: Priority Queue.	**08**
MODULE 5 **Balanced tree:** AVL trees, B tree, B+ tree, Splay. **Graphs:** Introduction, Matrix and List Representation. **Hashing:** Open Hashing, Closed Hashing, Collision and Collision Resolution Strategies.	**08**

Course Outcomes:

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

CO1	Apply the knowledge of computing to various data structures and its operations
CO2	Analyze a problem and identify suitable data structure to provide solution
CO3	Design solution using modern tools and suitable data structure
CO4	Implement programs with suitable data structure based on the requirements of the application

Text Books:

1. Data Structures using C and C++, Yedidyah Langsam Moshe J. Augenstein and Aaron M. Tenenbaum, 2nd Edition, 2009, PHI/Pearson.
2. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4th Revised Edition, 2013, Addison-Wesley, ISBN-13: 9780132847377

Reference Books:

1. Data Structures Using C, Reema Thareja, 1st Edition, 2011, Oxford Higher Education
2. Fundamentals of Data Structures, Ellis Horowitz, Sartaj Sahni, Illustrated Edition, Computer Science Press.

E-Books / Web References:

1. https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
2. https://ds2-iiith.vlabs.ac.in/List%20of%20experiments.html

MOOCs:

https://archive.nptel.ac.in/courses/106/102/106102064/

Mapping of CO-PO:

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

Low-1: Medium-2: High-3

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –III

PYTHON FOR DATA SCIENCE (Integrated)

Course Code:	**ADS23303**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:2**	**SEE Marks:**	**50**
Type of Course:	**IPC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): C Programming

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	Learn the syntax and semantics of Python Programming Language.
2	Write Python functions to facilitate code reuse and optimization.
3	To build a strong foundation to understand advanced python packages for data science.
4	To understand the access to a wide variety of data analysis and data science libraries.
5	To meet industry demand for experts with Python skills.

Module 1	No. of Hours	RBT Level
Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables. **Flow control:** Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements. **Text Book 1: Chapters - 1, 2**	**08**	**L3**
Module 2		
Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Local and Global Scope, The global Statement. **Lists:** The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, The Tuple Data Type. **Text Book 1: Chapters - 3, 4**	**08**	**L3**
Module 3		
Dictionaries and Structuring Data: The Dictionary Data Type, Nested Dictionaries and Lists, Manipulating Strings: Working with Strings, Useful String Methods. **Introduction to NumPy:** Fixed-Type Arrays in Python, Creating Arrays from Python Lists, Creating Arrays from Scratch, NumPy Standard Data Types, NumPy Array Attributes, Array Indexing: Accessing Single Elements, Array Slicing: Accessing Subarrays. **Text Book 1: Chapters - 5, 6 Text Book 2: Chapter - 2**	**08**	**L3**
Module 4		
Array Manipulation: Reshaping of Arrays, Array Concatenation and Splitting, Aggregations, Sorting Arrays. **Data Manipulation with Pandas:** Installing and Using Pandas, Introducing Pandas Objects, The Pandas Series Object, The Pandas DataFrame Object, Data Indexing and Selection, Sorting and Ranking, Unique Values, Value Counts, and Membership. **Text Book 2: Chapter - 2 Text Book 3: Chapter - 5**	**08**	**L3**
Module 5		

Combining Datasets: Concat, Append: Concatenation of NumPy Arrays, Simple Concatenation with pd.concat, Concatenation with joins, The append() method, Merge and Join: Categories of Joins - One-to-one joins, Many-to-one joins, Many-to-many joins. **Plotting and Visualization:** A Brief matplotlib API Primer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Saving Plots to File. Plotting with pandas and seaborn - Line Plots, Bar Plots, Scatter or Point Plots, Pie chart. **Text Book 02: Chapter - 3 Text Book 03: Chapter - 9**	**08**	**L3**

Course Outcomes:

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

CO1	Experiment with the concepts of data types, Operators and Flow Control Statements of Python.
CO2	Make use of methods to create and manipulate lists, tuples and dictionaries.
CO3	Understand the fundamental of NumPy and Ndarrays.
CO4	Understand the fundamental of Pandas.
CO5	Illustrate graphically data and results of statistical calculations.

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

High-3: Medium-2: Low-1

Textbooks:

1. Al Sweigart, “Automate the Boring Stuff with Python”, William Pollock, 2015, ISBN: 978-1593275990.
2. Python Data Science handbook, by Jake Vander Plas, O’Reilly.
3. Python for Data Analysis, by Wes McKinney, 2nd Edition, O’Reilly.

Reference Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist”, 2nd Edition, Green Tea Press, 2015, ISBN: 978-9352134755.
2. Gowrishankar S, Veena A, ―Introduction to Python Programming, 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372.
3. AurelienGeron, ―Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems‖, 2nd Edition, O ‘Reilly Media, 2019. ISBN – 13: 978-9352139057.

E-Books / Web References:

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

MOOCs:

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

Prog. No.	Lab Programs	No. of Hours/ RBT levels
1	Programs on data types, string concatenation and replication.	**02 L3**
2	Program on operators and Flow Control Statements.	**02 L3**
3	Programs on loops.	**02 L3**
4	Programs on Functions.	**02 L3**
5	Programs on List and Tuples.	**02 L3**
6	Programs on Dictionaries.	**02 L3**
7	Programs on String manipulation functions.	**02 L3**
8	Programs on NumPy array creation.	**02 L3**
9	Programs on DataFrame creation.	**02 L3**
10	Programs on creation of count plot and pie chart.	**02 L3**

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

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

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

Continuous Internal Evaluation (CIE):

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

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

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

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –III

COMPUTER NETWORKS

Course Code:	**ADS23304**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**2:2:0**	**SEE Marks:**	**50**
Type of Course:	**PC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

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

Module 1	No. of Hours	RBT Level
Introduction: Data Communications, Networks, Types of Networks, TCP/IP Protocol Suite, OSI Model, OSI versus TCP/IP **Introduction to Physical Layer-1:** Digital Signals, Signal Impairment, Multiplexing: Frequency-Division Multiplexing, Time-Division Multiplexing, Transmission Media: Guided Media, Unguided Media: Wireless	**08**	**L2**
Module 2		
Data-Link Layer: Data-Link Control: Framing, Error Control: Types of Errors, Block Coding, Linear Block Codes, Cyclic Codes, **Media Access Protocols:** Random Access: Aloha, Carrier Sense Multiple Access (CSMA), Carrier sense multiple access with collision detection (CSMA/CD)	**08**	**L2**
Module 3		
Local Area Networks: Ethernet: Standard Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, WIFI, IEEE 802.11 Project: Architecture, MAC Frame Format, Addressing Mechanism. **Bluetooth:** Architecture, Bluetooth Layers, Virtual LANS: Membership, Configuration, Communication among Switches, Advantages	**08**	**L2**
Module 4		
Network Layer: Internet Protocol Version 4: IPv4 Addressing, Datagram Format, ICMPv4: Messages, Mobile IP: Addressing, Agents, Next Generation IP (IPV6): IPv6 Addressing, Representation, Address Space, Address Space Allocation, The IPv6 Protocol: Packet Format, Transition from IPV4 to IPV6.	**08**	**L3**
Module 5		
Application Layer: Standard Applications: World Wide Web and HTTP, World Wide Web, Web Client (Browser), Web Server, Hypertext Transfer Protocol (HTTP), Nonpersistent versus Persistent Connections, Electronic Mail, Architecture, Domain Name System (DNS): Name Space, Domain Name, DNS in the Internet, DNS Messages	**08**	**L2**

Course Outcomes:

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

CO1	Understand basic computer networking concepts OSI, TCP/IP models.

CO2	Describe various networking architectures, flow & error control mechanisms
CO3	Understand Ethernet and Wireless LAN concepts
CO4	Identify the protocols and services of different layers
CO5	Understand functions of Application layer in internet

CO / PO Mapping

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

High-3: Medium-2: Low-1

Textbooks:

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

Reference Books:

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

E-Books / Web References:

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

MOOCs:

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

Scheme of Evaluation:

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 Integrated 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

FUZZY SYSTEMS

Course Code:	**ADS233051**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**ESC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): Discrete Mathematics.

Course Learning Objectives: The course will enable students to

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

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

Course Outcomes:

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

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

CO / PO Mapping														
CO / PO/ PSO	**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

Textbooks:

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.

MOOCs:

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

Scheme of Evaluation:

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 Integrated courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Paper	05	
	Mini Project	05	
SEE	Semester End Examination	50	50
Grand Total			100

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –III

OBJECT ORIENTED PROGRAMMING WITH C++

Course Code:	**ADS233052**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**ESC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	To understand object-oriented programming using C++and Gain knowledge about the capability to store information together in an object.
2	To illustrate the capability of a class to rely upon another class and functions.
3	To Create and process data in files using file I/O functions
4	To understand the generic programming features of C++ including Exception handling

Module 1	No. of Hours	RBT Level
An overview of C++: What is object-Oriented Programming? Introducing C++ Classes, The General Form of a C++ Program. **Classes and Objects:** Classes, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Static Class Members, When Constructors and Destructors are Executed, The Scope Resolution Operator, Passing Objects to functions, Returning Objects, Object Assignment Ch 11, Ch 12	**5**	**L3**
Module 2		
Arrays, Pointers, References, and the Dynamic Allocation Operators: Arrays of Objects, Pointers to Objects, The this Pointer, Pointers to derived types, Pointers to class members. **Functions Overloading, Copy Constructors:** Functions Overloading, Overloading Constructor Functions. Copy Constructors, Default Function Arguments, Function Overloading and Ambiguity. Ch 13, Ch 14	**6**	**L3**
Module 3		
Operator Overloading: Creating a Member Operator Function, Operator Overloading Using a Friend Function, Overloading new and delete **Inheritance:** Base-Class Access Control, Inheritance and Protected Members, Inheriting Multiple Base Classes , Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes Ch 15, Ch 16	**6**	**L3**
Module 4		
Virtual Functions and Polymorphism: Virtual Functions, The Virtual Attribute is Inherited, Virtual Functions are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early vs Late Binding. **Templates:** Generic Functions, Applying Generic Functions, Generic Classes. The type	**5**	**L3**

name and export Keywords. The Power of Templates Ch 17, Ch 18		
Module 5		
Exception Handling: Exception Handling Fundamentals, Handling Derived-Class Exceptions, Exception Handling Options, Applying Exception Handling. The C++ I/O **System Basics:** C++ Streams, The C++ Classes, Formatted I/O. **File I/O:** <fstream> and File Classes, Opening and Closing a File, Reading and Writing Text Files, Detecting EOF. Ch 19, Ch 20, Ch21	**6**	**L3**

Course Outcomes:

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

CO1	Illustrate the basic concepts of object-oriented programming.
CO2	Design appropriate classes for the given real world scenario.
CO3	Apply the knowledge of compile-time / run-time polymorphism to solve the given problem
CO4	Use the knowledge of inheritance for developing optimized solutions
CO5	Apply the concepts of templates and exception handling for the given problem
CO6	Use the concepts of input output streams for file operations

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

High-3: Medium-2: Low-1

Text Books:

1. Herbert schildt, The Complete Reference C++, 4th edition, TMH, 2005

Reference Books:

1. Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt.Ltd., Sixth Edition 2016.
2. Bhave , " Object Oriented Programming With C++", Pearson Education , 2004.
3. A K Sharma , "Object Oriented Programming with C++", Pearson Education, 2014

E-Books / Web References:

1. Basics of C++ - https://www.youtube.com/watch?v=BClS40yzssA
2. Functions of C++ - https://www.youtube.com/watch?v=p8ehAjZWjPw

Tutorial Link:

1. https://www.w3schools.com/cpp/cpp_intro.asp
2. https://www.edx.org/course/introduction-to-c-3
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013843642506788864433 75_shared/overview

Scheme of Evaluation: (Integrated courses)

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

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

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

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

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER III
SOCIAL CONNECT & RESPONSIBILITY

Course Code	**SCK23306**	CIE Marks	**100**
Teaching Hours/Week (L: T:P: S)	0:0:3:1	SEE Marks	------
Total Hours of Pedagogy	40-hour Practical Session +15-hour Planning	Total Marks	**100**
Examination nature (No SEE – Only CIE)	For CIE Assessment - Activities Report Evaluation by College NSS Officer / HOD / Sports Dept / Any Dept.		
Credits	01 - Credit		

Course objectives: The course will enable the students to:

1. Provide a formal platform for students to communicate and connect to the surrounding.
2. create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledgein finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

General Instructions - Pedagogy:

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

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

Contents:

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellowhuman beings, nature, society, and the world at large.

The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-longactivities conducted by faculty mentors.

In the following a set of activities planned for the course have been listed:

Social Connect & Responsibility - Contents

Part I:

Plantation and adoption of a tree:

Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE)They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.

Part II:

Heritage walks and crafts corner:

Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives,Visit, case study, report, outcomes.

Part III:

Organic farming and waste management:

Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes.

Part IV:

Water conservation:

Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.

Part V:

Food walk:

City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

Course outcomes (Course Skill Set):

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

CO1: Communicate and connect to the surrounding.

CO2: Create a responsible connection with the

society.

CO3: Involve in the community in general in which they work.

CO4: Notice the needs and problems of the community and involve them in problem –solving.

CO5: Develop among themselves a sense of social & civic responsibility & utilize their

knowledgein finding practical solutions to individual and community problems.

CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

Activities:

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories withothers. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY:

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersionwith NGOs/social sections will be a key part of the course. Will all leadto the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, basedon an in-depth understanding of a key social problem.

Duration:

A total of 40 - 50 hrs engagement per semester is required for the 3rd semester of the B.E./B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic ,and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines ofscheme & syllabus.

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE):

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall

be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the socialconnect Information/Data collected during the social connect Analysis of the information/data and report writing Considering all above points allotting the marks as mentioned below

Excellent : 80 to 100
Good : 60 to 79
Satisfactory : 40 to 59
Unsatisfactory and fail : <39

Special Note :

NO SEE – Semester End Exam – Completely Practical and activities based evaluation

Pedagogy – Guidelines:

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	**Plantation and adoption of a tree:**	May be individual or team	Farmers land/ parks / Villages / roadside/ community area / College campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
2.	**Heritage walk and crafts corner:**	May be individual or team	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
3.	**Organic farming and waste management:**	May be individual or team	Farmers land / parks / Villages visits / roadside/ community area / College campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
4.	**Water conservation:** & conservation techniques	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers / campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
5.	**Food walk: Practices in society**	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty

Plan of Action (Execution of Activities)

Sl. NO	Practice Session Description
1	**Lecture session in field to start activities**
2	**Students Presentation on Ideas**
3	**Commencement of activity and its progress**
4	**Execution of Activity**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
8	**Case study based Assessment, Individual performance**
9	**Sector/ Team wise study and its consolidation**
10	**Video based seminar for 10 minutes by each student At the end of semester with Report.**

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assignedactivity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted asper the instructions and scheme.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**
Field Visit, Plan, Discussion	10 Marks
Commencement of activities and its progress	20 Marks
Case study based Assessment Individual performance with report	20 Marks
Sector wise study & its consolidation 5*5 = 25	25 Marks
Video based seminar for 10 minutes by eachstudent At the end of semester with Report. **Activities 1 to 5, 5*5 = 25**	25 Marks
Total marks for the course in eachsemester	**100 Marks**

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSSofficer of the institute.
- Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field.

There should be positive progress in the vertical order for the benefit of society in general through activities.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –III

OPERATING SYSTEMS

Course Code:	**ADS233071**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**2:0:0**	**SEE Marks:**	**50**
Type of Course:	**AEC**	**Duration of SEE (hours):**	**03**
Credits: 02			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

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

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

Course Outcomes:

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

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

CO / PO Mapping

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

High-3: Medium-2: Low-1

Textbooks:

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

Reference Books:

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

E-Books / Web References:

1. Operating system overview https://www.tutorialspoint.com/operating_system/os_overview.html
2. Lecture notes on Operating System https://www.bput.ac.in › lecture-notes-download
3. Operating System https://en.wikipedia.org/wiki/Operating_system
4. https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O
5. 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 Evaluation:

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 Integrated courses

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –III

ETHICS AND PUBLIC POLICY FOR AI

Course Code:	**ADS233072**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**2:0:0**	**SEE Marks:**	**50**
Type of Course:	**AEC**	**Duration of SEE (hours):**	**03**
Credits: 02			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	To understand Ethical Framework for a Good AI Society, establishing Rules for trustworthy AI
2	To Designing ethics for good society
3	To familiar with Tools, methods and practices for designing AI for social good
4	To familiar with Innovation and future AI
5	To understand the Case Study: AI in health care, knowing Regulation and Governance of AI ethics

Module 1	No. of Hours	RBT Level
An Ethical Framework for a Good AI Society: opportunities, Risks, principles and Recommendations. Establishing the rules for building trustworthy AI Textbook1: Chapter 3, chapter 4	**6**	**L2**
Module 2		
Translating principles into practices of digital ethics: five risks of being Unethical The Ethics of Algorithms: Key problems and Solution How to Design AI for Social Good: Seven Essential Factors Textbook1: Chapter 6, Chapter 8, Chapter 9	**6**	**L2**
Module 3		
How to design AI for social good: seven essential factors From What to How: An Initial Review of publicly available AI Ethics tools, Methods and Research to Translate principles into Practices Textbook1: Chapter 9, Chapter 10	**6**	**L2**
Module 4		
Innovating with Confidence: Embedding AI Governance and fairness in financial Services Risk management framework, What the near future of AI could be. Textbook1: Chapter 20, chapter 22	**6**	**L2**
Module 5		
Human-AI Relationship, AI and Workforce, Autonomous Machines and Moral Decisions, AI in HealthCare: balancing Progress and Ethics, 14.09.2023 15.09.2023 Regulation and Governance of AI Ethics Textbook2 : Chapter 5,Chapter 8, Chapter 9	**6**	**L2**

Course Outcomes:

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

CO1	Describe Ethical Framework for a Good AI Society, establishing Rules for trustworthy AI
CO2	Explain ethics for good society
CO3	Illustrate various Tools, methods and practices for designing AI for social good
CO4	Describe the Innovation and future AI

CO5	Illustrate Regulation and Governance of AI ethics in Healthcare domain.

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

High-3: Medium-2: Low-1

Text Books:

1. "Ethics, governance and Policies in Artificial Intelligence", Author-Editor : Luciano Floridi, Springer, 1st Edition 2021, vol 144, Oxford Internet Institute, University of ixford, UK, ISSN 0921-8599, e-ISSN 25428349 Philosophical Studies series, ISBN 978-3-030-81906-4 e-ISBN 978-3-030-81907-1, ://doi.orghttps/10.1007/978-3-030-81907-1, 2021.
2. "Ethics and AI: Navigating the Moral Landscape of Digital Age", Author: Aaron Aboagye,

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

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

Continuous Internal Evaluation (CIE):

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

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

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

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

National Service Scheme (NSS)		Semester	**3rd to 6th**
Course Code	**NSK23308**	CIE Marks	**25*4 = 100**
Teaching Hours/Week (L:T:P: S)	0:0:3:1	SEE Marks	------
Total Hours of Pedagogy	40hour Practical Session +15hour Planning	Total Marks	**25*4 = 100**
Examination nature (SEE)	Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th semester)		
Credits	NCMC – Non-Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)		

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

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

General Instructions - Pedagogy:

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

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

National Service Scheme (NSS) – Contents

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social andeconomic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach forimplementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.

7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat,Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
Spreading public awareness under rural outreach programs (minimum5 programs). 1. Social connect and responsibilities. 2. Plantation and adoption of plants. Know your plants. 3. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 4. Govt. school Rejuvenation and helping them to achieve good infrastructure. NOTE: • Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of thatrespective semester for successful completion as per the instructions of NSS officer with the consent of HOD of thedepartment. • At the end of every semester, activity report should be submitted for evaluation.

Distribution of Activities - Semester wise from 3rd to 6th semester

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

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

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

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

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

Plan of Action (Execution of Activities For Each Semester)

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

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

Course outcomes (Course Skill Set):

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

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

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

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

Assessment Details for CIE (both CIE and SEE)

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

Marks scored for 50 by the students should be Scale down to 25 marks In each semester

for CIE entry in the VTU portal.

25 marks CIE entry will be entered in University IA marks portal at the end of each semester 3rd to 6th

sem, Report and assessment copy should be made available in the department semester wise.

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

Suggested Learning Resources:

Books :

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –III

PHYSICAL EDUCATION (SPORTS & ATHLETICS)

Course Code	**:**	PEK23308		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:1				
Total Hours	**:**	24 P				

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

1. Understand the fundamental concepts and skills of Physical Education, Health,Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth anddevelopment
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state / national / international levels.
5. Create consciousness among the students on Health, Fitness and Wellness indeveloping and maintaining a healthy lifestyle.
6. Understand and practice of Traditional Games

Module I : Orientation **4 Hours**

A. Lifestyle
B. Health & Wellness
C. Pre-Fitness test.

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

A. Warming up (Free Hand exercises)
B. Strength – Push-up / Pull-ups
C. Speed – 30 Mtr Dash

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

1. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
2. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.

Scheme and Assessment for auditing the course and Grades:

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Yoga for Better Life		Semester	**III – VI sem**
Course Code	**YOK23308**	CIE Marks	100/sem
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	000
Total Hours of Pedagogy per semester	24 - 28 hours (Theory + practical)	Total Marks	100/sem
Examination nature (SEE)	**Objective type Theory / Practical / Viva-Voce**		

Course objectives:

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

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

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

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

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

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

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

- Physical
    1. Improved body flexibility and balance
    2. Improved cardiovascular endurance (stronger heart)
    3. Improved digestion
    4. Improved abdominal strength
    5. Enhanced overall muscular strength
    6. Relaxation of muscular strains
    7. Weight control
    8. Increased energy levels
    9. Enhanced immune system
- Mental
    1. Relief of stress resulting from the control of emotions

2. Prevention and relief from stress-related disorders
3. Intellectual enhancement, leading to improved decision-making skills

- Spiritual
  1. Life with meaning, purpose, and direction
  2. Inner peace and tranquility
  3. Contentment

Yoga Syllabus

Semester III

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, importance of prayerYogic practices for common man to promote positive health
Rules to be followed during yogic practices by practitionerYoga its misconceptions,
Difference between yogic and non yogic practices
Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12count, 2 rounds
Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana
Different types of Asanas

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

Semester IV

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

Suryanamaskar12 count- 4 rounds of practice

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

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

Meaning, importance and benefits of Kapalabhati.
40 strokes/min 3 rounds
Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama
Pranayama – 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana

4. Chandra Bhedana 5. Nadishodhana

Semester V

Patanjali'sAshtanga Yoga its need and importance.

Ashtanga Yoga

1. Asana
2. Pranayama
3. Pratyahara

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

Different types of Asanas

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

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

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

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

Revision of practice 60 strokes/min 3 rounds

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

1. Ujjayi 2. Sheetali 3. Sheektari

Semester VI

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

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

Different types of Asanas

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

b. Standing 1. Vatayanasana
   2. Garudasana

c. Balancing 1. Veerabhadrasana
   2. Sheershasana

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

Revision of Kapalabhati practice 80 strokes/min - 3 rounds

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

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

Course outcomes (Course Skill Set):

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

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

Assessment Details (both CIE and SEE)

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

Suggested Learning Resources:

Books:

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

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

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

https://youtu.be/KB-TYlgd1wE
https://youtu.be/aa-TG0Wg1Ls

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
DATA STRUCTURES LABORATORY

(Common to CSE/ISE/AI/AM/CI)

Course Code	**CSEL23309**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**3 Hours**

Course Learning Objectives:

The course will enable students to:

CLO1	Understand elementary data structures with an emphasis on problem-solving.
CLO2	Develop skills to design and analyze simple linear and non-linear data structures.
CLO3	Strengthen the ability of the students to identify and apply the suitable data structure for the given real-world problem.
CLO4	Enables them to gain knowledge in practical applications of data structures.

Sl. No.	**EXPERIMENTS**
1	Develop a menu driven Program for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate Overflow and Underflow situations on Stack d. Display the status of Stack e. Exit Support the program with appropriate functions for each of the above operations
2	Develop a Program for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands
3	Develop and Implement a Program for evaluation of Stack Suffix expression with single digit operands and operators: +, -, *, /, %, ^.
4	Develop recursive program to i) To Find GCD of 2 numbers ii) To Solve the Tower of Hanoi Problem.
5	Develop a menu driven Program for the following operations on QUEUE of Characters (Array Implementation of QUEUE with maximum size MAX) a. Enqueue an Element on to Queue b. Dequeue an Element from Queue c. Demonstrate Overflow and Underflow situations on Queue d. Display the status of Queue e. Exit Support the program with appropriate functions for each of the above operations

6	Implement a program to multiply two polynomials using singly linked list.
7	Design a doubly linked list to represent sparse matrix. Each node in the list can have the row and column index of the matrix element and the value of the element. Print the complete matrix as the output.
8	Write a program to create Binary Tree and to traverse the tree using In-order, Preorder and Post order.
9	Write a program to implement priority queue using Heap.
10	Write a program to implement Hashing using Linear probing. Implement insertion, deletion, search and display.

Course Outcomes:

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

CO309.1	Implement stack and queue operations using array.
CO309.2	Demonstrate Recursive functions.
CO309.3	Demonstrate working of linked lists.
CO309.4	Implement Binary tree traversals, Priority queue and hashing.

Textbooks:

1. Ellis Horowitz, Sartaz Sahni, Fundamentals of Data Structures in C, Anderson, Freed, Second Edition, University press, 2008, Reprinted 2016
2. Seymour Lipschutz, Schaum's Outlines, Data Structures with C, McGraw Hill, Special Indian Edition, Thirteenth Reprint 2015.

Reference Books:

1. Aaron Tanenbaum, Yedidyah Langsam and Moshe Augenstein, Data Structures using C, Pearson, Thirteenth Impression, 2014. ISBN:978-81-317-0229-1
2. Richard F. Gilberg and Behrouz A. Forouzan, Data Structures A Pseudo code approach with C, Thomson, 2005. ISBN:978-81-315-0314-0

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO309.1	3	3	3	-	2	-	-	2	-	2	-	2	2	-
CO309.2	3	3	3	-	2	-	-	2	-	2	-	2	2	-
CO309.3	3	3	3	-	2	-	-	2	-	2	-	2	2	-
CO309.4	3	3	3	-	2	-	-	2	-	2	-	2	2	-
Average	**3**	**3**	**3**	**-**	**2**	-	**-**	**2**	**-**	**2**	**-**	**2**	**2**	**-**

Low-1: Medium-2: High-3

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER – IV

Course: Probability and Linear Algebra (Mathematics for CSE Stream)

Course Code	**MAT23401A**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Type of Course	**BS**	**Examination Hours**	**03**
No. of Credits	**3**		

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

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

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

Textbooks:

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

Reference books:

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

COURSE OUTCOMES:

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

CO41.1	• Describe the properties and characteristics of random variables, including their probability distributions, probability mass/density functions, and cumulative distribution functions. • Solve problems using binomial, Poisson, exponential and normal distributions • Compute joint probabilities, marginal probabilities, and expectations and covariance using joint distributions.
CO41.2	• Solve matrix equations of the form AX = b using row reduction algorithm • Analyse the properties and characteristics of linear transformations. • Compute the inverse of a matrix using the Gauss-Jordan elimination method.
CO41.3	• Determine if a set of vectors forms a subspace of a given vector space • Determine if a set of vectors is linearly independent and Construct bases for vector spaces and subspaces. • Represent vectors in different coordinate systems and understand the change of basis. • Diagonalize matrices using the eigen decomposition method.
CO41.4	• Compute inner products, norms, and distances between vectors in an inner product space. • Compute the projection of a vector onto a subspace and understand its geometric interpretation. • Implement the Gram-Schmidt process to convert a linearly independent set of vectors into an orthonormal set. • Compute the QR-factorization of a matrix and use it to solve systems of linear equations.
CO41.5	• Compute the least squares solution to an overdetermined system of linear equations. • Diagonalize symmetric matrices using the eigen decomposition method. • Utilize the properties of quadratic forms and diagonalization to solve constrained optimization problems. • Compute the Singular Value Decomposition of a matrix

Scheme of Examination:

Semester End Examination (SEE):

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

Continuous Internal Evaluation (CIE):

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

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

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

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

CO/PO	PO1	PO2	PO3	PO12
CO41.1	3	2	1	3
CO41.2	3	2	1	3
CO41.3	3	2	1	3
CO41.4	3	2	1	3
CO41.5	3	2	1	3
Average	3	2	1	3

Low-1: Medium-2: High-3

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –IV

DESIGN AND ANALYSIS OF ALGORITHMS

(Common to CSE/ISE/AD/AM/CI)

Course Code	**CSE23402**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Type of Course	**PC**	**Examination Hours**	**3 Hours**
No. of Credits	**3**		

Course Objectives:

The course will enable students to:

CLO1	To learn mathematical background for analysis of algorithm
CLO2	Analyze the asymptotic performance of algorithms.
CLO3	To understand the concept of designing an algorithm.
CLO4	Synthesize efficient algorithms in common engineering design situations.

CONTENTS	# of Hours
MODULE 1 **Introduction:** Notion of algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithmic Efficiency: Analysis frame work, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms. **Brute Force**: Selection Sort and Bubble Sort.	**08**
MODULE 2 **Divide and Conquer:** Merge sort, Quicksort, Multiplication of long integers, Strassen's Matrix multiplication, Max-Min Problem **Decrease and Conquer:** Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Applications of DFS and BFS.	**08**
MODULE 3 **Transform and Conquer:** Presorting, Heapsort, Problem reduction. **Space and Time Tradeoffs:** Sorting by Counting, Naive String Matching, Input Enhancement in String Matching: Horspool's and Boyer-Moore algorithm.	**08**
MODULE 4 **Dynamic Programming:** Computing a Binomial Coefficient, Warshall's and Floyd's Algorithms, The Knapsack Problem and Memory Functions. **Greedy Technique:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and codes.	**08**
MODULE 5 **Backtracking:** N-Queen's Problem, Sum of Subset Problem. **Branch-and-Bound:** Travelling Sales Person problem,0/1 Knapsack problem **NP and NP-Complete Problems**: Basic concepts, nondeterministic algorithms, P, NP, NP-Complete, and NP-Hard classes	**08**

Course Outcomes:

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

CO1	Understand and explore the asymptotic runtime complexity of algorithms by using mathematical relations.
CO2	Analyze a problem and identify the computing requirements appropriate for a solution
CO3	Apply mathematical foundations, algorithmic principles, and computer science theory to the modeling, and evaluation of computer-based solutions.
CO4	Investigate and apply optimal design, development principles, skills and tools in the construction of software solutions of varying complexity.

Text Books:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin, University, 3rd Edition, 2012, Pearson, ISBN 13: 978-0-13-231681-1.
2. Introduction to Algorithms, Cormen T.H., Leiserson C.E., Rivest R.L., Stein C., 3rd Edition, 2010, PHI, ISBN:9780262033848.

Reference Books:

1. Computer Algorithms, Horowitz E., Sahani S., Rajasekharan S., 2nd Edition, 2006, Galgotia Publications, ISBN:9780716783169.

E-Books / Web References:

1. http://www.facweb.iitkgp.ac.in/~sourav/daa.html
2. https://freevideolectures.com/course/2281/design-and-analysis-of-algorithms

MOOCs:

1. https://nptel.ac.in/courses/106101060/
2. https://www.coursera.org/specializations/algorithms

Mapping of CO-PO:

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

Low-1: Medium-2: High-3

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –IV

STATISTICAL MACHINE LEARNING I

(Integrated)

Course Code:	**ADS23403**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:2**	**SEE Marks:**	**50**
Type of Course:	**IPC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): Basics of Probability

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	To understand the problems solvable with data science
2	Ability to solve problems from a statistical perspective.
3	To build the skills to create data analytical pipelines.
4	To bring familiarity with the data science ecosystem and the various tools needed to continue developing as a data scientist.
5	Learn methods to transform raw data into a form that is ready for application of algorithms.

Module 1	No. of Hours	RBT Level
Introduction to Data Science: Data Science Roles, Lifecycle of Data Science, Representation of Data Science as a Venn Diagram. **Data Mining:** What is Data Mining? Types of Data Mining, Challenges of implementation in Data Mining, Advantages and Disadvantages, Applications of Data Mining. **Basics of Statistics:** Introduction to Statistics, how do we obtain and sample data, Empirical rule, Data distribution - kurtosis, skewness, Measuring Data Similarity and Dissimilarity.	**08**	**L2**
Module 2		
Inferential Statistics: Overview of Probability Distributions (Bernoulli, Binomial, Poisson, Chi-square, t-tail), Confidence Intervals, Bayesian Analysis of samples from Normal Distribution, Fisher Estimator, Central Limit Theorem. **Hypothesis Testing:** Concepts of hypotheses, testing simple hypotheses, Uniform tests, Two-sided alternatives, t-Test, F-Distribution, Bayes Test Procedures, ANOVA test.	**08**	**L3**
Module 3		
Introduction to Machine Learning: Basic steps of ML, EDA, Different Preprocessing techniques, Data Integration, Outlier removal, Applying Data Transformations, Scaling, Data Normalization, Training and Test Data the Same Way, Cross validation.	**08**	**L3**
Module 4		
Dealing with Missing Values: Assumptions and Missing Data Mechanisms, Simple approaches to missing Data, dealing with Noisy Data: Identifying Noise, Types of Noise Data, Noise filtering at data level. **Data Reduction:** Curse of Dimensionality, PCA, LDA, Data sampling. **Feature Engineering:** Processes, Techniques - Imputation, Discretization, Binning, Categorical encoding, Feature splitting, Outliers, Variable transformations - Function, Power and Quantile transformers, Scaling, creating features.	**08**	**L3**

Module 5		
Introduction to Supervised learning - Regression Algorithms: Linear Regression, Polynomial Regression, Lasso, Ridge and Elastic Net Regression, Regularization methods, Categorical Variables in Regression, Loss functions, Risk functions. **Use Case:** Relationship between Buying Intention and Awareness of Electric Vehicles, Application of Technology Acceptance Model in Cloud Computing, Impact of Social Networking Websites on Quality of Recruitment, Transportation optimization, Applications in Smart phones.	**08**	**L3**

Course Outcomes:

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

CO1	Understand the basics of data science, data mining techniques.
CO2	Interpret the basic statistical description of data.
CO3	Understand the data pre-processing techniques used in the data science.
CO4	Understand how to handle noisy data and perform dimensionality reduction.
CO5	Demonstrate Supervised Learning techniques on real data using regression algorithms.

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

High-3: Medium-2: Low-1

Textbooks:

1. Principles of Data Science by Sinan Ozdemir, Sunil Kakade, Packt Publishing Limited, 2nd Edition, 2018
2. Probability and Statistics, by Morris H Degroot, Mark J Schervish, Pearson, 4th Edition, 2012.
3. Data preprocessing in Data Mining‖, by Salvador Garcia, JuliánLuengo Francisco Herrera, Springer.

Reference Books:

1. Data Mining Concepts and Techniques by Jiawei Han and Micheine Kamber, Morgan Kaufmann, 3rd Edition, 2011.
2. Introduction to Machine Learning with Python, by Sarah Guido, Andreas C. Müller, O 'Reilly, 2017.

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
3. **Building Machine Learning Systems with Python:** http://totoharyanto.staff.ipb.ac.id/files/2012/10/Building-Machine-Learning-Systems-with-Python-Richert-Coelho.pdf

MOOCs:

1. IBM Data Science Professional Certificate: https://www.coursera.org/professional-certificates/ibm-data-science
2. https://www.coursera.org/learn/machine-learning
3. https://www.udemy.com/course/machine-learning-one-our/?ranMID=39197&ranEAID=JVFxdTr9V80&ranSiteID=JVFxdTr9V80-Gdwe6MbhMFzQeBY4coFxw&LSNPUBID =JVFxdTr9V80&utm_source=aff-campaign&utm_medium=udemyads

Prog. No.	Lab Programs	No. of Hours/ RBT levels
1	Write a python program to determine statistical parameters of NumPy arrays.	**02 L3**
2	Write a python program to implement hypothesis test (t-test, F-test, ANOVA test) on NumPy arrays.	**02 L3**
3	Write a program to implement different data imputations in Machine Learning using Python.	**02 L3**
4	Write a program to implement different feature scaling techniques using Python.	**02 L3**
5	Write a program to implement different normalization techniques using Python.	**02 L3**
6	Write a program to detect and correct outliers using Python.	**02 L3**
7	Write a program to demonstrate dimensionality reduction using PCA.	**02 L3**
8	Write a program to demonstrate discretization and binning.	**02 L3**
9	For any given dataset, implement Linear Regression, Ridge and Lasso Regression. Plot the correct and wrong predictions.	**02 L3**
10	For any given dataset, implement Elastic Net Regression and Polynomial Regression.	**02 L3**

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

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

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

Continuous Internal Evaluation (CIE):

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

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

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

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –IV

DATABASE MANAGEMENT SYSTEMS

Course Code:	**ADS23404**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**2:2:0**	**SEE Marks:**	**50**
Type of Course:	**PC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	Explain the concept of databases, database management systems and how they work.
2	Making use of Entity-Relationship Modelling for creating databases from the real-world scenarios.
3	Usage of Structured Query Language (SQL) statements for storing and processing information.
4	Normalization of database using Normalization rules.
5	Overview of NoSQL and how to query NoSQL Databases.

Module 1	No. of Hours	RBT Level
Introduction to Databases: Introduction, An Example, Characteristics of Database approach, Advantages of using DBMS approach, When not to use a DBMS. **Database System Concepts and Architecture:** Data models, Schemas and instances, Three schema architecture. **SQL:** SQL Data Definition and Data Types specifying basic constraints in SQL, Schema Change Statement in SQL, Basic retrieval queries in SQL, Insert, Delete and Update statements in SQL, Additional features of SQL,More complex SQL Queries, Views (Virtual Tables) in SQL, Triggers and Stored Procedures.	**08**	**L2, L3**
Module 2		
Data Modelling using the Entity-Relationship (ER) model: Using High-Level conceptual Data Models for Database Design, A sample Database Application, Entity types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity types, Refining the ER Design, ER Diagrams, Relationship Types of Degree Higher than two, Relational Database Design using ER-to-Relational Mapping. **Relational Algebra:** Unary Relational Operations, SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Aggregate functions and Grouping**.**	**08**	**L2, L3**
Module 3		
Database Design Theory and Normalization: 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, Multi-valued Dependencies and a Fourth Normal Form, Join Dependencies, Fifth Normal Form.	**08**	**L2, L3**
Module 4		
Transaction Processing, Concurrency Control: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Two Phase Locking Techniques for Concurrency Control. ARIES Recovery Algorithm	**08**	**L2, L3**

Module 5		
NoSQL: An overview of NoSQL, Characteristics of NoSQL, NoSQL storage types, Advantages and Drawbacks of NoSQL, Case Study: Application definition, Requirement Analysis, Implementation using MongoDB, Database Queries, Writing Queries. **Vector database:** Introduction, Vector Index, Working of Vector database.	**08**	**L2, L3**

Course Outcomes:

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

CO1	Identify the concepts of Databases and its architecture, and write database queries using SQL.
CO2	Apply ER Modelling for design of Databases and solving queries using Relational Algebra.
CO3	Design and develop databases from the real world using the concept of Normalization.
CO4	Apply the concept of Transaction Processing and recovery techniques.
CO5	Understand the working of NoSQL databases and applying query techniques on them.

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

High-3: Medium-2: Low-1

Textbooks:

1. Fundamentals of Database Systems by Ramez Elmasri and Shamkant B. Navathe, Pearson, 7th Edition, 2017.
2. Getting Started with NoSQL by Gaurav Vaish, Packt, 2013.
3. Vector Database by RoieSchwaber-Cohen, Pinecone, 2023.

Reference Books:

1. Database System Concepts, by Silberschatz, Korth and Sudharshan, Mc-GrawHill, 6th Edition, 2013
2. Database management systems by Ramakrishnan, and Gehrke, McGraw Hill, 3rd Edition, 2014.
3. 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://onlinecourses.nptel.ac.in/noc19_cs12/preview
2. https://swayam.gov.in/course/220database-management-system
3. www.w3schools.com/sql/

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 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 Integrated 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 –IV

IMAGE PROCESSING

Course Code:	**ADS234051**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**2:2:0**	**SEE Marks:**	**50**
Type of Course:	**ESC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

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

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

Course Outcomes:

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

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

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

High-3: Medium-2: Low-1

Textbooks:

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

Reference Books:

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

E-Books / Web References:

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

MOOCs:

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

Scheme of 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 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 Integrated 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 –IV

OPTIMIZATION TECHNIQUE

Course Code:	**ADS234052**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**2:0:0**	**SEE Marks:**	**50**
Type of Course:	**ESC**	**Duration of SEE (hours):**	**03**
Credits: 02			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	Appreciate the importance of linear algebra in computer science and allied engineering science.
2	Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
3	Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

Module 1	No. of Hours	RBT Level
VECTOR CALCULUS: Functions of several variables, Differentiation and partial differentials, gradients of vector-valued functions, gradients of matrices, useful identities for computing gradients, linearization and multivariate Taylor series.	**8**	**L3**
Module 2		
APPLICATIONS OF VECTOR CALCULUS: Back propagation and automatic differentiation, gradients in a deep network, The Gradient of Quadratic Cost, Descending the Gradient of Cost, The Gradient of Mean Squared Error.	**8**	**L3**
Module 3		
Convex Optimization-1: Local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, Optimization using gradient descent, Sequential search 3point search and Fibonacci search.	**8**	**L3**
Module 4		
Convex Optimization-2: Unconstrained optimization -Method of steepest ascent/descent, NR method, Gradient descent, Mini batch gradient descent, Stochastic gradient descent.	**8**	**L3**
Module 5		
Advanced Optimization: Momentum-based gradient descent methods: Adagrad, RMSprop and Adam Non-Convex Optimization: Convergence to Critical Points, Saddle-Point methods.	**8**	**L3**

Course Outcomes:

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

CO1	Apply the concepts of vector calculus to solve the given problem
CO2	Apply the concepts of partial differentiation in machine learning and deep neural networks.
CO3	Analyze the convex optimization algorithms and their importance in computer science & engineering.
CO4	Apply the optimization algorithms to solve the problem.
CO5	Analyze the advanced optimization algorithms for machine learning .

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

High-3: Medium-2: Low-1

Text Books:

1. Mathematics for Machine learning, Marc Peter Deisennroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.
2. S. Bubeck, Convex Optimization: Algorithms and Complexity, Foundations and Trends in Optimization, 2015.
3. S. Boyd, N. Parikh, and E. Chu," Distributed optimization and statistical learning via the alternating direction method of multipliers", Foundations and Trends in Machine Learning, Now Publishers Inc.

Reference Books:

1. Linear Algebra and Optimization for Machine Learning, Charu C. Aggarwal, Springer, 2020.
2. A. Beck, First-Order Methods in Optimization, MOS-SIAM Series on Optimization, 2017.
3. F. Bach, "Learning with Submodular Functions: A Convex Optimization Perspective", Foundations and Trends in Machine Learning, Now Publishers Inc.

Web links and Video Lectures (e-Resources):

- https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall2011/index.htm
- https://www.math.ucdavis.edu/~linear/linear.pdf
- https://www.coursera.org/learn/linear-algebra-machine-learning
- https://nptel.ac.in/syllabus/111106051/
- https://github.com/epfml/OptML_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.**

Continuous Internal Evaluation (CIE):

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

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

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

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMSETER -IV

Universal Human Values (UHV)

Course Code	**UHK23406**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:1	SEE Marks	50
Total Hours of Pedagogy	15-hour Theory Session +15-hour Self study	Total Marks	100
Credits	01	Exam Hours	01 Hour
Examination type (SEE)	SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is **MCQ (multiple choice questions).**		

Course objectives:

This course is intended to:

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
- This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Teaching-Learning Process (General Instructions)

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

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in the society and Provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self evolution.
7. Encourage the students for group work to improve their creative and analytical skills.

Module-1

Introduction to Value Education **(3 hours)**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

Module-2

Harmony in the Human Being : (3 hours)

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

Module-3

Harmony in the Family and Society : (3 hours)

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to- Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Module-4

Harmony in the Nature/Existence : (3 hours)

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Module-5

Implications of the Holistic Understanding – a Look at Professional Ethics : (3 hours)

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Course outcome (Course Skill Set)

At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature);

- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Expected to positively impact common graduate attributes like:

1. Ethical human conduct
2. Socially responsible behaviour
3. Holistic vision of life
4. Environmentally responsible work
5. Having Competence and Capabilities for Maintaining Health and Hygiene
6. Appreciation and aspiration for excellence (merit) and gratitude for all

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 out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures 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 Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.

- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for **50 questions,** each of the 01 marks. **The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books for READING:

Text Book and Teachers Manual

a. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034-47-1
b. The Teacher"s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Bharat Mein Angreji Raj – Pandit Sunderlal
8. Rediscovering India - by Dharampal
9. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
10. India Wins Freedom - Maulana Abdul Kalam Azad
11. Vivekananda - Romain Rolland (English)
12. Gandhi - Romain Rolland (English)
13. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
14. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
15. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
16. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
17. A N Tripathy, 2003, Human Values, New Age International Publishers.
18. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.

19. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press

20. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

21. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Web links and Video Lectures (e-Resources):

- Value Education websites,
- https://www.uhv.org.in/uhv-ii,
- http://uhv.ac.in,
- http://www.uptu.ac.in
- Story of Stuff,
- http://www.storyofstuff.com
- Al Gore, An Inconvenient Truth, Paramount Classics, USA
- Charlie Chaplin, Modern Times, United Artists, USA
- IIT Delhi, Modern Technology – the Untold Story
- Gandhi A., Right Here Right Now, Cyclewala Productions
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
- https://fdp-si.aicte-india.org/8dayUHV_download.php
- https://www.youtube.com/watch?v=8ovkLRYXIjE
- https://www.youtube.com/watch?v=OgdNx0X923I
- https://www.youtube.com/watch?v=nGRcbRpvGoU

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –IV

OBJECT ORIENTED PROGRAMMING WITH JAVA (Integrated)

Course Code:	**ADS234071**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**1:0:2**	**SEE Marks:**	**50**
Type of Course:	**AEC**	**Duration of SEE (hours):**	**03**
Credits: 02			

Prerequisites (if any): C Programming.

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	Introduces Object Oriented Programming concepts. Learn fundamental features of Java Programming
2	Setup Java JDK environment to create, debug and run Java Programs To understand in detail about classes, and inheritance.
3	Learn Object Oriented concepts using Java programs.
4	Apply the concepts of multiprogramming to develop Java programs
5	To gain knowledge on: packages, multithreaded programing and exceptions and develop robust java programs.

Module 1	No. of Hours	RBT Level
An Overview of OOP with Java: Object-Oriented Programming (Two Paradigms, Abstraction, The Three OOP Principles), Using Blocks of Code, Lexical Issues (Whitespace, Identifiers, Literals, Comments, Separators, The Java Keywords), Member functions and data, objects and functions**,** The Java Buzzwords. **Data types, variables and Arrays:** The primitive types, a closer look at Literals, Variables, Type conversion and casting, Automatic type promotion in Expressions, Arrays. **Operators:** Arithmetic operators, The Bitwise operators, Relational operators, Boolean Logical operators, Assignment operator, The? operator, Operator precedence **Control Statements:** Java's selection statements, iteration statements, Jump statements	**08**	**L2**
Module 2		
Introducing Classes: Classes fundamentals; Declaring objects; Introducing methods, Constructors, Destructors, this keyword, garbage collection **Methods and Classes:** Overloading Methods, Argument Passing, Returning Objects, Recursion, Access Control, understanding static, Introducing final, Inner Classes.	**08**	**L3**
Module 3		
Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch (run-time polymorphism), Using Abstract Classes, Using final with Inheritance. **Interfaces:** Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods.	**08**	**L2**
Module 4		
Packages: Packages, Packages and Member Access, Importing Packages**.** **Exceptions:** Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses.	**08**	**L2**
Module 5		
Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Interthread Communication.	**08**	**L2**

Course Outcomes:

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

CO1	Apply the fundamental constructs of Java Programming to create, debug and run programs with modern tools
CO2	Illustrate the concepts of Object Oriented Programming using Java Programs
CO3	Implement reusable Java programs using Interfaces and Packages
CO4	Apply Exception handling mechanism and thread synchronization
CO5	Implement Java programs using String handling methods

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

High-3: Medium-2: Low-1

Textbooks:

1. Herbert Schildt, “Java: A beginner's guide”, 11th Edition, McGraw-Hill Education, 2022..
2. E Balagurusamy, “Object Oriented Programming with C++”, 8 th Edition, 2020.

Reference Books:

1. E Balaguruswamy, “Programming with Java”, 6 th Edition, McGraw-Hill Education, 2019.
2. Surbhi Kakar, “A Textbook of Java Programming”, 1st Edition, Dreamtech Press, 2019.
3. R. Nageswara Rao, “Core Java: An Integrated Approach”, 1st Edition, Dreamtech Press, 2016

E-Books / Web References:

1. https://docs.oracle.com/javase/tutorial/essential/index.html
2. http://www.onlinecomputerbooks.com/free-java-books.php

MOOCs:

1. https://www.udemy.com/course/java-programming-tutorial-for-beginners/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013847939122315264565 22_shared/overview

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 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 Integrated 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 –IV

GREEN IT AND SUSTAINABILITY

Course Code:	**ADS234072**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**2:0:0**	**SEE Marks:**	**50**
Type of Course:	**AEC**	**Duration of SEE (hours):**	**03**
Credits: 02			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	Understand challenges for Green ICT and the environmental impact.
2	Learn different aspects of ICT metrics and Sustainable Cloud Computing.
3	Explore effects of software design on the sustainability.

Module 1	No. of Hours	RBT Level
Green ICT -History, Agenda, and Challenges Ahead: Introduction, Industrial Revolution, The Emergence of Information and Communication Technologies, The Agenda and Challenges Ahead.	**06**	**L2**
Module 2		
Emerging Technologies and Their Environmental Impact: Introduction, Number of Connected Devices , Increased , Functionality, Increased Number of Separate Functions , Increased Demand for Speed and Reliability , Obsolescence—The Problem of Backward Compatibility, The Other Side of the Balance Sheet, Videoconference as an Alternative to Business Travel, Dematerialization of Product Chain, Travel Advice/Road Traffic Control, Intelligent Energy Metering , Building Management Systems, Saving IT	**06**	**L2**
Module 3		
Measurements and Sustainability: Introduction, ICT Technical Measures, Ecological Measures and Ethical Consideration, Systems Engineering for Designing Sustainable ICT-Based Architectures.	**06**	**L2**
Module 4		
Sustainable Cloud Computing: Introduction, Challenges in the Use of Cloud Computing As Green Technology, Cloud Computing and Sustainability, Sustainable Applications of Cloud Computing, Technologies Associated With Sustainable Cloud Computing, Future Prospects of Sustainable Cloud Computing, Reflections on Sustainable Cloud Computing Applications.	**06**	**L2**
Module 5		
Sustainable Software Design: Overview and Scope, Evaluating Sustainability Effects , Sustainability and the Product Life Cycle , Direct Effects: Sustainability During Use, Runtime Energy Consumption Basics , Analyzing the Energy Consumption of an Application , Energy Consumption Reduction Using Physical Properties of Semiconductors, Optimizing the Energy Consumption of an Application: Compiler Techniques, Optimizing the Energy Consumption of an Application: Runtime Approaches.	**06**	**L2**

Course Outcomes:

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

CO1	Classify the challenges for Green ICT
CO2	Relate the environmental impact due to emerging technologies. .

CO3	Demonstrate different aspects of ICT metrics. .
CO4	Compare the various parameters related to Sustainable Cloud Computing.
CO5	Analyze the Energy Consumption of an Application .

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

High-3: Medium-2: Low-1

Text Books:

1. Green Information Technology – A Sustainable Approach, Mohammad Dastbaz Colin Pattinson, Babak Akhgar, Elsevier, 2015 Inc.

2. San Murugesan; G. R. Gangadharan, Harnessing Green IT: Principles and Practices, Wiley-IEEE Press

Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=kvn_-mJ2tSo https://www.youtube.com/watch?v=kxngsYn5N3Y
https://www.youtube.com/watch?v=EgdFi3sCgzU https://www.brightest.io/sustainability-measurement

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

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

Continuous Internal Evaluation (CIE):

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

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

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

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER -IV

PHYSICAL EDUCATION (SPORTS & ATHLETICS)

Course Code	**:**	PEK23408	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:1			
Total Hours	**:**	24 P			

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

1. Understand the ethics and moral values in sports and athletics
2. Perform in the selected sports or athletics of student's choice.
3. Understand the roles and responsibilities of organisation and administration of sports and games.

Module I : Ethics and Moral Values **4 Hours**

A. Ethics in Sports
B. Moral Values in Sports and Games

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

A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.
B. Athletics (Track Events) – Any event as per availability of Ground.

Module III: Role of Organisation and administration **4 Hours**

Scheme and Assessment for auditing the course and Grades:

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –IV

ALGORITHMS LABORATORY

(Common to CSE/ISE/AD/AM/CI)

Course Code:	**CSEL23409**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**3**

Sl. No.	**Experiments/Programs**
1	a. Implement naïve String matching algorithm using Brute Force Approach b. Implement and analyze iterative and recursive binary search algorithm using divide and conquer method .
2	Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.
3	Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.
4	a. Incorporate the array data structure and demonstrate whether a given unweighted graph is connected or not using DFS method. b. Implement the graph traversal technique using BFS method to print all the nodes reachable from a given starting node in an unweighted graph.
5	Demonstrate how to obtain the Topological ordering of vertices in a given digraph.
6	Implement Horspool's String matching algorithm.
7	Compute the Transitive Closure for a given directed graph using Warshall's algorithm.
8	For a given weighted graph, construct an All-Pairs Shortest Path using Floyds algorithm .
9	Implement 0/1 Knapsack problem using Dynamic Programming Memory Functions technique.
10	Find Minimum Cost Spanning Tree for a given weighted graph using Prims and Kruskal's algorithm.
11	From a given vertex in a weighted connected graph, determine the Single Source Shortest Paths using Dijkstra's algorithm
12	Demonstrate the working of back tracking approach for solving N-Queen's problem.

Course Outcomes:

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

CO1	Interpret the brute-force, divide-and-conquer paradigms
CO2	Recognize the design techniques for graph traversal and String Matching problems using representative algorithms
CO3	Demonstrate the greedy technique, dynamic programming paradigm as to when an algorithmic design situation calls for it
CO4	Illustrate the Backtracking algorithm design paradigms

Text Books:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin, University, 3rd Edition, 2012, Pearson, ISBN 13: 978-0-13-231681-1.
2. Introduction to Algorithms, Cormen T.H., Leiserson C.E., Rivest R.L., Stein C., 3rd Edition, 2010, PHI, ISBN:9780262033848.

Reference Books:

1. Computer Algorithms, Horowitz E., Sahani S., Rajasekharan S., 2nd Edition, 2006, Galgotia Publications, ISBN:9780716783169.

Mapping of CO-PO:

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

Low-1: Medium-2: High-3

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
Record	10	**50**
Test	20	
Experiential Learning (Mini Project)	20	NIL
Total Marks for the Course	**50**	**50**

B.E. in Artificial Intelligence and Data Science
Scheme of UG Autonomous Program – 2023 batch

V SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Question Paper Setting Board (PSB)	Teaching Department (TD)	Teaching Hours/Week			Examination			CREDITS
						L	T	P	CIE	SEE	Total	
1	ADS23501	Management, Economics and Finance for IT Engineers	HSMS	AI&DS	AI&DS	3	0	0	50	50	100	3
2	ADS23502	Big Data Analytics: Tools and Techniques	IPCC	AI&DS	AI&DS	2	2	2	50	50	100	4
3	ADS23503	Statistical Machine Learning II	PCC	AI&DS		3	2	0	50	50	100	4
4	ADS23504	Statistical Machine Learning II Laboratory	PCCL			0	0	2	50	50	100	1
5	ADS23505X	Professional Elective - I	PEC	AI&DS		3	0	0	50	50	100	3
6	ADSP23506	Mini Project	PROJ			0	0	4	100	---	100	2
7	RMIK23507	Research Methodology and IPR	AEC	Any Department	Any Department	2	2	0	50	50	100	3
8	CIVK23508	Environmental Studies and E-Waste Management	MC	CV/Env/Chem	CV	2	0	0	50	50	100	2
9	NSK23308	National Service Scheme (NSS)	MC	NSS coordinator	NSS coordinator	0	0	2	100	---	100	0
	PEK23308	Physical Education (PE) (Sports and Athletics)		Physical Education Director	Physical Education Director							
	YOK23308	Yoga		Yoga Teacher	Yoga Teacher							
								Total	550	350	900	22

H. M. Rajashekhar Swamy

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

Professional Elective Course - I	
ADS235051	Web Technologies
ADS235052	Advanced Image Processing

PCC: Professional Core Course, **PCCL:** Professional Core Course laboratory, **UHV:** Universal Human Value Course, **MC:** Mandatory Course (Non- **AEC:** credit), Ability Enhancement Course, **SEC:** Skill Enhancement Course, **L:** Lecture, **T:** Tutorial, **P:** Practical **S**= SDA: Skill Development Activity, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation. **K :** The letter in the course code indicates common to all the stream of engineering. **PROJ:** Project /Mini Project. **PEC:** Professional Elective Course.

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall
not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. 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:

i) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

ii) **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.
The CIE marks awarded for the Mini-project, shall be based on the evaluation of the 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.

No SEE component for Mini-Project.
Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

B.E. in Artificial Intelligence and Data Science
Scheme of UG Autonomous Program – 2023 batch

VI SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Question Paper Setting Board (PSB)	Teaching Department (TD)	Teaching Hours/Week			Examination			CREDITS
						L	T	P	CIE	SEE	Total	
1	ADS23601	Data Visualization using Tableau	IPCC	AI&DS	AI&DS	2	2	2	50	50	100	4
2	ADS23602	Neural Networks and Deep Learning	PCC	AI&DS	AI&DS	3	2	0	50	50	100	4
3	ADS23603X	Professional Elective - II	PEC	AI&DS		3	0	0	50	50	100	3
4	ADS23604X	Open Elective -I	OEC			3	0	0	50	50	100	3
5	ADS23605	Major Project Phase - I	PROJ	AI&DS		0	0	4	100	-	100	2
6	ADSL23606	Neural Networks and Deep Learning laboratory	PCCL	AI&DS		0	0	2	50	50	100	1
7	ADS23607X	Ability Enhancement Course	AEC	AI&DS		1	0	0	50	50	100	1
8	NSK23608	National Service Scheme (NSS)	MC	NSS coordinator	NSS coordinator	0	0	2	100	---	100	0
	PEK23608	Physical Education (PE) (Sports and Athletics)		Physical Education Director	Physical Education Director							
	YOK23608	Yoga		Yoga Teacher	Yoga Teacher							
9	IKSK23609	Indian Knowledge System	IKS	HSS	HSS	1	0	0	100	-	100	0
					Total				500	400	900	18

Professional Elective Course	
ADS236031	Cryptography and Network Security
ADS236032	Cloud Computing

Open Elective Course	
ADS236041	Foundations of Data Science
ADS236042	Neural Networks and Deep Learning

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

Ability Enhancement Course	
ADS236071	Software Engineering
ADS236072	Data Analytics for IoT

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L**: Lecture, T: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K** : The letter in the course code indicates common to all the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulationgoverning the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –V

MANAGEMENT, ECONOMICS AND FINANCE FOR IT ENGINEERS

Course Code:	**ADS23501**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**HSMS**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	Introduce the fundamentals, tools and theories of managerial economics.
2	Explain the principles of management, organization and entrepreneur.
3	Illustrate the importance of planning, organizing, staffing, directing and controlling.
4	Elucidate how to launch an entrepreneurial career.
5	Familiarize the students with basic concepts of financial management and financial system

Module 1	No. of Hours	RBT Level
Nature and Scope of Managerial Economics - Introduction, What is Economics? What is Managerial Economics? , How Economics Contributes to Managerial Decisions, Application of Economics to Business Decision: An Example. **Objectives of Business Firms** - Introduction, Profit as Business Objective, Alternative Objectives of Business Firms, Baumol's Hypothesis of Sales Revenue Maximization, Marris's Hypothesis of Maximization of Firm's Growth Rate, Williamson's Hypothesis of Maximization of Managerial Utility Function.	**08**	**L2**
Module 2		
Nature and Functions of Management: Importance of Management, Definition of Management, Management Functions, Levels of Management. **Planning:** Nature of Planning, Importance of Planning, Types of Plans, Steps in Planning, Difference between Strategic Planning and Tactical Planning, Planning Skills, Strategic Planning in Indian Industry. **Organization**: What is an "Organization"? Process of Organizing, Principles of Organizing. **Staffing:** Importance and need for proper Staffing.	**08**	**L2**
Module 3		
Direction and Supervision - Requirements of Effective Direction, Giving Orders, Motivation, First-level or Front-line Supervision. **Leadership** - Difference between a Lead and a Manager, Characteristics of Leadership, Traditional Approaches to Leadership, New approaches to leadership, Leadership Style in Indian Organizations. **Communication** - Importance of Communication, Purposes of Communication, Formal Communication, Forms of Communication, Informal Communication, The Communication Process, and Barriers to Communication.	**08**	**L2**
Module 4		
Entrepreneurship - Introduction, Concept of Entrepreneurship, Functions of Entrepreneur, Characteristics of an Entrepreneur, Types of Entrepreneurs, Intrapreneurs- An emerging class, Stages in Entrepreneurial Process, Role of Entrepreneurs in Economic Development, and Entrepreneurship in India. **Preparation of project** - Introduction, Meaning of Project, Project Identification, Project Selection, Report-Need and Significance, Contents of a Project Report Project Formulation, Guidelines by Planning Commission for Project Report, Errors in Project Report, Project Appraisal, Market Feasibility Study, Technical Feasibility Study,	**08**	**L2**

Financial Feasibility Study, Social Feasibility Study.		
Module 5		
Introduction to Financial Management: Introduction, Evolution of Financial Management, Meaning, Importance Scope and Objectives, Conflicts in Principles of Profit vs. Value Maximization. **Case Studies:** 1. Cashless Aftermath: Effectiveness and Efficiency Worries 2. Faculty Procedure 3. Designing an Organization Structure 4. Ensuring Effective Communication	**08**	**L2**

Course Outcomes:

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

CO1	Explain the application of economic principles in management decision making.
CO2	Discuss the functional areas of management and apply their principles in establishing an enterprise
CO3	Illustrate the project proposals and reports for the effective management of an organization.
CO4	Identify the business opportunities and analyze the management skills for the economic growth of the society
CO5	Analyze how the entrepreneur applies the principles of management to meet the personal and societal needs.

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

High-3: Medium-2: Low-1

Textbooks:

1. Dwivedi D. N, "Managerial Economics", Vikas Publishing House 8th Edition, 2018.
2. P.C Tripathi, P.N Reddy, "Principles of Management", Tata McGraw Hill, 6th Edition, 2010.
3. K R Paneesh, "Management and Entrepreneurship", Sudha Publications, 4th Edition, 2010.
4. Nishikant Jha, Kuldeep Sharma, Nilesh Ekanath Koli, "Financial Management", Himalaya Publishing House Pvt. Ltd, 1st Edition, 2016.

Reference Books:

1. Geethika, Ghosh & Choudhury, "Managerial Economics", McGraw Hill Education 3rd Edition, 2021.
2. Robert Lussier, Thomson, "Management Fundamentals Concepts", Application, Skill Development- SAGE Publications, Inc, 9th Edition, 2020.

E-Books / Web References:

1. https://www.pdfdrive.com/financial-management-and-analysis-workbook-step-by-step-exercises- and-tests-tohelp-you-master-financial-management-and-analysis-e158595305.html
2. https://www.pdfdrive.com/fundamentals-of-financial-management-concise-sixth-edition- e20229517.html
3. https://www.youtube.com/watch?v=CCQwz_Gwo6o
4. https://www.digimat.in/nptel/courses/video/110107144/L01.html

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

Scheme of Evaluation: (Integrated courses)

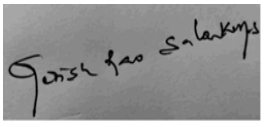
Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions**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

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Case Study Presentation	10	
SEE	Semester End Examination	50	50
Grand Total			100



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –V

BIG DATA ANALYTICS: TOOLS AND TECHNIQUES

Course Code:	**ADS23502**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**2:2:2**	**SEE Marks:**	**50**
Type of Course:	**IPCC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

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

Module 1	No. of Hours	RBT Level
Introduction To Big Data : Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data processing platforms: HADOOP, SPARK, FLINK, and MOA, Challenges of Conventional Systems, Big Data Analytics Applications and Case Studies.	**10**	**L2**
Module 2		
Hadoop: Introduction to Hadoop: Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. Hadoop Distributed File System Basics: HDFS Design Features, Components, HDFS User Commands. Hadoop Map-Reduce Framework.	**10**	**L3**
Module 3		
Hive – What is Hive? Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), CREATE TABLE, DROP TABLE, ALTER TABLE, CREATE DATABASE, DROP DATABASE, DESCRIBE, INSERT, COUNT(*), SELECT, DISTINCT, HAVING, LIMIT, GROUP BY,ORDER BY, VARIOUS JOINS. Pig 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. Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive.	**10**	**L3**
Module 4		
Essential Hadoop Tools and ecosystem: Using Apache Pig, Hive, Sqoop, Flume, Oozie, **HBase:** Fundamentals of HBase and ZooKeeper, IBM Info Sphere Big Insights and Streams. **Spark:** RDD's in Spark, Data Frames & Spark SQL, Spark Streaming. Introduction to NoSQL Big Data Management.	**10**	**L3**
Module 5		50
MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks,	**10**	**L3**

MongoDB, Databases, Cassandra Databases. NO-SQL database Techniques for Big Data, Comparison of Relational Databases with NO-SQL Databases. Advantages of NO-SQL over RDBMS, Scale out VS Scale up, Types of NO-SQL databases, Characteristics of NO-SQL Databases.NO-SQL solutions for Big Data Management, NO-SQL Data Models, Key-value stores, column based stores, graph based stores and document based stores.		

Course Outcomes:

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

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

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

High-3: Medium-2: Low-1

Textbooks:

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

Reference Books:

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

E-Books / Web References:

1. Big Data Now: http://cdn.oreillystatic.com/oreilly/radarreport/0636920028307/Big_Data_Now_2012_ Edition.pdf
2. Bigdata Analytics with Hadoop: https://www.packtpub.com/free-ebook/big-data-analytics-with- hadoop-3/9781788628846

MOOCs:

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

Scheme of 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 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.**

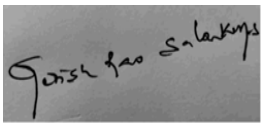
Continuous Internal Evaluation (CIE):

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 Integrated 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 –V

STATISTICAL MACHINE LEARNING II

Course Code:	**ADS23503**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:2:0**	**SEE Marks:**	**50**
Type of Course:	**PCC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): Basics of Statistics

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	Understanding of the fundamental classification algorithms and challenges of supervised algorithms
2	Become conversant with types of multiclass classification algorithms, and their applicability
3	Familiarize with the unsupervised machine learning algorithms
4	To improve the performance of the algorithms using hyper parameter tuning techniques.
5	Apply and practice the knowledge by solving real time problems.

Module 1	No. of Hours	RBT Level
Supervised Learning - Classification Algorithms: Logistic regression, k-Nearest Neighbors (Regression and Classification)**,** Naive Bayes, Decision Trees. **Use Case:** Prediction of Customer buying Intension due to Digital Marketing, Measuring Acceptability of a New Product, Predicting phishing websites, loan categorization, Diagnosis and Treatment of Diseases, Security applications.	**10**	**L3**
Module 2		
Ensemble models: Support Vector Machine (SVC and SVR), Kernel Methods, Random Forest, Ensemble classification methods (Bagging and Boosting Techniques), Stacking classifier.	**10**	**L3**
Module 3		
Multiclass Classification: Multiclass classification problem, Generalization bounds, Uncombined multi-class algorithms, aggregated multi-class algorithms, Performance Metrics **Explainable AI:** Introduction to XAI, LIME, SHAP. **Introduction to Data Annotation:** Images and Text.	**10**	**L3**
Module 4		
Unsupervised Learning: Introduction to Unsupervised Learning, Clustering, k-means Clustering, Bisecting k- means, K-Means as special case of Expectation Maximization, Agglomerative Clustering and Divisive Clustering, DBSCAN, Comparing and Evaluating Clustering Algorithms, Semi-Supervised Learning models.	**10**	**L3**
Module 5		
Hyperparameter Tuning: Overview, Manual Search, Grid Search, Random Search, Multi-fidelity Optimization.	**10**	**L3**

Course Outcomes:

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

CO1	Implement machine learning models to classify data on exemplary applications related to real world.
CO2	Apply supervised learning techniques to real data using classification algorithms.
CO3	Apply multiclass classification learning techniques to real data.
CO4	Apply unsupervised learning algorithms for prediction.
CO5	Apply hyper parameter tuning techniques to improve the performance of the model.

CO / PO Mapping														
CO / PO/ PSO	**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

Textbooks:

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

Reference Books:

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

E-Books / Web References:

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

MOOCs:

1. **Udemy.**
2. **Coursera**
3. **NPTEL**

Scheme of 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 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.**

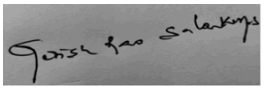
Continuous Internal Evaluation (CIE):

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 Integrated 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 V

STATISTICAL MACHINE LEARNING II LABORATORY

Course Code:	**ADSL23504**	**CIE Marks:**	**50**
Hours/Week (L:T:P):	**0:0:2**	**SEE Marks:**	**50**
Type of Course:	**PCCL**	**Duration of SEE (hours):**	**03**
Credits: 01			

Prerequisites: Basics of Probability

Course Objectives: The course will enable students to:

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

Prog. No.	Lab Programs	No. of Hours/ RBT levels
1	Write a program to implement the Logistic Regression and K-fold cross validation on the diabetes dataset.	**02 L3**
2	Write a program to implement the K-Nearest Neighbour classifier for a sample training data set stored as a .CSV file. Find the optimal number of neighbours.	**02 L3**
3	Write a program to implement the Naive Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier for scaled and unscaled data.	**02 L3**
4	Write a program to implement the Decision Tree for a sample training data set stored as a .CSV file.	**02 L3**
5	Write a program to demonstrate pipeline in Machine Learning.	**02 L3**
6	Write a program to demonstrate Support Vector Machine using different Kernel functions.	**02 L3**
7	Write a program to implement Bagging and Boosting classifiers.	**02 L3**
8	Write a program to classify the data using Multiclass classification algorithm.	**02 L3**
9	Write a program to cluster the data using K-Means clustering algorithm.	**02 L3**
10	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**

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

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

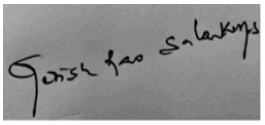
Conduct of Practical Examination:

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

Scheme of Examination (CIE):

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

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



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –V

WEB TECHNOLOGIES

Professional Elective Course

Course Code:	**ADS235051**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

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

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

Course Outcomes:

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

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

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

High-3: Medium-2: Low-1

Textbooks:

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
3. https://www.w3schools.com/css/
4. https://www.w3schools.com/jS/default.asp
5. https://www.w3schools.com/pHP/default.asp
6. https://getbootstrap.com/
7. https://www.apachefriends.org/index.html
8. https://www.w3schools.com/xml/
9. https://www.w3schools.com/xml/ajax_intro.asp https://jquery.com/

MOOCs:

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

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

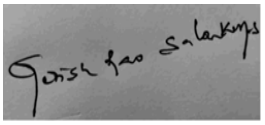
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one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

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

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



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –V

ADVANCED IMAGE PROCESSING

Professional Elective Course

Course Code:	**ADS235052**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): Image Processing

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	To develop insight into various techniques of Digital image representation and processing.
2	To evaluate the techniques followed in Digital Image Morphology
3	To illustrate the techniques involved in image restoration algorithms.
4	To illustrate the techniques involved in object and symbol recognition algorithms.
5	To illustrate the techniques involved in Image understanding and Motion analysis algorithms.

Module 1	No. of Hours	RBT Level
Data structures for image analysis: Levels of image data representation, Traditional image data structures- Matrices, Chains, Topological data structures, Relational structures, Hierarchical data structures-Pyramids, Quadtrees, Other pyramidal structures **Practical Aspects of a Vision System:** Image Display: OpenCV, The IplImage Data Structure	**08**	**L2,L3**
Module 2		
Digital Morphology: Elements of Digital Morphology-Binary Dilation, Binary Erosion, Opening and Closing. The ‘‘Hit-and-Miss’’ Transform, Identifying Region Boundaries, Conditional Dilation, Counting Regions	**08**	**L2,L3**
Module 3		
Image Restoration: Image Degradations in the Real World, The Frequency Domain, The Fourier Transform, Fourier Transforms in OpenCV, The Inverse Filter, The Wiener Filter, Motion Blur—A Special Case Frequency Filters in General, Isolating Illumination Effects	**08**	**L2,L3**
Module 4		
Object recognition: Knowledge representation, Statistical pattern recognition, Syntactic pattern recognition, Recognition as graph matching **Symbol Recognition:** Optical Character Recognition(OCR) on Simple Perfect Images, OCR on Scanned Images—Segmentation	**08**	**L2,L3**
Module 5		
Image understanding: Image understanding control strategies, Pattern recognition methods in image understanding, Semantic image segmentation and understanding Texture: Texture recognition method applications **Motion analysis and Video tracking:** Motion models to aid tracking	**08**	**L2,L3**

Course Outcomes:

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

CO1	Comprehend and represent images through various data structures.
CO2	Develop a good insight into various digital image morphological techniques
CO3	Explain the underlying concepts of Image restoration.
CO4	Contrast between object and symbol recognition techniques
CO5	Demonstrate different techniques for image understanding and motion analysis.

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

High-3: Medium-2: Low-1

Textbooks:

1. Image Processing: Analysis and Machine Vision by Milan Sonka, Vaclav Hlavac, and Roger Boyle. Cengage Learning 4th Edition, 2015.
2. Algorithms for Image Processing and Computer Vision, J.R. Parker, Second Edition, Wiley Publishing, Inc.

Reference Books:

1. A Robert Schalkoff, Pattern Recognition-Statistical, Structural and neural approach, John Willey & Sons, 4th Edition, 2007.
2. Andrian Low, Introductory Computer Vision and Image Procession, McGraw Hill Co., 1991.
3. R. Gonzalez and R. E. Wood, Digital Image Processing, Prentice Hall of India, 4th Edition, 2018.

E-Books / Web References:

1. Digital Image Processing, Wilhelm Burger
   http://omercetin.com.tr/DERS/IP/Kitap/2.Principles%20of%20digital%20image%20processing.pdf
2. Introductory Digital Image Processing, John R Jensen
   https://media.oiipdf.com/pdf/f11c7ea9-28a4-42c8-8854-21a2f96a6338.pdf

MOOCs:

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

Scheme of Evaluation: (Integrated courses)

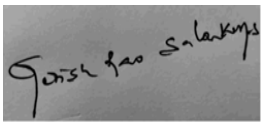
Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions**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

MINI PROJECT

Course Code:	**ADSP23506**	**CIE Marks:**	**100**
Hours/Week (L: T: P):	**0:0:4**	**Credits:**	**02**
Type of Course:	**PROJ**		

Course Learning Objectives: The course will enable students to

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

Guidelines for Mini Project

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

The mini-project tasks would involve:

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

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

Course Outcomes:

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

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

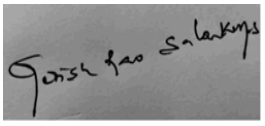
CO / PO Mapping														
CO / PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**1**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**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

High-3: Medium-2: Low-1

Scheme of Evaluation:

Continuous Internal Evaluation (CIE):

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



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER – V

RESEARCH METHODOLOGY AND IPR

Course Code	**RMIK23507**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
Type of Course	**AEC**	**Examination Hours**	**03**
No. of Credits	**3**		

Course Objectives: To enable students to apply the knowledge of Research Methodology in broad domain of aeronautical engineering by making them to learn:

CLO1	To make the student understand the foundations of Research and problem solution
CLO2	Knowledge in Research design, Qualitative and Quantitative Research
CLO3	Knowledge to formulate and derive static and dynamic aero elastic equations of motion.
CLO4	To understand the different types of IPR

Content	No. of Hours/ RBT levels
Module 1 **RESEARCH METHODOLOGY:** Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. **DEFINING THE RESEARCH PROBLEM:** Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration	**08 Hours/ L3**
Module 2 **REVIEWING THE LITERATURE:** Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed. **RESEARCH DESIGN**: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs	**08 Hours/ L3**
Module 3 **DESIGN OF SAMPLE SURVEYS:** Design of Sampling: Introduction, Sample Design, Sampling and Non-Sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. **MEASUREMENT AND SCALING:** Qualitative and Quantitative Data, **DATA COLLECTION:** Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.	**08 Hours/ L3**
Module 4 **TESTING OF HYPOTHESES:** Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.	**08 Hours/ L3**

INTERPRETATION AND REPORT WRITING: Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.	
Module 5 **INTELLECTUAL PROPERTY**: Principles of IPR, Kinds of IPR, Patent-Concepts, Novelty, Utility Inventiveness/Non-obviousness, Procedure for granting and obtaining patents; Copyright- conditions for grant of copyright, Copyright in Literary, Dramatic and Musical ,Works, Sound Recording, Cinematograph Films, Copyright in Computer Programme, Author Special Rights, Right of Broadcasting and performers, Trademark Law and Practices - Procedure of registration of trademark; Emerging Issues and Challenges; Few Future Aspects of Intellectual Property Rights	**08 Hours/ L3**

Textbook:

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

Reference Books:

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

COURSE OUTCOMES:

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

CO 1	Understand the research problem by literature review to solve problems
CO 2	Develop skills in qualitative and quantitative data analysis and presentation.
CO 3	Develop advanced critical thinking skills.
CO 4	Understand to write the report writing and awareness about IPR

Semester End Examination (SEE):

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

Continuous Internal Evaluation (CIE):

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

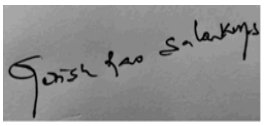
Typical Evaluation pattern for regular courses is shown in Table 2.

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

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

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

Low-1: Medium-2: High-3



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER – V

ENVIRONMENTAL STUDIES

Course Code	**CIVK23508**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:0:0	SEE Marks	50
Credits	02	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3

Prerequisites:

Course Objectives: Students will be taught:

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

Content	No. of Hours/ RBT levels
Module 1 – Ecosystem and Sustainability Ecosystems (Structure and Function): Forest, Desert, Wetlands, River, Oceanic and Lake. Sustainability: 17 SDGs-History, targets, implementation, Capacity Development	**6 Hours L2**
Module 2 - Natural Resource Management Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind. Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining - case studies and Carbon Trading	**6 Hours L2**
Module 3 – Environmental Pollution & Waste Management Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. Waste Management: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge	**6 Hours L2**
Module 4 - Global Environmental Issues Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology	**6 Hours L2**
Module 5 – Environmental Legislation Environmental Legislation: Water Act 1974, Air Act 1981, Environmental Protection Act 1984, Solid Waste Management Rules-2016, E- Waste management Rule - 2022, Biomedical Waste management-2016	**6 Hours L2**

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

CIVK23508.1	**Analyze** ecosystem dynamics to formulate strategies for addressing sustainability challenges and implementing the SDGs.
CIVK23508.2	**Evaluate** energy technologies to design effective resource management strategies.
CIVK23508.3	**Evaluate** the impacts of pollution to develop effective waste management strategies.
CIVK23508.4	**Evaluate** global environmental issues to design solutions for sustainable management.
CIVK23508.5	**Interpret** environmental laws and regulations for sustainable management practices.

Textbooks:

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

References:

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

Web Reference:

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

Scheme of Examination:

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

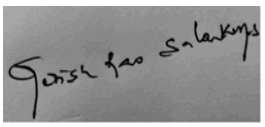
Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of three test marks will be added to test component. CIE is executed by way of two quizzes/Alternate Assessment Tools(AAT's), some possible AAT's: Seminar/ assignments/ mini-projects/ concept videos/ partial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

Typical Evaluation pattern is shown in Table 1.

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

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

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIVK23508.1	2					1	1	1							3
CIVK23508.2	2	2	2			1	3	1							3
CIVK23508.3		2	2	2		1	3	1							2
CIVK23508.4		2	2	2		1	3	1							2
CIVK23508.5	1	2	2	2		1	2	1							2
Average	**1.67**	**2**	**2**	**2**		**1**	**2.4**	**1**							**2.4**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SEMESTER: V

PHYSICAL EDUCATION (SPORTS & ATHLETICS)

Course Code	**:**	PEK23509		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:1				
Total Hours	**:**	24 P				

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

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

Module I : Orientation **4 Hours**

A. Fitness
B. Food & Nutrition

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

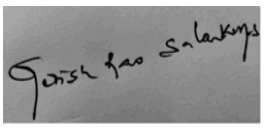
A. Agility – Shuttle Run
B. Flexibility – Sit and Reach
C. Cardiovascular Endurance – Harvard step Test

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

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

Scheme and Assessment for auditing the course and Grades:

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



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

DATA VISUALIZATION USING TABLEAU

Course Code:	**ADS23601**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**2:2:2**	**SEE Marks:**	**50**
Type of Course:	**IPCC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

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

Module 1	No. of Hours	RBT Level
Data Visualization: Introduction to the Art and Science of Data Visualization, What is Data Visualization? Importance of Data Visualization, Data Visualization Tools, Four Pillars of Visualization, History of Data Visualization. **Design Fundamentals:** Design Principles, Colors, and "Chart Junk", The Shaffer 4 C's of Data Visualization, Best practices (examples).	**08**	**L3**
Module 2		
Storytelling with Data: 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. **Tableau:** 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.	**08**	**L3**
Module 3		
Data connection: Extracting data, Joining, Blending, Splits, Sorting, Fields operations. **Tableau calculations:** Operators, Functions, Numeric, string, date, table calculations.	**08**	**L3**
Module 4		
Sort and filter: Basic filters, Filter operations, Extract filters, Quick filters, Context filters, Condition filters, Data source filters, Top filters, Build groups, hierarchy, sets. **Charts:** Bar, Line, Pie, Crosstab, Bubble, Bullet, Area, Pareto, Bump chart, Gantt chart, Histogram, Motion charts, Waterfall charts. Plots: Scatter, Boxplot. Maps: Heat map, Tree map.	**08**	**L3**
Module 5		
Advanced Tableau: Formatting, Forecasting, Trend Lines, Clustering, Regression. **Power BI:** Introduction, Features, Architecture, Visualization options, Data Analysis Expressions.	**08**	**L3**

Course Outcomes:

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

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

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

High-3: Medium-2: Low-1

Textbooks:

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.

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

E-Books / Web References:

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

MOOCs:

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

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

Scheme of Evaluation: (Integrated Courses)

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

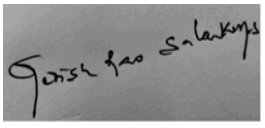
The laboratory assessment would be restricted to only the CIE evaluation.

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

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

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

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



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

NEURAL NETWORKS & DEEP LEARNING

Course Code:	**ADS23602**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:2:0**	**SEE Marks:**	**50**
Type of Course:	**PCC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

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

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

Course Outcomes:

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

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

CO / PO Mapping														
CO / PO/ PSO	**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

Textbooks:

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

Reference Books:

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

E-Books / Web References:

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

MOOCs:

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

Scheme of 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.**

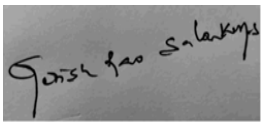
The laboratory assessment would be restricted to only the CIE evaluation.

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	**50**	**50**
Grand Total			**100**



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

CRYPTOGRAPHY AND NETWORK SECURITY

Professional Elective Course

Course Code:	**ADS236031**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): Basics of Computer Networks

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	Apply different Classical Encryption Techniques
2	Analyse different Block Ciphers and the Data Encryption Standard
3	Illustrate Public-Key Cryptography algorithms
4	Understand different types of malicious software
5	Understand the concepts of Payload-System and Firewalls

Module 1	No. of Hours	RBT Level
Computer and Network Security Concepts: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms. **Classical Encryption Techniques:** Symmetric Cipher Model, Substitution Techniques, Transposition techniques Text Book 1: Chapters: 1.1, 1.2, 1.3, 1.4, 1.5, 3.1, 3.2, 3.3	**08**	**L2**
Module 2		
Block Ciphers and the Data Encryption Standard: Traditional block Cipher structure, The data encryption standard, A DES example, The strength of DES, Block cipher design principles Text Book 1: Chapter: 4.1, 4.2, 4.3, 4.4, 4.5	**08**	**L2**
Module 3		
Public-Key Cryptography and RSA: Principles of public-key cryptosystems, The RSA algorithm, Other Public-Key Cryptosystems: Diffie-Hellman key exchange, Elgamal Cryptographic systems Text Book 1: Chapters: 9.1, 9.2, 10.1, 10.2	**08**	**L2**
Module 4		
Malicious Software: Intruders, Types of malicious software (malware), Viruses, Virus Countermeasures, Distributed denial of service (DDoS) **Firewalls:** The Need for Firewalls, Firewall Characteristics, Firewall types Text Book 2: Chapters :9.1, 10.1 to 10.3, 11.1 to 11.3	**08**	**L2**
Module 5		
Transport-Level Security: Web Security Considerations, Secure Socket Layer and Transport Layer Security: SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol: Handshake Protocol **IEEE 802.11i Wireless Lan Security:** IEEE 802.11i Services, IEEE 802.11i Phases of Operation, IP Security Overview Chapters: 5.1, 5.2, 6.1, 8.1	**08**	**L2**

Course Outcomes:

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

CO1	Implement different Classical Encryption Techniques
CO2	Implement Block Ciphers and the Data Encryption Standard algorithm
CO3	Implement Public-Key Cryptography algorithms
CO4	Explain different types of malicious software and firewalls
CO5	Understand the concept of Web security, IP security and wireless security

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

High-3: Medium-2: Low-1

Textbooks:

3. William, Stallings. Cryptography and network security: For VTU. Pearson Education India, 2006.
4. William, Stallings. Network Security Essentials: Applications and Standards (For VTU).Pearson Education India, 2011.

Reference Books:

1. V. K Pachghare: Cryptography and Information Security, PHI 2nd Edition
2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.

E-Books / Web References:

1. https://www.sanfoundry.com
2. https://www.oreilly.com/library/view/cryptography-and network/9789332579125/

MOOCs:

1. https://www.coursera.org/learn/cryptography
2. https://onlinecourses.nptel.ac.in/

Scheme of Evaluation: (Integrated courses)

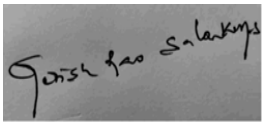
Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions**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

CLOUD COMPUTING

Professional Elective Course

Course Code:	**ADS236032**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

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

Module 1	No. of Hours	RBT Level
Introduction: Introduction to cloud computing, History of cloud computing, Characteristics and Benefits, Challenges Ahead, Types of clouds: (Public cloud, private cloud and hybrid cloud), Economics of cloud, Building Cloud Computing platforms and technologies.	**8**	**L2**
Module 2		
Virtualization: Introduction to Virtualization, Characteristics of Virtualization, Taxonomy of Virtualization techniques, Types of Virtualization Techniques, Pros and Cons of Virtualization, Technology examples Xen: Paravirtualization, VMware: Full Virtualization. **Case Study**: Install Virtualbox/VMware Workstation with different flavors of linux or windows OS on top of windows	**8**	**L2**
Module 3		
Cloud Computing Architecture: Introduction, cloud reference model, cloud computing services: Infrastructure as a service (IAAS), Platform as a service (PAAS) and Software as a service (SAAS), Aneka framework overview, Anatomy of the Aneka Container, Building Aneka clouds, Cloud Programming and Management, Open source platforms for private clouds.	**8**	**L2**
Module 4		
Cloud Security and Cloud Platforms in the Industry: Cloud Security: Operating System (OS) Security, Virtual Machine (VM) Security, Security risks posed by shared images, ethical issues. **Cloud Platforms:** Amazon Web Services (AWS) - Compute services, Storage services, Communication services, Microsoft Azure- Azure concepts, SQL Azure.	**8**	**L2**
Module 5		
Cloud Applications: Scientific Applications: Healthcare: ECG analysis in the cloud, Biology: Gene expressions data analysis for cancer diagnosis. Business and Consumer Applications: Social Networking, media applications and multiplayer online gaming.	**8**	**L2**

Course Outcomes:

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

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

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

High-3: Medium-2: Low-1

Textbooks:

1. Rajkumar Buyya, Christian Vecchiola and Thamrai Selvi Mastering Cloud Computing McGraw Hill Education.

2. Dan C Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elseveir 2013.

Reference Books:

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

E-Books / Web References:

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

MOOCs:

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

Scheme of Evaluation: (Integrated courses)

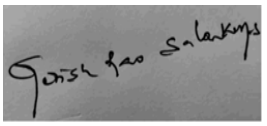
Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions**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

FOUNDATIONS OF DATA SCIENCCE

Open Elective Course

(Offered to other branch students)

Course Code:	**ADS236041**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**OEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

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

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

Course Outcomes:

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

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

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

High-3: Medium-2: Low-1

Textbooks:

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

Reference Books:

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

E-Books / Web References:

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

MOOCs:

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

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

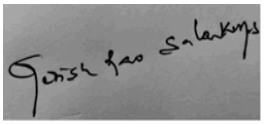
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one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

NEURAL NETWORKS AND DEEP LEARNING

Open Elective Course

(Offered to other branch students)

Course Code:	**ADS236042**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**OEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): Statistical Machine learning I and II.

Course Learning Objectives: The course will enable students to

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

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

Course Outcomes:

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

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

CO / PO Mapping														
CO / PO/ PSO	**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

Textbooks:

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

Reference Books:

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

E-Books / Web References:

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

MOOCs:

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

Scheme of Evaluation: (Integrated courses)

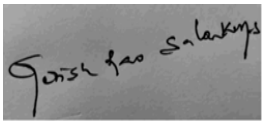
Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions**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

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

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



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

MAJOR PROJECT PHASE-I

Course Code:	**ADSP23605**	**CIE Marks:**	**100**
Hours/Week (L: T: P):	**0:0:4**	**Credits:**	**2**
Type of Course:	**PROJ**		

Course Learning Objectives: The course will enable students to

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

Major Project Guidelines:

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

Batch Formation:

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

Project Topic Selection:

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

Students can select courses in ***NPTEL*** from the discipline of ***Humanities and Social Sciences, Management, Multidisciplinary and Design Engineering.*** The course

chosen could be either of ***4w/8w/12w*** duration. The students need to enrol for a course, register for the exam and submit the e-certificate to the department, as and when it is released by NPTEL. ***The same will be considered as one of the components during project evaluation of phase 1.***

Project Evaluation:

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

Course Outcomes:

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

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

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

High-3: Medium-2: Low-1

Scheme of Evaluation:

Continuous Internal Evaluation (CIE):

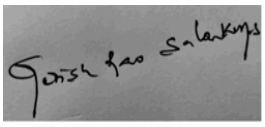
The following are the weightings given for the various stages of the project

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

Calendar of Events for the Project Work:

Week	Event
Prior to beginning of 6th Semester	Formation of group, problem selection and approval by the department committee.
Beginning of 6th Semester	Finalization of project and guide allotment
6th Semester	Literature survey, Design and Development of Project methodology
Last two weeks of 6th Semester	Synopsis submission and CIE Presentation

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



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER – VI

NEURAL NETWORKS & DEEP LEARNING LABORATORY

Subject Code	**ADSL23606**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
Type of course	**PCCL**	**Examination Hours**	**03**
No. of Credits: 01			

Course Objectives: The course will enable students to:

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

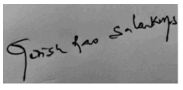
Prog. No.	Lab Programs	No. of Hours/ RBT levels
1	For the set of images perform the following a. Read the images from the folder. b. For one image – Apply text, borders, noise removal, brightness increase, filtering, enhancement, and augmentation.	**03** **L3**
2	Write a python program to implement YOLO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

Conduct of Practical Examination:

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

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members havebeen encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovativepedagogical practices. Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/concept videos/ partial reproduction of research work/ oral presentation.



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

SOFTWARE ENGINEERING

Ability Enhancement Course

Course Code:	**ADS236071**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**1:0:0**	**SEE Marks:**	**50**
Type of Course:	**AEC**	**Duration of SEE (hours):**	**01**
Credits: 01			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	Discuss the software engineering principles, process, and requirements in building large software programs.
2	To Infer the fundamentals of object-oriented concepts, different system models, and design patterns
3	Discuss the various types of software testing practices and software evolution processes
4	Identify the importance of agile practices in software development and Real Time OS
5	Recognize the Project planning with its methods and methodologies

Module 1	No. of Hours	RBT Level
Introduction to Software Engineering: Introduction, Professional Software development, Software Engineering Ethics, Case Studies. **Software Process:** Software Process models, Process Activities, Process Improvement. **Requirements Engineering**: Functional and non-functional requirements, Requirements Engineering process, Eliciting Requirements, Requirements specification, Validating Requirements, Requirements change.	**5**	**L2**
Module 2		
Introduction, System Modeling: Context models, Interaction models, Structural models, Behavioral models, Model-driven architecture **Architectural Designs:** Architectural design decisions, View, Patterns, Application Architecture.	**5**	**L2**
Module 3		
Software Testing: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object -Oriented Software, Validation Testing, System Testing, The Art of Debugging. **Software Evolution:** Evolution processes, Program evolution dynamics, Software maintenance, Legacy system management.	**5**	**L2**
Module 4		
Agile Software Development : Agile Methods, Agile development techniques, Agile project management, Scaling agile methods **Real-Time Software Engineering:** Embedded system design, Architectural patterns for real-time software systems, Real Time Operating Systems(RTOS)	**5**	**L2**
Module 5		
Introduction to Project Management: Risk Management, Managing people, Teamwork. **Project Planning:** Software pricing, Plan Driven Development, Project scheduling Agile	**5**	**L2**

planning, Estimation techniques, COCOMO cost modeling. **Quality Management:** Software Quality, Software standards, Reviews and inspections, Software measurement.		

Course Outcomes:

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

CO1	Understand the activities involved in software engineering and analyze the role of various process models and Requirements.
CO2	Explain the basics of class models using modeling techniques and Architectural designs.
CO3	Illustrate the various software testing methods and understand the importance of agile methodology.
CO4	Describe software practices in agile methodology.
CO5	Illustrate the role of project planning and quality management in software development.

CO / PO Mapping														
CO / PO/ PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	-	-	2	2	3	1	1	-	2	3	2
CO2	3	3	3	-	1	2	2	3	1	1	-	2	3	2
CO3	3	3	2	-	1	2	2	2	1	1	-	2	3	2
CO4	3	3	3	-	2	1	1	1	1	1	1	2	3	2
CO5	3	3	2	-	-	1	1	1	1	1	2	2	3	2
Average	3	3	2.6	-	1.3	1.6	1.6	2	1	1	1.5	2	3	2

High-3: Medium-2: Low-1

Textbooks:

1. Software Engineering, Ian Sommerville, 10th Edition, Pearson Education
2. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.

Reference Books:

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

MOOCs:

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

Scheme of Evaluation: (Integrated courses)

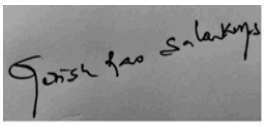
Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions**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

DATA ANALYTICS FOR IOT

Course Code:	**ADS236072**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**1:0:0**	**SEE Marks:**	**50**
Type of Course:	**AEC**	**Duration of SEE (hours):**	**01**
Credits: 01			

Prerequisites (if any): IOT

Course Learning Objectives: The course will enable students to

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

Module 1	No. of Hours	RBT Level
The situation, Defining IoT analytics, IoT analytics challenges. Chapter 1 (Except Business value concerns)	**6**	**L2**
Module 2		
Building Elastic analytics, Elastic analytics concepts, Designing for scale, Cloud security and analytics Chapter 3 (Only the above mentioned topics)	**6**	**L2**
Module 3		
Exploring and Visualizing Data-The Tableau Overview, Techniques to understand data quality, Basic time series analysis, Get to know categories in the data, Bring in Geography, Using R for statistical Analysis. Chapter 6 (Only the above mentioned topics)	**6**	**L2**
Module 4		
Machine Learning Basics: What is machine learning, Generalization, Feature Engineering with IoT data, Validation methods, Random forest model using R. Chapter 10 (Only the above mentioned topics)	**6**	**L3**
Module 5		
Linked analytical Datasets, Managing Data lakes, The Data retention strategy. Chapter 11	**6**	**L2**

Course Outcomes:

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

CO1	Identify the requirement and measurements for capacity planning by considering the goal, issues, and processes.
CO2	Explain capacity measurement and monitoring
CO3	Make use of measurement data for prediction towards the overall planning process.
CO4	Explain the concepts related to deployment, installation, configuration, and management.

CO5	Demonstrate how the virtualization and cloud services fit into a capacity plan

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

High-3: Medium-2: Low-1

Text Books:

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

Scheme of Evaluation: (Integrated courses)

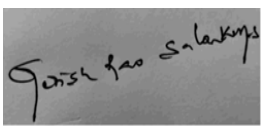
Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions**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

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

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

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

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



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

PHYSICAL EDUCATION (SPORTS & ATHLETICS)

Course Code	**:**	PEK23608		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:1				
Total Hours	**:**	24 P				

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

1. Understand the Postural deformities and Stress management in sports and athletics
2. Participate in the competition at regional/state / national / international levels.
3. Understand and practice of specific games and athletic Jumping events.
4. Understand and practice of Aerobics.

Module IV : Orientation **4 Hours**

1. Postural deformities.
2. Stress management

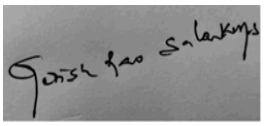
Module V : Specific Games (Any one to be selected by the student) **16 Hours**

1. Throw ball
2. Table Tennis
3. Athletics (Field Events- Jumps) – Any event as per availability of Ground.

Module VI: Aerobics **4 Hours**

Scheme and Assessment for auditing the course and Grades:

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



DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VI

INDIAN KNOWLEDGE SYSTEMS

Course Code	**:**	**IKSK23609**		**CIE**	**:**	**50 Marks**
L: T:P	**:**	**1: 0: 0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**15L**		**SEE Duration**	**:**	**01 Hours**

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

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

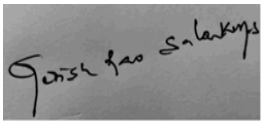
Course Outcomes: After completing the course, the students will be able to	
CO1:	Provide an overview of the concept of the Indian Knowledge System and its importance.
CO2:	Appreciate the need and importance of protecting traditional knowledge.
CO3:	Recognize the relevance of Traditional knowledge in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

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

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

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

High-3 : Medium-2 : Low-1



B.E. in Artificial Intelligence and Data Science
Scheme of UG Autonomous Program – 2023 batch

VII SEMESTER (Scheme-A)

Sl. No.	Course Code	Course Title	Course Type	Question Paper Setting Board (PSB)	Teaching Department (TD)	Teaching Hours/Week			Examination			CREDITS
						L	T	P	CIE	SEE	Total	
1	ADS23701	Natural Language Processing	IPCC	AI&DS	AI&DS	3	0	2	50	50	100	4
2	ADS23702	Advanced Data Visualization using Power BI	IPCC	AI&DS		3	0	2	50	50	100	4
3	ADS23703	Deep Learning for Computer Vision	PCC	AI&DS		3	0	0	50	50	100	4
4	ADS23704X	**Professional Elective-III**	PEC	AI&DS		3	0	0	50	50	100	3
5	ADS23705X	**Open Elective- II**	OEC	AI&DS		3	0	0	50	50	100	3
6	ADS23706	Major Project Phase-II	PROJ	AI&DS		0	0	12	100	100	200	6
								Total	350	350	700	24

Professional Elective Course	
ADS237041	Data Science for Security
ADS237042	Object Oriented Modeling and Design

Open Elective Course	
ADS237051	Data Visualization using Tableau and Power BI
ADS237052	Generative AI

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L**: Lecture, **T**:

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

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

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

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Rajarajeshwarinagar, Bengaluru-98

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

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall

not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK (21MEP75): The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To install responsibilities to oneself and others.
(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve ingroup discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) 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 project work, shall be based on the evaluation of the project work 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.

(2) Interdisciplinary: 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. The CIE marks awarded for the project work, shall be based on the evaluation of project work 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 procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

B.E. in Artificial Intelligence and Data Science
Scheme of UG Autonomous Program – 2023 batch

VIII SEMESTER (Scheme-A)

Sl. No.	Course Code	Course Title	Course Type	Question Paper Setting Board (PSB)	Teaching Department (TD)	Teaching Hours/Week			Examination			CREDITS
						L	T	P	CIE	SEE	Total	
1	ADS23801X	**Professional Elective -IV**	PEC	AI&DS	AI&DS	3	0	0	50	50	100	3
2	ADS23802X	**Open Elective - III**	OEC	AI&DS		3	0	0	50	50	100	3
3	ADSI23803	**Internship (Industry/Research) (14 - 20 weeks)**	INT	AI&DS		0	0	12	100	100	200	10
								Total	200	200	400	16

Professional Elective Course	
ADS238011	Advanced Natural Language Processing
ADS238012	Predictive and Prescriptive Analysis

Open Elective Course	
ADS238021	Large Language Models

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

Note: VII and VIII semesters of IV years of the programSwapping Facility

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

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester **Research Internship /Industrial Internship / Rural**

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Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

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

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

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

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

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

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

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

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B.E. in Artificial Intelligence and Data Science
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Scheme B- VII SEMESTER (Swappable VII and VIII SEMESTER)

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						L	T	P	CIE	SEE	Total	
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4	ADS23704X	**Professional Elective-III** (To be Completed in 5th/6th Semester)	PEC	AI&DS		3	0	0	50	50	100	3
5	ADS23705X	**Open Elective- II** (To be Completed in 5th/6th Semester)	OEC	AI&DS		3	0	0	50	50	100	3
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(xi) To impart flexibility and adaptability.
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(xiii) To expand intellectual capacity, credibility, judgment and intuition.
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Scheme B- VIII SEMESTER (Swappable VII and VIII SEMESTER)

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whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VII

NATURAL LANGUAGE PROCESSING

Course Code:	**ADS23701**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:2**	**SEE Marks:**	**50**
Type of Course:	**IPCC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): Machine Learning and Deep Learning

Course Learning Objectives: The course will enable students to

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

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

Course Outcomes:

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

CO1	Understand NLP foundations, text processing techniques, and practical applications.
CO2	Apply diverse language models, embeddings; adapt in practical applications.
CO3	Implement tagging, parsing, Named Entity Recognition techniques.
CO4	Perform classical NLP, sentiment analysis, text classification, and summarization.
CO5	Obtain competence in machine translation, dialog systems, and ethical NLP practices.

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

High-3: Medium-2: Low-1

Textbooks:

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

Reference Books:

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

E-Books / Web References:

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

MOOCs:

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

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

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	**50**	**50**
Grand Total			**100**

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VII

ADVANCED DATA VISUALIZATION USING POWER BI

Course Code:	**ADS23702**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:2**	**SEE Marks:**	**50**
Type of Course:	**IPCC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): Data Visualization using Tableau

Course Learning Objectives: The course will enable students to

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

Module 1	No. of Hours	RBT Level
Data Modelling in Tableau, Performing Data Analysis on a relational model, Building Relationships in Tableau, working on creating calculated fields, Building Visualizations using related data, Performing a case study on a set of related data. Filtering at a large scale using calculated fields and nested CASE statements. Table summary statistics – show percentage of values down and across the table. Dynamic population of Rows and columns with Parameterization. Students will Perform analysis on various datasets to understand the above concepts.	**10**	**L3**
Module 2		
Level of Details Expression (LOD) fundamentals. FIXED, INCLUDE and EXCLUDE LODs and their application to solve complex problems, multiple examples of how to use these LODs in different scenarios. Complex data Analysis using LODs and nested LODs. Ranking at multiple levels, Bringing Data on a dual Axis, Creating moving averages chart. Reference bands and distribution bands with parameterization. Students will Perform analysis on various datasets to understand the above concepts.	**12**	**L3**
Module 3		
Machine Learning using Tableau/Python. Installation of TabPy server. Connecting	**10**	**L3**

between Tableau and Python using TapPy. Passing Data from Tableau to Python, Simple and Multiple Linear regression in Tableau using TabPy server, computing correlation-coefficient across dimensions. Passing Data from Tableau to Python for Classification examples, executing Naïve Bayes, Random Forest, Decision Tree using, SVM etc. from Tableau through TabPy Server. Clustering. Dashboard creation and Fundamentals. Tableau Pulse – The AI capabilities of Tableau, features and techniques for data analytics. Students will Perform analysis on various datasets to understand the above concepts.		
Module 4		
Importing Data into PowerBI, Creation of Various charts – Stacked Bar chart, stacked column chart, clustered column chart, Area chart, stacked area chart, Line and stacked column chart etc. Build Visual, Format Page. Sort and Filters, Slicing, Simple and multi-level Ranking. Data Modelling in PowerBI, Performing Data Analysis on a relational Model, Create Model Relationships, Building Visualizations using related data from the data Model. Students will Perform analysis on various datasets to understand the above concepts.	**10**	**L3**
Module 5		
The language of Power BI - Data Analysis Expressions (DAX) Engine Basics. Aggregate functions – AVERAGE, AVERAGEX, AVERAGEA, COUNT, COUNTA, COUNTX, MAX, MAXA, MAXX, MIN, MINA, MINX, SUM, SUMA, SUMX. Date Functions – DATE, DAY, MONTH, YEAR, DATEDIFF Filter Functions – ALL, ALLEXCEPT, ALLSELECTED, CALCULATE, CALCULATETABLE, KEEPFILTERS, SELECTEDVALUE Table Manipulation functions – ADDCOLUMNS, CROSSJOIN, CURRENTGROUP, DATATABLE, GENERATE, GENERATEALL, GROUPBY, NATURALJOIN, NATURALOUTERJOIN, SELECTCOLUMNS, SUMMARIZE, SUMARIZECOLUMNS, TOPN, VALUES DAX statements – DEFINE, EVALUATE, ORDER BY, VAR Creating Measures, Calculated Columns and Tables. Problem solving Techniques using Measures and Calculated columns and Tables using above functions. Dashboard creation. Students will Perform analysis on various datasets to understand the above concepts.	**10**	**L3**

Course Outcomes:

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

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

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

High-3: Medium-2: Low-1

Textbooks:

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

Reference Books:

1. Information Dashboard Design: Displaying Data for At-a-Glance Monitoring, Stephen Few, O'Reilly Media, 2013
2. Show Me the Numbers: Designing Tables and Graphs to Enlighten, Stephen Few, Analytics Press, 2004
3. Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics, Nathan Yau, Wiley, 2011
4. Now You See It, Stephen Few, Analytics Press, 2009
5. The Visual Display of Quantitative Information, Edward Tufte, Graphics Press, 2nd Edition, 2001
6. Data Analysis with Microsoft Power BI 1st edition – Brian Larson

E-Books / Web References:

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

MOOCs:

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

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of 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 Integrated 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 –VII

DEEP LEARNING FOR COMPUTER VISION

Course Code:	**ADS23703**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:2:0**	**SEE Marks:**	**50**
Type of Course:	**PCC**	**Duration of SEE (hours):**	**03**
Credits: 04			

Prerequisites (if any): Image Processing & Deep Learning

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	To impart the fundamentals of image formation, the major ideas, methods, andtechniques 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 Objectdetection and Face Recognition systems.
4	To provide the student with programming experience from implementing computervision and object recognition applications.

Module 1	No. of Hours	RBT Level
Introduction to Computer Vision: Basic concepts: pixel representation of an image, Image in frequency domain, different color models, and their transformation, Filtering and Convolution, Image preprocessing using PIL/Pillow, OpenCV, and Keras: reading multiple images from a directory, plotting, enhancement, filtering, re-scaling, morphological operations and image data augmentation.	**8**	**L2**
Module 2		
Object Detection: Basic concepts: bounding box representation, sliding window methods, anchorboxes, grid cells, and non-maximum suppression (NMS). State-of-the-artarchitectures: R-CNN and YOLO. Evaluation metrics: Intersection over Union (IoU) and Mean Average Precision (mAP), Practical use case.	**10**	**L3**
Module 3		
Generative AI Models: Introduction to Gen AI, Types, Variational Autoencoders and GANs (Variations of GANs – cGAN, wGAN, cyclic GAN, style tranfers using GAN), difference between VAEs & GANs, Image Captioning – LSTMs based, Transformers based.	**12**	**L3**
Module 4		
Normalizing Flows and Diffusion Models: Diffusion process, Forward Diffusion, Reverse Diffusion, Training a diffusion model, Architecture, Guided Diffusion, Stable diffusion, Sampling Procedure,Practical Implementation.	**12**	**L3**
Module 5		
Face Recognition: Deep learning for face recognition: face detection in photographs, face identification & verification using VGGFace2, and face classification using FaceNet. Practical use case. Challenges: privacy and ethical considerations, variability in pose, expression, lightning, and occlusion.	**8**	**L3**

Course Outcomes:

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

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

CO / PO Mapping														
CO / PO/ PSO	**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

Textbooks:

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 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 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 Integrated 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 –VII

DATA SCIENCE FOR SECURITY

Professional Elective Course

Course Code:	**ADS237041**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

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

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

Course Outcomes:

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

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

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

High-3: Medium-2: Low-1

Textbooks:

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

Reference Books:

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

Scheme of 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 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 Integrated 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 –VII

OBJECT ORIENTED MODELLING AND DESIGN

Professional Elective Course

Course Code:	**ADS237042**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
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.

Module 1	No. of Hours	RBT Level
Advanced object and class concepts: Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. State Modeling: Events, States, Transistions and Conditions, State Diagrams, State diagram behaviour.	**10**	**L2**
Module 2		
UseCase Modelling and Detailed Requirements: 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.	**10**	**L2**
Module 3		
Process Overview, System Conception and Domain Analysis: 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.	**10**	**L2**
Module 4		
Use case Realization: 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.	**10**	**L2**
Module 5		
Design Patterns: 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).	**10**	**L2**

Course Outcomes:

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

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

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

High-3: Medium-2: Low-1

Textbooks:

5. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005
6. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005.
7. 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, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern – Oriented Software Architecture. A system of patterns , Volume 1, John Wiley and Sons.2007.
3. Booch, Jacobson, Rambaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, pearson, Reprint 2013

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 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 Integrated 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	**100**	**50**
		Grand Total	**100**

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VII

DATA VISUALIZATION USING TABLEAU AND POWER BI

Open Elective Course

(Offered to other branch students)

Course Code:	**ADS237051**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**OEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

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

Module 1	No. of Hours	RBT Level
Data Modelling in Tableau, Performing Data Analysis on a relational model, Building Relationships in Tableau, working on creating calculated fields, Building Visualizations using related data, Performing a case study on a set of related data. Filtering at a large scale using calculated fields and nested CASE statements. Table summary statistics – show percentage of values down and across the table. Dynamic population of Rows and columns with Parameterization. Students will Perform analysis on various datasets to understand the above concepts.	**10**	**L3**
Module 2		
Level of Details Expression (LOD) fundamentals. FIXED, INCLUDE and EXCLUDE LODs and their application to solve complex problems, multiple examples of how to use these LODs in different scenarios. Complex data Analysis using LODs and nested LODs. Ranking at multiple levels, Bringing Data on a dual Axis, Creating moving averages chart. Reference bands and distribution bands with parameterization.	**12**	**L3**

Students will Perform analysis on various datasets to understand the above concepts.		
Module 3		
Machine Learning using Tableau/Python. Installation of TabPy server. Connecting between Tableau and Python using TapPy. Passing Data from Tableau to Python, Simple and Multiple Linear regression in Tableau using TabPy server, computing correlation-coefficient across dimensions. Passing Data from Tableau to Python for Classification examples, executing Naïve Bayes, Random Forest, Decision Tree using, SVM etc. from Tableau through TabPy Server. Clustering. Dashboard creation and Fundamentals. Tableau Pulse – The AI capabilities of Tableau, features and techniques for data analytics. Students will Perform analysis on various datasets to understand the above concepts.	**10**	**L3**
Module 4		
Importing Data into PowerBI, Creation of Various charts – Stacked Bar chart, stacked column chart, clustered column chart, Area chart, stacked area chart, Line and stacked column chart etc. Build Visual, Format Page. Sort and Filters, Slicing, Simple and multi-level Ranking. Data Modelling in PowerBI, Performing Data Analysis on a relational Model, Create Model Relationships, Building Visualizations using related data from the data Model. Students will Perform analysis on various datasets to understand the above concepts.	**10**	**L3**
Module 5		
The language of Power BI - Data Analysis Expressions (DAX) Engine Basics. Aggregate functions – AVERAGE, AVERAGEX, AVERAGEA, COUNT, COUNTA, COUNTX, MAX, MAXA, MAXX, MIN, MINA, MINX, SUM, SUMA, SUMX. Date Functions – DATE, DAY, MONTH, YEAR, DATEDIFF Filter Functions – ALL, ALLEXCEPT, ALLSELECTED, CALCULATE, CALCULATETABLE, KEEPFILTERS, SELECTEDVALUE Table Manipulation functions – ADDCOLUMNS, CROSSJOIN, CURRENTGROUP, DATATABLE, GENERATE, GENERATEALL, GROUPBY, NATURALJOIN, NATURALOUTERJOIN, SELECTCOLUMNS, SUMMARIZE, SUMARIZECOLUMNS, TOPN, VALUES DAX statements – DEFINE, EVALUATE, ORDER BY, VAR Creating Measures, Calculated Columns and Tables. Problem solving Techniques using Measures and Calculated columns and Tables using above functions. Dashboard creation. Students will Perform analysis on various datasets to understand the above concepts.	**10**	**L3**

Course Outcomes:

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

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

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

High-3: Medium-2: Low-1

Textbooks:

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

Reference Books:

1. Information Dashboard Design: Displaying Data for At-a-Glance Monitoring, Stephen Few, O'Reilly Media, 2013
2. Show Me the Numbers: Designing Tables and Graphs to Enlighten, Stephen Few, Analytics Press, 2004
3. Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics, Nathan Yau, Wiley, 2011
4. Now You See It, Stephen Few, Analytics Press, 2009
5. The Visual Display of Quantitative Information, Edward Tufte, Graphics Press, 2nd Edition, 2001
6. Data Analysis with Microsoft Power BI 1st edition – Brian Larson

E-Books / Web References:

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

MOOCs:

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

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of 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 Integrated 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	100	50
Grand Total			100

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VII

GENERATIVE AI

Open Elective Course

(Offered to other Department students)

Course Code:	**ADS237052**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**OEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): Image Processing & Deep Learning

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	To impart the fundamentals of image formation, the major ideas, methods, andtechniques 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 Objectdetection and Face Recognition systems.
4	To provide the student with programming experience from implementing computervision and object recognition applications.

Module 1	No. of Hours	RBT Level
Introduction to Computer Vision: Basic concepts: pixel representation of an image, Image in frequency domain, different color models, and their transformation, Filtering and Convolution, Image preprocessing using PIL/Pillow, OpenCV, and Keras: reading multiple images from a directory, plotting, enhancement, filtering, re-scaling, morphological operations and image data augmentation.	**8**	**L2**
Module 2		
Object Detection: Basic concepts: bounding box representation, sliding window methods, anchorboxes, grid cells, and non-maximum suppression (NMS). State-of-the-artarchitectures: R-CNN and YOLO. Evaluation metrics: Intersection over Union (IoU) and Mean Average Precision (mAP), Practical use case.	**10**	**L3**
Module 3		
Generative AI Models: Introduction to Gen AI, Types, Variational Autoencoders and GANs (Variations of GANs – cGAN, wGAN, cyclic GAN, style tranfers using GAN), difference between VAEs & GANs, Image Captioning – LSTMs based, Transformers based.	**12**	**L3**
Module 4		
Normalizing Flows and Diffusion Models: Diffusion process, Forward Diffusion, Reverse Diffusion, Training a diffusion model, Architecture, Guided Diffusion, Stable diffusion, Sampling Procedure,Practical Implementation.	**12**	**L3**
Module 5		
Face Recognition: Deep learning for face recognition: face detection in photographs, face identification & verification using VGGFace2, and face classification using FaceNet. Practical use case. Challenges: privacy and ethical considerations, variability in pose, expression, lightning, and occlusion.	**8**	**L3**

Course Outcomes:

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

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

CO / PO Mapping														
CO / PO/ PSO	**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

Textbooks:

Deep learning for Computer Vision by Jason Brownlee.

Reference Books:

1. Internet source.

E-Books / Web References:

4) https://analyticsindiamag.com/optimisation-machine-learning-methods-gradient-descent/
5) https://serokell.io/blog/ml-optimization
6) https://machinelearningmastery.com/why-optimization-is-important-in-machine-learning/

MOOCs:

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

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 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 Integrated 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 –VIII

MAJOR PROJECT PHASE-II

Course Code:	**ADSP23706**	**CIE Marks:**	**100**
Hours/Week (L: T: P):	**0:0:12**	**SEE Marks:**	**100**
Credits:	**6**	**SEE Duration:**	**3 Hrs**
Type of Course:	**PROJ**		

Course Learning Objectives: The course will enable students to

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

Major Project Guidelines:

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

Course Outcomes:

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

CO1	Apply knowledge of mathematics, science and engineering to solve respective engineering domain problems.
CO2	Design, develop, present and document innovative/multidisciplinary modules for a complete engineering system.
CO3	Use modern engineering tools, software and equipment to solve problem and engage in life-long learning to follow technological developments.

CO4	Function effectively as an individual, or leader in diverse teams, with the understanding of professional

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

High-3: Medium-2: Low-1

Scheme of Evaluation:

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

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

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

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

Calendar of Events for the Project Work:

Week	Event
II Week of 7th Semester	Preliminary seminar
III of 7th Semester Week	First visit of the internal guides to industry (In case of project being carried out in industry)
III to IX Week	Implementation of the project
X Week	Submission of draft copy of the project report
XI and XII Week	Second visit by guide to industry for demonstration. Final seminar by Department project Committee and guide for internal assessment. Finalization of CIE.

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VIII

ADVANCED NATURAL LANGUAGE PROCESSING

Professional Elective Course

Course Code:	**ADS238011**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): Natural Language Processing

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	Explore the application of transfer learning in NLP to adapt models to specific tasks efficiently.
2	Understand and implement neural network models for dependency and constituency parsing.
3	Implement models for relation extraction and event extraction to achieve comprehensive information extraction.
4	Develop practical applications leveraging multimodal and cross-lingual NLP techniques.
5	Analyze the evolution and advancements of LLMs, including GPT-2, GPT-3, and BERT variants.

Module 1	No. of Hours	RBT Level
Introduction to advanced language models: BERT, GPT, Transformer architecture: Self-attention mechanism, multi-head attention, Pre-training and fine-tuning strategies, transfer learning in NLP, Applications of transformers in NLP tasks, Implementing transformers with Hugging Face library Sequence-to-sequence models: Encoder-decoder architecture, Attention mechanisms in seq2seq models	**08**	**L3**
Module 2		
Deep learning for syntactic parsing: Dependency and constituency parsing with neural networks, Tree-based models and their applications, Text generation techniques: GANs, VAEs, and autoregressive models, Evaluation metrics for parsing and generation	**08**	**L3**
Module 3		
Neural NER models: BiLSTM-CRF, transformer-based NER, Relation extraction and event extraction, End-to-end information extraction pipelines, Applications in knowledge graph construction and entity linking	**08**	**L3**
Module 4		
Multimodal NLP: Combining text with images, audio, and video, Cross-lingual NLP: Multilingual embeddings, cross-lingual transfer, Pre-trained multilingual models (e.g., mBERT, XLM-R), Zero-shot and few-shot learning in NLP, Applications in multimodal and cross-lingual tasks	**08**	**L3**
Module 5		
Evolution of LLMs: GPT-2, GPT-3, BERT variants (RoBERTa, ALBERT), Distillation and efficiency improvements: DistilBERT, TinyBERT, Multimodal models: VisualBERT, CLIP, Large-scale training and infrastructure, Implementing advanced models using Hugging Face Transformers, Evaluation metrics for LLMs, Model interpretability and explainability	**08**	**L3**

Course Outcomes:

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

CO1	Demonstrate an understanding of transformer architecture, including self-attention and multi-head attention mechanisms.
CO2	Understand and implement text generation techniques, including GANs, VAEs, and autoregressive models.
CO3	Apply information extraction techniques to construct knowledge graphs and perform entity linking.
CO4	Develop applications leveraging multimodal and cross-lingual NLP techniques.
CO5	Design and manage large-scale training infrastructure for advanced NLP models.

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

High-3: Medium-2: Low-1

Textbooks:

1. Deep Learning for Natural Language Processing - Jason Brownlee, 2018.
2. Practical Natural Language Processing - Sowmya Vajjala, Bodhisattwa Majumder, O'Reilly, 2020.
3. Pretrained Transformers for Text Ranking: BERT and beyond" by Jimmy Lin, Rodrigo Nogueira, and Andrew Yates, Morgan & Claypool Publishers.

Reference Books:

1. Natural Language Processing with Transformers by Lewis Tunstall, Leandro von Werra, and Thomas Wolf, O'Reilly Media.
2. ERT, RoBERTa, and DistilBERT in Action: Building and deploying transformer models" by Michael Walker, Manning Publications.

E-Books / Web References:

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

MOOCs:

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

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of 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 Integrated 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	100	50
		Grand Total	100

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VIII

PREDICTIVE AND PRESCRIPTIVE ANALYSIS

Professional Elective Course

Course Code:	**ADS238012**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**PEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): NA

Course Learning Objectives: The course will enable students to

Sl. No	Course Learning Objectives (CLO)
1	To introduce the concept of Predictive Analytics with key techniques.
2	To implement Predictive Analytics techniques on Machine Learning algorithms.
3	To introduce the concept of Prescriptive Analytics via Linear Programming (LP) technique.
4	To understand the concept of Sensitivity Analysis and Duality, and its significance in LP problem.
5	To formulate LP Problem and apply in real-world situations.

Module 1	No. of Hours	RBT Level
Overview of Predictive Analytics: Core ideas in data mining, Supervised and unsupervised learning, Classification vs Prediction, Steps in data mining, SEMMA Approach, Sampling, Pre-processing, Data cleaning, Data Partitioning, Building a model, Statistical models for predictive analytics.	**8**	**L2**
Module 2		
Implementation of Predictive Analytics: Data splitting, Balancing, Overfitting, Oversampling, Multiple Regression, Artificial neural networks (MLP), Variable importance, Profit/loss/prior probabilities, Model specification, Model selection, Multivariate Analysis.	**8**	**L2**
Module 3		
Prescriptive Analytics and Linear Programming (LP): Introduction: Prescriptive Analytics and Optimization, Applications in Decision Making, Structuring a Decision Problem and Model Building, Solving a Linear Programming (LP) Problem - Graphical Illustration, Infeasibility, Unboundedness, Multiple Optimal Solutions	**8**	**L2, L3**
Module 4		
Sensitivity Analysis and Duality: The Simplex Algorithm, Solving an LP using Solver, Sensitivity Analysis and Applications, Primal and Dual Problems, Significance of the Dual.	**8**	**L2, L3**
Module 5		
LP Formulations and Applications: Blending Problems, Network and Transportation Problems, Shortest Path Problem, Multi-Period Problems, Scheduling Decisions	**8**	**L2, L3**

Course Outcomes:

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

CO1	Obtain a good fundamental knowledge of Predictive Analysis.
CO2	Implement Predictive Analysis by understanding the underlying principles.
CO3	Obtain an overview of Prescriptive Analytics and solve Linear Programming Problem (LPP).
CO4	Perform Sensitivity Analysis and obtaining Dual of a given object.
CO5	Apply Linear Programming Formulation for solving real-world problems.

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

High-3: Medium-2: Low-1

Textbooks:

1. Larose, Daniel T. Data mining and predictive analytics. John Wiley & Sons, 2015.
2. Prescriptive Analytics: The Final Frontier for Evidence-based Management and Optimal Decision Making by Dursun Delen, Pearson, 1st edition, 2019.

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. Prescriptive Analytics: A Short Introduction to Counterintuitive Intelligence by Milchman and Fang, 2018.

E-Books / Web References:

1. Predictive Analytics Using Statistics and Big Data : Concepts and Modeling
2. https://intranel.com/resources/ebook-predictive-analytics-in-action/
3. https://www.everand.com/book/396121908/Prescriptive-Analytics-A-Complete-Guide-2019-Edition

MOOCs:

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

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 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 Integrated 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	**100**	**50**
		Grand Total	**100**

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

SEMESTER – VIII

LARGE LANGUAGE MODELS

Open Elective

Course Code:	**ADS238021**	**CIE Marks:**	**50**
Hours/Week (L: T: P):	**3:0:0**	**SEE Marks:**	**50**
Type of Course:	**OEC**	**Duration of SEE (hours):**	**03**
Credits: 03			

Prerequisites (if any): Natural Language Processing

Course Learning Objectives: The students will be abler to:

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

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

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

Course Outcomes:

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

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

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

High-3: Medium-2: Low-1

Text Books:

1) J & M, slp3 is an NLP textbook
2) On the Opportunities and Risks of Foundation Models - (published by Stanford researchers in July 2021) surveys a range of topics on foundational models (large langauge models are a large part of them).
3) A Primer in BERTology: What we know about how BERT works provides an excellent overview of what we understand about BERT (last update: Nov 2020).

E-Books / Web References:

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

Scheme of Examination (CIE):

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

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

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

Table 1: CIE Evaluation

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

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

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER –VIII

INTERNSHIP

Course Code:	**ADSI23803**	**CIE Marks:**	**100**
Hours/Week (L: T: P):	**0:0:12**	**SEE Marks:**	**100**
Credits:	**10**	**SEE Duration:**	**3 Hrs**
Type of Course:	**INT**		

Guidelines for Internship

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

Course Outcomes:

Upon successful completion of internship the student will be able to

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

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

High-3: Medium-2: Low-1

Scheme of Evaluation:

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

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

Continuous Internal Evaluation (CIE):

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

Semester End Evaluation (SEE):

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