School of Computer Science, Engineering & Applications

Bharathidasan University

Tiruchirappalli - 620023

M.Sc., Artificial Intelligence and Data Science

Course Structure and Syllabus

(Applicable to the candidates admitted from the academic year 2025-2026 onwards)

BHARATHIDASAN UNIVERSITY

SCHOOL OF COMPUTER SCIENCE, ENGINEERING & APPLICATIONS

Master of Science (Artificial Intelligence & Data Science)

(Choice Based Credit System)

REGULATIONS

(w.e.f 2025-2026)

1. **Name of the Programme**: M.Sc., Artificial Intelligence & Data Science (2 Year)
2. **Aim of the Course**: The aim of the Master of Science in Artificial Intelligence & Data Science is to equip students with advanced knowledge in AI algorithms and data-driven technologies. It focuses on developing critical thinking and problem-solving skills through real-world applications. The course prepares graduates for research, innovation, and leadership roles in tech industries. It bridges the gap between theoretical foundations and practical implementations in AI and Data Science.
3. **Eligibility for Admission to the Programme:** Candidates who have passed B.Sc. (Computer Science, Data Science, Artificial Intelligence, Computer Technology, Information Technology, Information Science, Information Systems, Software Science, Software Development, Statistics, Mathematics), BCA from this University or from recognized University.
4. **Duration of the Course:** The Course duration shall be for two years consisting of four semesters. In order to be eligible for the award of the degree of the candidate shall successfully complete the course in a maximum period of four years from the date of enrolment for the first semester of the course.
5. **Choice Based Credit System:** The University follows the 'Choice Based Credit System (CBCS)' for all its programmes. Each credit is worth 12 hours of student study time, comprising all learning activities. Thus, a four-credit course involves 48 study hours. This helps the student to understand the academic effort and to successfully complete a course.
6. **Structure of the Course and Evaluation Pattern:**

Internal Marks: 25 External Marks: 75

The duration of University examination for both theory and practical subjects shall be 3 hours. The maximum marks for each theory and practical course is 100. Continuous Internal Assessment (CIA) will be 25. The University theory and practical examination will be conducted for 75 marks, which will be added with Continuous Internal Assessment to make 100 marks for the

course. For the conduct of University examinations in theory, the question paper for the theory examination will be set by the external examiner and for practical examination; the question paper will be set by both internal and external examiners appointed by the Department.

7. Attendance:

- Students should gain at least 75% attendance in each course.
- In each semester every candidate must compulsorily register for the examination in all the courses pertaining to that semester.
- Candidate who has less than 75% attendance of the working days in a semester will be permitted to take the ESE pertaining to that semester unless he/she gets a condonation certificate.
- On the day on which a course is concluded, the course teacher of the course shall intimate the Head of the Department, of the particulars of all the students who have a shortage of attendance in the course offered by him/her.
- The Head of the Department should announce the names of all the students who will not be eligible to take the end-semester examination in the various courses due to the shortage of attendance.
- Condonation of shortage of attendance shall be given as per the provisions given below:
- The Head of the Department may condone lack of attendance for a student in a course when the student had put in at least 65% attendance for the course concerned and pays a condonation fee of the suitable amount to be prescribed by the University from time to time. A candidate who has put in less than 65% attendance must repeat the course.

8. Procedures for Awarding Marks for Internal Assessment

THEORY COURSES

- For regularity and discipline - 5 Marks
- For two assignments (Equal weightage) - 5 Marks
- For two tests to be conducted (Equal weightage) - 5 Marks
- Model examination - 10 Marks

Total –25 Marks

PRACTICAL COURSES

- For regularity and discipline - 5 Marks
- Completion of all Experiments prescribed for the course - 5 Marks
- Observation Note - 5 Marks
- For model Examination - 10 Marks

Total - 25 Marks

In the case of CIA, a candidate who secures not less than 40% of total marks prescribed for any course shall be declared to have passed for that course, failing which the candidate has to redo the academic activities prescribed for the Continuous Internal Assessment (CIA).

9. Pattern of Question Paper (Theory)

Time 3 hours Max Marks 75

Section - A: (10 X 2 = 20 Marks)

All questions are to be answered. Two questions from each Unit

Section – B: (5X 5 = 25 Marks)

Five Questions are to be answered, Two questions from each unit in the either or Pattern

Section - C :(3 x 10 = 30 Marks)

Three Questions are to be answered out of five questions – One question from each unit

10. Passing Minimum for a course:

A candidate shall be declared to have passed a certain course if he/she secures not less than 40% marks in the internal and external (ESE), and not less than 50% in the aggregate.

A candidate shall be declared to have passed in the project work if he/she gets not less than 40% in the valuation of dissertation and not less than 50% in the aggregate of both the marks for valuation of dissertation and viva-voce examination to pass in project work.

11. Supplementary Examinations:

Any candidate, for whom, when the results of the exam conducted in April/May of the ESE are published there is just one course for which credit is to be earned and it is from the final semester, will be eligible to appear for the supplementary exam which may be conducted in the supplementary July/August provided that he/she appears for the ESE for that courses in April/May.

M.Sc., ARTIFICIAL INTELLIGENCE AND DATA SCIENCE PROGRAMME COURSE STRUCTURE UNDER CBCS

Programme Outcomes (POs):

S.No.	Programme Outcomes
PO1	**Technical Knowledge:** Apply knowledge of mathematics, statistics, science and computing appropriately to model the software applications, configure software platforms and analyze real-time data in heterogeneous domains.
PO2	**Problem Analysis:** Design a system, component or process, or tools to meet desired needs within realistic constraints such as economic, environmental, social, ethical and safety contexts.
PO3	**Design/development of Solutions**: Have the ability to design, implement, evaluate, analyze, and interpret complex problems and data, provide sustainable computational solutions and synthesis the information to provide a valid conclusion for domains of business, healthcare, and the environment.
PO4	**Modern tool usage:** Create, Select and apply appropriate technologies, tools, and techniques for data modelling, processing complex problems, data analysis, and prediction analysis.
PO5	**Communication:** Communicate effectively with the computing community, and with society, about complex computing activities by being able to comprehend and write effective reports, design documentation, demographics and make effective presentations.
PO6	**Project management:** Manage projects and function effectively as an individual, member or leader in diverse teams, and multidisciplinary settings.
PO7	**Sustainability:** Understand the impact of professional analytical solutions in societal and environmental contexts and apply the knowledge to benefit individuals for sustainable development.
PO8	**Life-long learning:** Recognize the need for, and prepare them to engage in independent lifelong learning in the context of techno advancements for the betterment of individuals, organizations, research community and society.
PO9	**Ethics:** Apply ethical principles, and commit to professional ethics and responsibilities and human values.
PO10	**Societal Contribution:** Utilize the knowledge education on an understanding of data, management principles, and computing solutions to apply to one's own work, as a member and leader of the projects to manage projects in multidisciplinary environments and societal contexts.

M.Sc., Artificial Intelligence and Data Science - Program Specific Outcomes (PSOs)

After the successful completion of the M.Sc., Artificial Intelligence and Data Science Programme, the students are expected to

PSO1	Possess a deep understanding of the core principles and methodologies of artificial intelligence, including machine learning, deep learning, natural language processing, computer vision, and reinforcement learning.
PSO2	Will be proficient in collecting, processing, and analyzing complex datasets, and in using data visualization tools to communicate findings and insights effectively to both technical and non-technical audiences.
PSO3	Will have strong coding skills in key programming languages (e.g., Python, R, Java, SQL) and experience with libraries and frameworks used in AI and data science.
PSO4	Will be able to design, implement, and evaluate machine learning and AI models, ensuring they meet performance standards and effectively solve real-world problems in diverse domains.
PSO5	Will be capable of conducting independent research in AI and Data Science, contributing new knowledge to the field, and applying research methods to solve practical problems.
PSO6	Will have a strong understanding of ethical, legal, and societal issues related to AI and data science, and will be equipped to implement AI solutions that prioritize fairness, transparency, privacy, and accountability.
PSO7	Will be able to apply AI techniques to solve real-world challenges across industries such as healthcare, finance, transportation, and manufacturing, demonstrating practical expertise in deploying AI systems in production environments.
PSO8	Will be proficient in using data-driven approaches to decision-making and optimization, capable of identifying trends, patterns, and anomalies that can influence business and operational strategies.
PSO9	Will develop strong collaboration skills, with the ability to work in multidisciplinary teams, and will be capable of clearly articulating technical concepts to non-technical stakeholders.
PSO10	Will be equipped with the skills to continuously learn and adapt to evolving technologies and methodologies in AI and data science, preparing them for lifelong professional development and leadership roles in the field.

Master of Artificial Intelligence and Data Science–Course Structure and Syllabus under CBCS

(Applicable to the candidates admitted from the academic year 2025-2026 onwards)

Course Number	Course Code	Course Name	L	P	C	Marks		Total
						Int.	Ext.	
Semester I								
MAIDS25011	CC-I	Mathematics for Artificial Intelligence and Data Science	5	0	4	25	75	100
MAIDS25012	CC-II	Introduction to Artificial Intelligence	5	0	4	25	75	100
MAIDS25013	CC-III	Principles of Data Science	5	0	4	25	75	100
MAIDS25014	CC-IV	Python Programming	4	0	4	25	75	100
MAIDS25015	CC-V	Database Technologies	5	0	4	25	75	100
MAIDS25016P	CC-VI	Python Programming Lab	0	3	2	25	75	100
MAIDS25017P	CC-VII	Database Technologies Lab	0	3	2	25	75	100
25VAC01	*VAC-I	Value Added Course – I	0	0	2*	25	75	100
		Total	24	6	24			**800**
Semester II								
MAIDS25021	CC-VIII	Artificial Neural Network	5	0	4	25	75	100
MAIDS25022	CC-IX	Big Data Analytics	5	0	4	25	75	100
MAIDS25023	CC-X	Machine Learning	4	0	4	25	75	100
MAIDS25024	EC-I	Elective-I	4	0	4	25	75	100
MAIDS25025	EC-II	Elective-II	4	0	4	25	75	100
MAIDS25026P	CC-XI	Big Data Analytics Lab	0	3	2	25	75	100
MAIDS25027P	CC-XII	Machine Learning Lab	0	3	2	25	75	100
EDC-I		Extra Disciplinary Course – I	2	0	2	25	75	100
Total			24	6	26			**800**
Summer Internship								

*****VAC-I Credits are not included in CGPA

Semester III								
MAIDS25031	CC-XIII	Deep Learning	5	0	4	25	75	100
MAIDS25032	CC-XIV	Natural Language Processing	5	0	4	25	75	100
MAIDS25033	CC-XV	Social Media Analytics	4	0	4	25	75	100
MAIDS25034	EC-III	Elective – III	4	0	4	25	75	100
MAIDS25035	EC-IV	Elective-IV	4	0	4	25	75	100
MAIDS25036P	CC-XVI	Deep Learning Lab	0	3	2	25	75	100
MAIDS25037P	CC-XVII	Natural Language Processing Lab	0	3	2	25	75	100
EDC-II		Extra Disciplinary Course-II	2	0	2	25	75	100
25VAC02	*VAC-II	Value Added Course – II	0	0	2*	25	75	100
		Total	24	6	26			**900**
Semester IV								
MAIDS25041	CC-XVIII	Major Project	0	0	14	-	-	100
TOTAL					**90**			**2600**

*****VAC-II Credits are not included in CGPA

Online Courses (Extra Credit Course)

MAIDS25042	Online Course – I	MOOCs /SWAYAM/NPTEL

Elective Courses			
Elective – I			**Elective – II**
A)	Computational Intelligence	A)	Probability and Statistics
B)	Data Engineering	B)	Optimization Techniques
C)	Data Visualization	C)	Numerical Analysis
Elective – III			**Elective – IV**
A)	Sensor Analytics	A)	Machine Learning Operations (MLOPs)
B)	Computer vision	B)	Cloud Computing
C)	Generative AI & LLM	C)	Affective Computing

Value Added Courses		
Course Number	**Course Code**	**Course Name**
25VAC01	VAC – I	Soft Skills: Professional English
25VAC02	VAC – II	Professional Ethics

Recommended Credits Distribution:

(i) Total should not be less than 90 Credits

(ii) Online Courses (Extra Credit Courses) will be included in the Cumulative Mark Statement, but the credits earned from these courses will not contribute towards the calculation of the Cumulative Grade Point Average (CGPA).

Course Type	Course	Total Credits
Core (Theory)	11	44
Core (Practical)	6	12
Core (Major Project)	1	14
Elective	4	16
Online Courses	1	-
EDC	2	4
Value Added Course	2	-
Total	27	90

SEMESTER I

Course Number: MAIDS25011 **CC-I**

L-P: 5-0 **Credits: 4**

MATHEMATICS FOR ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Objectives:

- To understand the properties of Linear Programming.
- To understand the properties of group theory.
- To use the properties of Linear Equations and Vector Spaces.
- To demonstrate proficiency on the topics of Eigenvalues, Eigenvectors and Inner Product Spaces.
- To understand the properties of multivariable calculus and graphs.

UNIT I LINEAR PROGRAMMING PROBLEM

Introduction to Operations Research: Basics definition - scope – objectives - phases – models-limitations of Operations Research - Linear Programming Problem - Formulation of LPP - Graphical solution of LPP - Simplex Method - Artificial variables - Big-M method - Two- phase method - Degeneracy - Unbound solutions – Duality in Linear Programming Problems– Dual Simplex.

UNIT II GROUP THEORY

Introduction to Group – Definitions & Examples – Properties, Permutation Groups, Examples and Problems – Subgroups – Cyclic Groups – Order of an element – Problems – Cosets – Lagrange's theorem – Euler's theorem – Fermat Theorem – Problems.

UNIT III GEOMETRY LINEAR EQUATIONS AND VECTOR SPACES

The Geometry of Linear Equations - An Example of Gaussian Elimination- Matrix Notation and Matrix Multiplication - Triangular Factors and Row Exchanges- Inverses and Transposes. Introduction to Vector Spaces, Definition of Vector spaces, Subspaces, sums of Subspaces, Direct Sums, Span and Linear Independence, bases, and dimension.

UNIT IV EIGEN VALUES, EIGEN VECTORS AND INNER PRODUCT SPACES

Eigenvalues and Eigenvectors - Eigenvectors and Upper Triangular matrices – Eigen spaces and Diagonal Matrices - Inequalities on Linear Spaces - Norms on Linear Spaces - Inner products - Orthogonality - Unitary and Orthogonal Matrices - Norms for matrices.

UNIT V CALCULUS OF SEVERAL VARIABLES AND BASIC GRAPH THEORY

Functions of Several Variables - Limits and continuity in Higher Dimensions – Partial Derivatives - The Chain Rule - Directional Derivative and Gradient vectors - Tangent Planes and Differentials - Extreme Values and Saddle Points - Lagrange Multipliers. Graphs - subgraphs - factors - Paths - cycles - connectedness - trees - Euler tours -Hamiltonian cycles - Planar Graphs - Digraphs.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. K Sharma, “Operations Research Theory &Applications”, 6th Edition, Laxmi Publications, 2017.
2. Gilbert Strang, “Linear Algebra and Its Application”, 5th Edition, Wellesley Cambridge Press, ISBN: 9780980232776, 2017.
3. S. Axler, “Linear algebra done right”, Springer, 2017.
4. Eldén Lars, “Matrix methods in data mining and pattern recognition, Society for Industrial and Applied Mathematics”, 2007.
5. M. D. Weir, J. Hass, and G. B. Thomas, “Thomas' calculus”, Pearson, 2016.
6. D. Jungnickel, “Graphs, networks and algorithms”. Springer, 2014.

Reference Book(s):

1. P. K. Gupta and D. S. Hira, “Operations Research”, S. Chand & co., 2017
2. David C. Lay, Steven R. Lay, Judi J. McDonald, “Linear Algebra and Its Applications”, 5th Edition, Pearson Education, 2016.
3. J. V. Kepner and J. R. Gilbert, “Graph algorithms in the language of linear algebra”, Society for Industrial and Applied Mathematics, 2011.
4. D. A. Simovici, “Linear algebra tools for data mining”, World Scientific Publishing, 2012.
5. P. N. Klein, “Coding the Matrix: linear algebra through applications to computer science”, Newtonian Press, 2015.
6. J. Patterson and A. Gibson, “Deep learning: a practitioner's approach”, O'Reilly Media, 2017.
7. S. Sra, S. Nowozin, and S. J. Wright, “Optimization for machine learning”, MIT Press, 2012.

E-Learning Resources:

- Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

Course Outcomes:

On successful completion of this course, students would be able to

- Understand the properties of Linear Programming.
- Understand the properties of Group Theory.
- Use the properties of Linear Equations and Vector Spaces.
- Demonstrate proficiency on the topics Eigenvalues, Eigenvectors and Inner Product Spaces.
- Understand the properties of multivariable calculus and graphs.

Course Number: MAIDS25012 **CC-II**

L-P: 5-0 **Credits: 4**

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Objectives:

- To make students understand the basic Artificial intelligence
- To understand about the Problem-solving methods.
- To understand the basic concepts and principles of Artificial Intelligence.
- To learn various applications domains of AI.
- To study the applications of AI.

UNIT-I

Introduction – Definition – Foundations of Artificial Intelligence – Intelligent Agents – Agent and Environments – The concept of Rationality – The nature of environments – The Structure of agents.

UNIT-II

Problem Solving – I Solving Problems by Searching – Problem-Solving Agents - Example Problems- Uninformed Search Strategies – Avoiding Repeated States – Searching with Partial Information – Informed Search Strategies – Heuristic Functions – Local Search Algorithms and Optimization Problems – Local Search in Continuous Spaces – Online Search Agents and Unknown Environments.

UNIT-III

Problem Solving – II Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search for CSPs – Local Search for Constraint Satisfaction Problems – The Structure of Problems – Adversarial Search – The minimax algorithm – Alpha-Beta Pruning.

UNIT-IV

Knowledge Representation - First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering- Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories - Reasoning with Default Information.

UNIT-V

Applications - Perception – Introduction – Image Formation – Early Image Processing Operations – Object Recognition – Speech Recognition - Robotics–Introduction – Robot Hardware –Robotic Perception – Planning to move – Robotic software architecture.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2009.

Reference Book(s):

1. M. Tim Jones, ―Artificial Intelligence: A Systems Approach (Computer Science),
2. Jones and Bartlett Publishers, Inc.; First Edition, 2008
3. Nils J. Nilsson, ―The Quest for Artificial Intelligence, Cambridge University Press, 2009.
4. William F. Clocksin and Christopher S. Mellish, Programming in Prolog: Using the ISO Standard,
5. Fifth Edition, Springer, 2003.
6. Gerhard Weiss, ―Multi Agent Systems, Second Edition, MIT Press, 2013.
7. David L. Poole and Alan K. Mackworth, ― Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.

Course Outcomes:

- Delineate Artificial intelligence.
- Build knowledge about Problem solving methods.
- Understand the basics of knowledge representations.
- Develop AI Applications.
- Design a Fuzzy set for a given application

Course Number: MAIDS25013 **CC-III**

L-P: 5-0 **Credits: 4**

PRINCIPLES OF DATA SCIENCE

Objectives:

- To gain knowledge in the basic concepts of Data Analysis
- To acquire skills in data preparatory and preprocessing steps.
- To understand the mathematical skills in statistics.
- To understand the concepts of Artificial Intelligence Roles and Skills in Data Science.
- To understand the role of Data Science in Real-time applications

UNIT I INTRODUCTION

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – building the models – presenting and building applications.

UNIT II DESCRIBING DATA - I

Frequency distributions – Outliers – relative frequency distributions – cumulative frequency distributions – frequency distributions for nominal data – interpreting distributions – graph averages – mode – median – mean – averages for qualitative and ranked data – describe variability – range – variance – standard deviation – degrees of freedom – interquartile ran variability for qualitative and ranked data.

UNIT III DESCRIBING DATA - II

Normal distributions – z scores – normal curve problems – finding proportions – finding scores – more about z scores – correlation – scatter plots – correlation coefficient for quantitative data – computational formula for correlation coefficient – regression – regression line – least squares regression line – standard error of estimate – interpretation of r2 – multiple regression equations – regression toward the mean.

UNIT IV AI: ROLES AND SKILLS

AI: Cognitive Computing: Learning Perceptions – Terminologies - Machine Learning – Neural Networks – Deep Learning - NLP – Speech Processing – Big Data and AI – Ethics in AI Research - Advanced Applications – AI Myths – Data Science Roles Data Scientist, Data Architect, Data Analyst – Machine Learning Engineer – Skills.

UNIT V DATA SCIENCE USE CASES

Data Science Use Cases Specifications and Discussion – Data Sources Identification – Data Types – Data Classification – Data Characteristics of Big V‟s – Data Science P‟s – Applications of AI: Domains: Customer Insights – Behavioral Analysis –- Marketing – Retails – Insurance – Risk and Security –Health care – Supply Chain Logistics.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (first two chapters for Unit I)
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Chapters 1–7 for Units II and III)
3. Joel Grus, "Data Science from Scratch", 2nd Edition, O′Reilly Publisher, ISBN: 9781492041139, May 2019 (for Unit IV and V)

Reference Book(s):

1. Lillian Pierson, Jake Porway, "Data Science for Dummies", Second Edition, John Wiley & Sons, Publishers, ISBN: 9781119327639, 2017 (EBook)
2. SinanOzdemir, Sunil Kakade, "Principles of Data Science", Second Edition (EBook) E-Learning Resources:

E-Learning Resources:

- Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

Course Outcomes:

On successful completion of this course, students would be able to

- Understand the foundational concepts of Data Science.
- Understand the nature of Data.
- Determine the relationship between data dependencies using statistics.
- Understand the concepts of Artificial Intelligence Roles and Skills in Data Science.

Course Number: MAIDS25014 **CC-IV**

L-P: 4-0 **Credits: 4**

PYTHON PROGRAMMING

Objectives:

- To understand different data types in Python.
- To learn the different concept sin Python.
- To analyze Database Connectivity and Data Visualization.
- To learn various applications domains of Python.
- To study the applications of Python programming.

UNIT-1 INTRODUCTION

Introduction to Python: Features of Python – Writing the First Python Program – Executing a Python Program – Data types in Python – Literals – Operators – Input and Output – Control Statements.

UNIT II ARRAYS, STRINGS, FUNCTIONS AND TUPLES

Creating an Array – Indexing and Slicing on Arrays – Types of Arrays – Working with arrays using numpy- Slicing and Indexing in numpy Arrays – Working with Multi-dimensional Arrays – Indexing and Slicing the Multi-dimensional Arrays – Creating Strings – Indexing, Slicing and Comparing Strings – Finding and Counting Substrings – Splitting and Joining Strings – Defining and Calling a Function–Pass by Object Reference –Anonymous Functions or Lambdas–Lists – Creating and Updating the Elements of a List – Methods to Process Lists –Creating Tuples – Functions to process Tuples – Inserting, Modifying and Deleting Elements from a Tuple.

UNIT III DICTIONARIES AND INTRODUCTIONT OOPS

Operations on Dictionaries – Dictionary Methods – Creating a Class – Types of Variables – Types of Methods – Constructors in Inheritance – Types of Inheritance – Operator Overloading – Method Overloading and Overriding – Interfaces in Python – Regular Expressions in Python.

UNIT IV DATASTUCTURES & GUI

Graphical User Interface: The Root Window – Working with Containers – Canvas – Frame – Widgets – Button Widget – Label Widget – Message Widget – Text Widget – Scrollbar Widget – Check button Widget – Radio button Widget – Entry Widget – List box Widget – Menu Widget – Creating Tables – Sending a Simple Mail.

UNIT V DATABASE CONNECTIVITY & DATA SCIENCE

Database Connectivity: Types of Databases used with Python – Using MySQL from Python – Retrieving all rows from a Table – Inserting, Deleting and Updating rows in a Table – Creating Database Tables using Python Data Science using Python: Data Frame and Data Visualization.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Dr.R.NageswaraRao, “Core Python Programming”, Second Edition, Dreamtech Press, 2019.

Reference Book(s):

1. Martin C. Brown, “The Complete Reference Python”, Indian Edition, McGraw Hill Education, 2018.
2. YashavantKanetkar, AdityaKanetkar, “Let us Python”, Second Edition, BPB Publications, 2019.

Course Outcomes:

- Create Arrays, Strings, Lists and Tuples.
- Examine Dictionaries & Object-Oriented Programming concepts in Python.
- Understand Database Connectivity and Data Visualization.
- Access Database with Python.
- Use MySQL with Python.

Course Number: MAIDS25015 **CC-V**

L-P: 5-0 **Credits: 4**

DATABASE TECHNOLOGIES

Objectives:

- To explore the features of a Database Management Systems
- To understand the basic concepts and terminology related to DBMS and Relational Database Design
- To interface a database with front end tools
- To understand the database design and normalization techniques
- To understand the internals of a database system
- To understand the concept of transaction management in the database

UNIT I:

Database System Applications: A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design with the ER Model

UNIT II:

SQL: Queries, Constraints, Triggers: form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active data bases. Schema refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multi-valued dependencies, FOURTH normal form, FIFTH normal form.

UNIT III:

Overview of XML, DTD, XML schema languages, XML query, XML related technologies, and XML databases.

UNIT IV:

NOSQL Databases and Big Data Storage Systems - Introduction to NOSQL Systems - CAP Theorem - Document-Based NOSQL Systems and MongoDB - NOSQL Key-Value Stores - Column-Based or Wide Column NOSQL Systems - NOSQL Graph Databases and Neo4j.

UNIT V:

Trends in Database Technology: Distributed Databases, Multimedia Databases, Mobile Databases, Temporal Databases and Spatial and Cloud Databases.

UNIT VI:

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. RamezElmasri and Shamkant B Navathe, "Fundamentals of Database Systems", Pearson Education, New Delhi, 2010.
2. Abraham Silberschatz, Henry F Korth and Sudharshan S, "Database System Concepts", Tata McGraw Hill, New Delhi, 2010.
3. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2016
4. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", McGraw Hill, New Delhi, 2003.
5. Gupta G K, "Database Management Systems", Tata McGraw Hill, New Delhi, 2011.

Reference Book(s):

1. AtulKahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2009.

E-Learning Resources:

1. https://www.studytonight.com/dbms
2. www.khanacademy.org › computer-programming › sql
3. https://docs.microsoft.com/en-us/azure/architecture/data-guide/big-data/non-relational-data

Course Outcomes:

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

- Comprehend the internal working of a database system
- Design database and apply normalization techniques
- Design and develop a database using SQL
- Know about the Transaction management, and database administration techniques
- Understand NOSQL technology

Course Number: MAIDS25016P **CC-VI**

L-P: 3-0 **Credits: 2**

PYTHON PROGRAMMING LAB

Objectives:

- To develop a strong understanding of Python programming syntax and core concepts.
- To enhance problem-solving skills through hands-on coding exercises in Python.
- To gain proficiency in working with data structures, files, and databases in Python.
- To apply object-oriented programming principles to design and implement efficient programs.
- To develop debugging, testing, and code optimization techniques for improved program performance.

PRACTICAL LIST

1. Generate the Fibonacci Series.
2. Check whether the given number is prime or not.
3. Find the factorial of a given number using function.
4. Sort the elements of an array in ascending order
5. Sort Words in Alphabetic Order
6. Perform various list operations like Append, Insert, Modify, Delete, Sort and Display
7. Swap two numbers without using a temporary variable.
8. Count the number of times a character appears in a given string.
9. Convert number in to its corresponding words
10. Perform Regular Expressions and working with widgets.
11. Stack Operations and Queue Operations.
12. Create, Insert, Delete and Update in Database.
13. Operations using Data Frames and Data Visualization.

Course Outcomes:

- Proficiency in Python syntax and fundamentals will be demonstrated.
- Python programming skills will be applied to solve computational problems.
- Practical experience will be gained in handling data and performing file operations.
- Python programs will be designed and implemented using object-oriented principles.
- The ability to debug, test, and optimize Python code effectively will be developed.

Course Number: MAIDS25017P **CC-VII**

L-P: 3-0 **Credits: 2**

DATABASE TECHNOLOGIES LAB

Objectives:

- To understand and apply core concepts of relational databases and SQL.
- To practice designing and implementing databases using normalization techniques.
- To develop skills in writing complex SQL queries for data retrieval, manipulation, and updates.
- To gain experience in using database management systems (DBMS) for creating and managing databases.
- To implement database-backed applications and understand transaction management and data integrity.

LIST OF EXERCISES:

1. Working with DDL, DML and DCL
2. Inbuilt functions in RDBMS.
3. Nested Queries & Join Queries.
4. Set operators & Views in SQL.
5. Control structures.
6. Working with Procedures and Functions
7. Triggers
8. Dynamic & Embedded SQL
9. Working with XML
10. Forms &Reports

Course Outcomes:

- Ability to design, implement, and manage relational databases.
- Proficiency in writing complex SQL queries for data extraction and manipulation.
- Skill in applying normalization and denormalization techniques to optimize database structure.
- Knowledge of DBMS functionalities like indexing, views, triggers, and stored procedures.
- Capability to develop database-driven applications with transaction handling and concurrency control.

SEMESTER II

Course Number: MAIDS25021 **CC-VIII**

L-P: 5-0 **Credits: 4**

ARTIFICIAL NEURAL NETWORK

Objectives:

- To explain the basic concepts and architectures of artificial neural networks.
- To study perceptron models and their learning rules.
- To understand associative and unsupervised learning techniques.
- To learn advanced networks like Adaline, Madaline, Backpropagation, and Hopfield networks.
- To explore applications of neural networks in areas like noise cancellation, forecasting, control, and pattern recognition.

UNIT – I

Perceptron Architecture- Single-Neuron Perceptron- Multi-Neuron Perceptron-

UNIT – II

Perceptron Learning Rule- Constructing Learning Rules- Training Multiple-Neuron Perceptrons.

UNIT – III

Simple Associative Networks- Unsupervised Hebb Rule- Hebb Rule with Decay-Instar Rule-Outstar Rule- Kohonen Rule.

UNIT – IV

Adaline Network- Madaline Network -Mean Square Error- LMS Algorithm- Back Propagationa Neural networks – Hopfield Networks

UNIT – V

Adaptive Filtering- Adaptive Noise Cancellation- Forecasting – Neural control applications – Character recognition.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Hagan Demuth Beale, ‘Neural network design’, PWS publishing company, 1995
2. Freeman, J.A and Skapura, D.M., ‘Neural Networks-Algorithms, applications and programming techniques’ Addison Wesley, 1991

3. Satish Kumar, Neural Networks – A classroom approach', Tata McGraw-Hill Publishing Company Limited, 2004

Course Outcomes:

- Understand the architecture of single and multi-neuron perceptrons and their functions.
- Apply perceptron learning rules and develop training models for multi-neuron systems.
- Explain and implement associative and unsupervised learning networks like Hebb, Instar, Outstar, and Kohonen.
- Analyze and apply Adaline, Madaline, LMS, Backpropagation, and Hopfield networks in solving real-world problems.
- Demonstrate neural network applications in adaptive filtering, noise cancellation, forecasting, and character recognition.

Course Number: MAIDS25022 **CC-IX**

L-P: 5-0 **Credits: 4**

BIG DATA ANALYTICS

Objectives:

- To understand the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data.
- To know about the research with the integration of large amounts of data.
- To classify data analytic methods.
- To study the applications of big data analytics.

UNIT-1 INTRODUCTION

Introduction to Big Data Analytics: Big Data Overview–Data Structures–Analyst Perspective on Data Repositories - State of the Practice in Analytics – BI Versus Data Science - Current Analytical Architecture – Drivers of Big Data – Big Data Ecosystem - Data Analytics Lifecycle – Data Discovery – Data Preparation – Model Planning – Model Building – Communicate Results – Operationalize.

UNIT–II DATA ANALYTIC METHODS

Basic Data Analytic Methods Using R : Introduction to R programming – R Graphical User Interfaces – Data Import and Export Attribute and Data Types – Descriptive Statistics Exploratory Data Analysis : Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables Data Exploration Versus Presentation -– Statistical Methods of Evaluation: Hypothesis Testing – Difference of Means – Wilcoxon Rank-Sum Test – Type I and Type II Errors – Power and Sample Size – ANOVA.

UNIT– III ADVANCED METHODS

Advanced Analytical Theory and Methods: Clustering – K Means – Use Cases – Overview – Determining number of clusters – Diagnostics Reasons to choose and cautions – Additional Algorithms - Association Rules: A Priori Algorithm – Evaluation of Candidate Rules Applications of Association Rules – Validation and Testing – Diagnostics. Regression: Linear Regression and Logistic Regression: – Use cases – Model Description – Diagnostics -Additional Regression Models.

UNIT– IV CLASSIFICATION

Classification : Decision Trees – Overview – Genetic Algorithm – Decision Tree Algorithms – Evaluating Decision Tree – Decision Trees in R - Naive Bayes – Bayes Theorem – Naïve Bayes Classifier – Smoothing – Diagnostics – Naïve Bayes in R – Diagnostics of Classifiers – Additional Classification Methods - Time Series Analysis: Overview –Box–Jenkins Methodology–ARIMA

Model –Autocorrelation Function – Autoregressive Models – Moving Average Models – ARMA and ARIMA Models–Building and Evaluating and ARIMA Model- Text Analysis: Text Analysis Steps – Example – Collecting – Representing Term Frequency – Categorizing – Determining Sentiments – Gaining Insights.

UNIT– V TECHNOLOGY

Advanced Analytics-Technology and Tools: MapReduce and Hadoop: Analytics for Unstructured Data. - Use Cases - MapReduce - Apache Hadoop – The Hadoop Ecosystem – pig – Hive – Hbase – Mahout – NoSQL - Tools in Database Analytics : SQL Essentials – Joins – Set operations – Grouping Extensions – In Database Text Analysis - Advanced SQL – Windows Functions – User Defined Functions and Aggregates – ordered aggregates- MAD Lib – Analytics Reports Consolidation – Communicating and operationalizing and Analytics Project – Creating the Final Deliverables : Developing Core Material for Multiple Audiences – Project Goals – Main Findings – Approach Model Description – Key points support with Data- Model details – Recommendations – Data Visualization.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services Published by John Wiley & Sons,
2. Noreen Burlingame, "The little book on Big Data", New Street publishers, 2012.
3. Anil Maheshwari, "Data Analytics", McGraw Hill Education, 2017.

Reference Book(s):

1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3. DietmarJannachand Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
4. KimS. Priesand Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.

Course Outcomes:

- Ability to understand and apply big data analytics concepts, including data discovery, preparation, and model building.
- Proficiency in using R programming for data analysis, visualization, and exploratory data analysis.

- Skill in advanced analytical methods such as clustering, association rules, regression models, and classification techniques.
- Knowledge of time series analysis and text analysis techniques for gaining insights from structured and unstructured data.
- Expertise in big data technologies like Hadoop, MapReduce, NoSQL, and advanced SQL for database analytics and operationalizing analytics projects.

Course Number: MAIDS25023 **CC-X**

L-P: 4-0 **Credits: 4**

MACHINE LEARNING

Objectives:

- To understand the concept of Machine Intelligence.
- To implement and apply machine learning algorithms to real-world applications.
- To identify and apply the appropriate machine learning technique.
- To classify pattern recognition, optimization and decision problems.
- To study the applications of Machine Learning.

UNIT-1INTRODUCTION

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Linear Discriminants – Perceptron – Linear Separability– Linear Regression.

UNIT–IILINEAR MODELS

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back- Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Course of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

UNIT– IIITREE AND PROBABILISTIC MODELS

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.

UNIT– IVDIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process

UNIT– VGRAPHICAL MODELS

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Stephen Marshland ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

Reference Book(s):

1. Tom M Mitchell, ―Machine Learning, First Edition, McGraw Hill Education, 2013.

Course Outcomes:

- Have a good understanding of the fundamental issues and challenges of Machine learning.
- Appreciate the underlying mathematical relationships within and across Machine Learning algorithms.
- Understand the paradigms of supervised and un-supervised learning.
- Design and implement various machine learning applications.
- Analyze different machine learning models.

Course Number: MAIDS25024 **EC-IA**

L-P: 4-0 **Credits: 4**

COMPUTATIONAL INTELLIGENCE

Objectives:

- To provide a strong foundation on fundamental concepts in Computational Intelligence.
- To enable Problem-solving through various approaches using neural networks, fuzzy and evolutionary algorithms
- To apply Computational Intelligence techniques using nature-inspired algorithms

UNIT-1

Introduction to Computational Intelligence- Definition and Scope of Computational Intelligence-Applications in Various Field-Basic Concepts: Optimization, Learning, Adaptation - Soft Computing vs. Hard Computing-Computational Intelligence vs. Classical Techniques vs. Artificial Intelligence - Future Trends and Directions – Traditional AI vs. Generative AI - Generative AI: overview of generative models and its applications - Language models LLM architecture -Understanding GPT - Introduction to Prompt Engineering: Types - application - text and image prompts

UNIT–II

Evolutionary Algorithms: Introduction to Evolutionary Algorithms - Genetic Algorithms - Basic Concepts and Operators - Evolution Strategies and Evolutionary Programming - Genetic Programming

UNIT– III

Differential Evolution – Multi - Objective Optimization using Evolutionary Algorithms - Co-Evolutionary Algorithms - Parallel and Distributed Evolutionary Algorithms - Real-World Applications: Engineering Design, Robotics - Comparison with Classical Optimization Techniques

UNIT– IV

Fuzzy Logic: Introduction to Fuzzy Logic- Fuzzy Sets and Membership Functions-Fuzzy Operators: AND, OR, NOT-Fuzzy Rules and Fuzzy Inference Systems (FIS)-Mamdani and Sugeno Fuzzy Inference Methods-Fuzzy Control Systems: PID Controllers vs. Fuzzy Controllers-Fuzzy Logic Applications in Control Engineering-Fuzzy Decision Making and Expert Systems- Fuzzy Clustering and Pattern Recognition- Fuzzy Logic in Medical Diagnosis and Healthcare

UNIT– V

Swarm Intelligence: Introduction to Swarm Intelligence- Ant Colony Optimization (ACO)-Particle Swarm Optimization (PSO)- Bee Colony Optimization (BCO)-Firefly Algorithm-Artificial Bee Colony Algorithm (ABC)-Grey Wolf Optimizer (GWO)-Differential Evolution Swarm (DES)-Applications in Engineering Design Optimization-Emerging Trends and Hybrid Approaches

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Computational Intelligence: Concepts to Implementations, Russell C. Eberhart and Yuhui Shi
2. Neural Networks and Deep Learning: A Textbook, Charu C. Aggarwal
3. Evolutionary Algorithms in Theory and Practice, Thomas Bäck
4. Fuzzy Logic with Engineering Applications, Timothy J. Ross
5. Swarm Intelligence, Russell C. Eberhart, Yuhui Shi, and James Kennedy

Reference Book(s):

1. Konar A., "Computational Intelligence: Principles, Techniques and Applications", Springer Verlag, 2005
2. Engelbrecht, A.P, "Fundamentals of Computational Swarm Intelligence", John Wiley & Sons, 2006.

E-Learning Resources:

- https://www.larksuite.com/en_us/topics/ai-glossary/computational-intelligence
- https://www.tutorialspoint.com/prompt_engineering/index.htm

Course Outcomes:

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

- To understand the fundamentals of Computational Intelligence, models, and its applications.
- To know about Generative AI.
- To understand Prompt Engineering and its applications.
- To Provide a basic exposition of the goals and methods of Computational Intelligence using different types of neural networks.
- To get familiarity with evolutionary algorithms.
- To apply Intelligent techniques using fuzzy logic.
- To know about optimization using swarm intelligence.

Course Number: MAIDS25024 **EC-IB**

L-P: 4-0 **Credits: 4**

DATA ENGINEERING

Objectives:

- Develop knowledge of foundation and building blocks for designing good data architecture.
- Gain an in-depth understanding of data generation in source systems and its relation to data storage.
- Understand the principles and processes involved in data ingestion.
- Explore the lifecycle of queries, query optimization techniques, and strategies to improve query performance.
- Understand the future of data engineering, including trends towards easier-to-use tools, cloud-scale data solutions, and the evolution of modern data architect

UNIT-I FOUNDATION AND BUILDING BLOCKS

Data Engineering Foundations – Data Engineering Life Cycle – Designing Good Architecture: Data Architecture – Enterprise Architecture - Principles of Good Data Architecture – Major Architecture Concepts – Types of Data Architecture – Choosing Technologies across the Data Engineering ring Lifecycle.

UNIT–II DATA ENGINEERING LIFECYCLE

Data Generation in Source Systems-Storage – Raw Ingredients of Data Storage – Data Storage Systems-Data Engineering Storage Abstractions – Trends in Storage.

UNIT– III INGESTION

Data Ingestion – Key Engineering Considerations for the Ingestion Phase-Batch Ingestion Considerations - Message and Stream Ingestion Considerations- Ways to Ingest Data.

UNIT– IV QUERIES, DATA MODELING AND TRANSFORMA

Queries-Life of the query -The query optimizer- Improving Query Performance- Queries on Streaming Data - Data Modelling: Data Model-Conceptual, Logical and Physical Data Model-Normalization-Techniques for Modeling Batch Analytical Data- Modeling Streaming Data-Transformation: Batch Transformations - Materialized Views, Federation and Query Virtualization.

UNIT– V SECURITY, PRIVACY AND THE FUTURE OF DATA ENGINE

Ways to Serve Data for Analytics and ML- Reverse ETL- Security and Privacy: People – Processes - Technology-Future of Data Engineering: The Decline of Complexity and Easy to Use Data Tools-The Cloud - Scale Data OS and Improved Interoperability-Enterprisey Data Engineering -Moving Beyond the Modern Data Stack, Toward the Live Data Stack.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Joe Reis, Matt Housley, “Fundamentals of Data Engineering: Plan and Build Robusr Sata Systems”, First Edition, O’Reilly Media, Inc. Publishers, 2022.

Reference Book(s):

1. Martin Kleppmann, “Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems”, O'Reilly Media, Inc. Publisher,2017.
2. Ashish Agarwal, “Ultimate Azure Data Engineering: Build Robust Data Engineering Systems on Azure with SQL, ETL, Data Modeling, and Power BI for Business Insights and Crack Azure Certifications”, Orange Education,2024.

E-Learning Resources:

- Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

Course Outcomes:

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

- Apply foundational principles of data architecture to design and implement scalable and efficient data systems across an enterprise.
- Analyze and apply modern trends and abstraction techniques in data storage system.
- Develop strategies for scaling and optimizing data ingestion pipelines.
- Apply query optimization and transformation techniques to enhance performance.
- Analyze emerging trends in data engineering, including cloud-scale solutions, reverse ETL, and live data stacks.

Course Number: MAIDS25024 **EC-IC**

L-P: 4-0 **Credits: 4**

DATA VISUALIZATION

Objectives:

- To introduce the fundamental concepts and importance of data visualization and its various applications.
- To teach methods of acquiring, processing, and displaying data from different file formats such as CSV, XML, and JSON.
- To develop the ability to create basic and animated visualizations programmatically using HTML5 Canvas and Google Charts.
- To familiarize students with D3.js for building complex, data-driven, and interactive visualizations.
- To enable students to design and implement advanced interactive features like dynamic updates, animations, and user controls in visualizations.

UNIT I

Introduction to Data Visualization: Acquiring and Visualizing Data - Simultaneous acquisition and visualization - Applications of Data Visualization - Keys factors of Data Visualization (Control of Presentation, Faster and Better JavaScript processing, Rise of HTML5, Lowering the implementation Bar) Exploring the Visual Data Spectrum: charting Primitives (Data Points, Line Charts, Bar Charts, Pie Charts, Area Charts), Exploring advanced Visualizations (Candlestick Charts, Bubble Charts, Surface Charts, Map Charts, Infographics). Making use of HTML5 CANVAS, Integrating SVG.

UNIT II

Basics of Data Visualization – Tables: Reading Data from Standard text files (.txt, .csv, XML), Displaying JSON content Outputting Basic Table Data (Building a table, Using Semantic Table, Configuring the columns), Assuring Maximum readability (Styling your table, Increasing readability, Adding dynamic Highlighting), Including computations - Using data tables library - relating data table to a chart.

UNIT III

Visualizing data Programmatically: Creating HTML5 CANVAS Charts (HTML5 Canvas basics, Linear interpolations, A Simple Column Chart, Animations), Starting with Google charts (Google Charts API Basics, A Basic bar chart, A basic Pie chart, Working with Chart Animations).

UNIT IV

Introduction to D3.js: Getting setup with D3 - Making selections - changing selection’s attribute - Loading and filtering External data: Building a graphic that uses all of the population distribution data - Data formats you can use with D3 - Creating a server to upload your data - D3’s function for loading data - Dealing with Asynchronous requests - Loading and formatting Large Data Sets.

UNIT V

Advanced Data Visualization: Making charts interactive and Animated: Data joins - updates and exits - interactive buttons - Updating charts - Adding transactions - using keys Adding a Play Button: wrapping the update phase in a function - Adding a Play button to the page - Making the Play button go - Allow the user to interrupt the play – sequence.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Jon Raasch, Graham Murray, VadimOgievetsky, Joseph Lowery, “JavaScript and jQuery for Data Analysis and Visualization”, WROX, 2014.
2. Ritchie S. King, “Visual story telling with D3”, Pearson, 2015.
3. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.

Reference Book(s):

2. A Julie Steele and Noah Iliinsky, “Designing Data Visualizations: Representing Informational Relationships”, O’Relly (Ebook),
3. Andy Kirk, Data Visualization: A Successful Design Process, PAKT
4. Scott Murray, Interactive Data Visualization for Web, O’Relly
5. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.
6. Tamara Munzner, Visualization Analysis and Design, AK Peters Visualization Series, CRC Press, Nov. 2014

E-Learning Resources:

- Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

Course Outcomes:

On successful completion of this course, students would be able to

- Demonstrate understanding of key data visualization concepts, chart types, and web technologies like HTML5 Canvas and SVG.
- Effectively read and visualize data from standard formats, ensuring clarity and usability through styling and interaction.
- Develop and animate charts using HTML5 Canvas and Google Charts API, applying programming techniques for visual storytelling.
- Utilize D3.js to load, manipulate, and visualize large and complex datasets with asynchronous data handling.
- Build interactive, animated visualizations with user-driven controls such as play buttons and dynamic updates for enhanced engagement.

Course Number: MAIDS25025 **EC-IIA**

L-P: 4-0 **Credits: 4**

PROBABILITY AND STATISTICS

Objectives:

- To understand the concept of correlation and its measurement through various coefficients, including Pearson's and Spearman's methods.
- To learn the principles of regression analysis, distinguish it from correlation, and apply the least squares method for linear regression.
- To grasp the fundamentals of probability distributions, random variables, and the concept of mathematical expectation.
- To study sampling methods, understand sampling distributions, and learn about different important probability distributions (Normal, t, Chi-square, F).
- To introduce statistical inference techniques, including estimation and hypothesis testing using various distributions.

UNIT-1

Correlation - Definition of Correlation- Scatter Diagram- Kari Pearson‟s Coefficient of Linear Correlation- Coefficient of Correlation and Probable Error of r- Coefficient of Determination - Merits and Limitations of Coefficient of Correlation- Spearman‟s Rank Correlation.

UNIT II

Regression Analysis - Regression and Correlation (Intro) - Difference between Correlation and Regression Analysis- Linear Regression Equations -Least Square Method- Regression Lines- Properties of Regression Coefficients Standard Error of Estimate.

UNIT III

Probability Distribution and mathematical Expectation- Random Variable Defined - Probability Distribution a Random Variable- Expectation of Random Variable- Properties of Expected Value and Variance.

UNIT IV

Sampling and Sampling Distributions - Data Collection- Sampling and Non Sampling Errors – Principles of Sampling-- Merits and Limitations of Sampling Methods of Sampling- Parameter and Statistic- Sampling Distribution of a Statistic- Examples of Sampling Distributions- Standard Normal – Student's t - Chi-Square (x2) and Snedecor's F- Distributions.

UNIT V

Statistical Inference- Estimation and Testing of Hypothesis - Statistical Inference- Estimation- Point and interval- Confidence interval using normal - t and x2Distributions- Testing of Hypothesis- Significance of a mean - Using t Distribution.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. K.L. Sehgal - “Quantitative Techniques and Statistics” - First Edition - Himalaya Publishing House - 2011.

Reference Book(s):

1. N. P. Bali - P. N. Gupta - C. P. Gandhi - “A Textbook of Quantitative Techniques” - First Edition - Laxmi Publications - 2008.
2. U. K. Srivastava - G. V. Shenoy - S. C. Sharma - “Quantitative Techniques for Managerial Decisions” - Second Edition - New Age International Publishers - 2005.
3. David Makinson - “Sets - Logic and Maths for Computing” - Springer - 2011.
4. Christopher Chatfield -” Statistics for Technology- A Course in Applied Statistics - Third Edition” - CRC Press - 2015.

Course Outcomes:

- Ability to compute and interpret different correlation coefficients and understand their applications and limitations.
- Competence in formulating and analyzing regression models to explain relationships between variables.
- Understanding of probability distributions and calculation of expectations and variances of random variables.
- Skill in applying appropriate sampling techniques and working with sampling distributions for inferential statistics.
- Capability to perform estimation and hypothesis testing for population parameters using confidence intervals and significance tests.

Course Number: MAIDS25025 **EC-IIB**

L-P: 4-0 **Credits: 4**

OPTIMIZATION TECHNIQUES

Objectives:

- To apply various optimization techniques for decision making.
- To introduce the use of variables for formulating complex mathematical models in management, science and industrial applications.
- To acquire knowledge on optimization techniques.
- To learn developing a linear programming.
- To study the applications of queuing model.

UNIT-1 INTRODUCTION-LINEAR PROGRAMMING PROBLEM

The Nature and Meaning of OR – Management – Applications of OR – Modeling in OR – General methods for solving OR models – Scope of OR. Linear Programming Problem: Formulation of LP problems – Graphical solution of LP problems – General formulation of LPP – Slack and Surplus variables – Standard form of LPP – Some important forms of LPP – Simplex Method and its special cases.

UNIT II ARIFICIAL VARIABLE TECHNIQUES AND IPP

Artificial Variable Techniques: Two Phase method and special cases. Integer Programming Problem: Importance–Definitions– Gomory's Pure Integer Programming Problem – Mixed Integer Programming Problem.

UNIT III ASSIGNMENT AND TRANSPORTATION PROBLEMS

Assignment Problem: Mathematical formulation– Hungarian method– Unbalanced assignment problem – Various types. Transportation Model: Mathematical formulation – Matrix form–Methods for finding Initial Basic Feasible solution and Optimal solution – Degeneracy in Transportation Problems – Unbalanced Transportation Problem.

UNIT IV SEQUENCING PROBLEMS AND QUEUING MODELS

Sequencing Problems: Assumptions – Solutions to Sequencing Problems: Processing n jobs through 2 machines – Processing n jobs through 3 machines – Processing n jobs on m machines. Queuing Models: Queuing System – Transient and Steady States– Kendal's Notation for representing Queuing Models – Various Models in Queuing System – Birth and Death Model.

UNIT VPERT AND CPM TECHNIQUES

PERT and CPM Techniques: Basic Steps – Network Diagram representation– Rules for drawing Network Diagram – Labeling Fulkerson's I–J Rule – Time Estimates and Critical Path in Network Analysis – Examples on optimum duration and minimum duration cost – PERT.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. S.D. Sharma, "Operations Research", Tenth Edition, Pearson, 2017.

Reference Book(s):

1. Hamdy A Taha, "Operations Research", Ninth Edition, 2016.
2. V. Sundaresan, K.S. Ganapathy Subramanian, K.Ganesan, "Resource Management Techniques", Ninth Edition, A. R. Publications, 2015.

Course Outcomes:

- Formulate and solve linear programming problems using graphical and simplex methods.
- Apply artificial variable techniques and solve integer programming problems.
- Optimize assignment and transportation problems using specialized algorithms.
- Analyze sequencing and queuing models for efficient workflow management.
- Utilize PERT and CPM techniques for effective project scheduling and time-cost optimization.

Course Number: MAIDS25025 **EC-IIC**

L-P: 4-0 **Credits: 4**

NUMERICAL ANALYSIS

Objectives:

- To understand the fundamental concepts of Numerical Methods and analysis.
- To explore tools and practices for working with Numerical concepts.
- To know about the research with the integration of large amounts of data.
- To learn various Stimulus concepts.
- To study the applications of Numerical methods.

UNIT-I

Algebraic and Transcendental Equations: Errors in numerical computation Iteration method-Bisection method – Regula - Falsi method – Newton - Raphson method Horner ‘s method.

UNIT II

Simultaneous Equations: Introduction-Simultaneous equations-Back substitution Gauss Elimination method-Gauss –Jordan Elimination method- Calculation of Inverse of a matrix- Crout‘s method-Iterative methods-Gauss- Jacobi Iteration method-Gauss seidal Iteration method-Newton Raphson‘s method for simultaneous equations.

UNIT III

Interpolation & Introduction: Newton‘s interpolation Formulae-Central difference Interpolation formulae-Gauss forward, Gauss backward, Lagrange‘s interpolation formulae- Divided differences-Newton‘s divided difference formula-Inverse Interpolation.

UNIT IV

Numerical Differentiation and Integration: Introduction-Derivates using Newton‘s forward difference formula-Derivates using Newton‘s backward difference formula Numerical Integration-Newton-cotes quadrature formula- Trapezoidal Rule-Simpson‘s one third rule- Simpson‘s 3/8 th rule.

UNIT V

Numerical Solution of Ordinary Differential Equations: Introduction-Taylor series method- Picard‘s method-Euler‘s method – Runge-kutta method of second, third, fourth order - Predictor & corrector methods - Mile‘s method.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Numerical Methods, Second Edition, S. Arumugam, A.ThangapandiIssac, A.Somasundaram, SCITECH publications, 2015.

Reference Book(s):

1. Mathews J.H. Numerical Method for Maths, Science and Engineering; PHI, New Delhi, 2001.
2. Iqbal H. Khan & Q. Hassan Numerical Methods for Engineers and Scientist – Galgotia Publications (P) Ltd., New Delhi, 1997.
3. M.K. Jain, S.R.K. Iyengar&R.K.Jain - Numerical Methods for Scientific and Engineering Computation - New Age International(P) Ltd., New Delhi, 1996.

Course Outcomes:

- Develop proficiency in solving algebraic and transcendental equations using iterative and root-finding methods.
- Apply direct and iterative techniques to solve simultaneous linear equations and compute matrix inverses.
- Utilize interpolation methods for estimating values and constructing polynomials from data points.
- Perform numerical differentiation and integration using various formulas and rules for accurate approximation.
- Implement numerical methods for solving ordinary differential equations, including Runge-Kutta and predictor-corrector techniques.

Course Number: MAIDS25026P **CC-XI**

L-P: 3-0 **Credits: 2**

BIG DATA ANALYTICS LAB

Objectives:

- To understand the fundamentals of Big Data analytics and the architecture of Hadoop.
- To learn the MapReduce programming model and implement MapReduce applications.
- To acquire skills in using HDFS commands for data storage and management in Hadoop.
- To explore data serialization and deserialization techniques in Hadoop, focusing on integer types.
- To gain hands-on experience with MongoDB CRUD operations and Hive query language (HQL) for data handling.

PRACTICAL LIST

1. Install Apache Hadoop
2. Map reduce program to calculate the frequency of a given word in a given file.
3. Create HDFS Commands
4. Study serializes and deserializes data of integer type in Hadoop.
5. Run a basic Word Count MapReduce program to understand MapReduce paradigm.
6. Create Basic CRUD operations in MongoDB.
7. Develop a map reduce program to find the grades of students.
8. Develop a map reduce program to to implement matrix multiplication.
9. Count words in a given file, to view the output file, and calculate execution time.
10. Clustering technique using spark.
11. Queries to sort and aggregate the data in a table using Hive QL.

Course Outcomes:

- Demonstrate knowledge of Hadoop architecture and effectively utilize MapReduce for distributed data processing.
- Perform basic file system operations using HDFS commands and manage large datasets efficiently.
- Write and execute MapReduce programs such as Word Count and Grep to analyze large data files.
- Utilize MongoDB for storing and manipulating data with CRUD operations and different collection types.
- Execute Hive queries for data definition and manipulation using HQL to manage and analyze structured data.

Course Number: MAIDS25027P **CC-XII**

L-P: 3-0 **Credits: 2**

MACHINE LEARNING LAB

Objectives:

- To apply the concepts of Machine Learning to solve real-world problems.
- To implement basic algorithms in clustering & classification applied to text & numeric data.
- To implement algorithms emphasizing the importance of bagging & boosting in classification & regression.
- To implement algorithms related to dimensionality reduction.
- To apply machine learning algorithms for Natural Language Processing applications.

PRACTICAL LIST

1. Solving Regression & Classification using Decision Trees.
2. Root Node Attribute Selection for Decision Trees using Information Gain.
3. Bayesian Inference in Gene Expression Analysis.
4. Pattern Recognition Application using Bayesian Inference.
5. Bagging in Classification.
6. Bagging, Boosting applications using Regression Trees.
7. Data& Text Classification using Neural Networks.
8. Weka tool for SVM classification for chosen domain application.
9. Data & Text Clustering using K-means algorithm.
10. Data & Text Clustering using Gaussian Mixture Models.
11. Dimensionality Reduction Algorithms in Image Processing applications.
12. Application of CRFs in Natural Language Processing.

Course Outcomes:

- Implement machine learning algorithms related to numeric data.
- Apply machine learning algorithms for text data.
- Use dimensionality reduction algorithms for image processing applications.
- Distinguish Clustering and Classification.
- Apply CRFs in Natural Language Processing

SEMESTER III

Course Number: MAIDS25031 **CC-XIII**

L-P: 5-0 **Credits: 4**

DEEP LEARNING

Objectives:

- To understand the fundamentals and architectures of neural networks, including backpropagation and training challenges.
- To gain hands-on experience with TensorFlow for building, training, and visualizing neural network models.
- To learn techniques for training deep neural networks and addressing issues like vanishing gradients and overfitting.
- To study advanced neural network architectures such as Recurrent Neural Networks (RNNs) and Convolutional Neural Networks (CNNs) and their applications.
- To explore deep reinforcement learning frameworks and advanced topics like Generative Adversarial Networks (GANs) and limitations of neural networks.

UNIT-I

Introduction to Neural Networks – Introduction – Basic Architecture of Neural Networks – Training and Neural Network with Back propagation – Practical Issues in Neural Network Training – The Secrets to the Power of Function Composition – Common Neural Architectures – Advanced Topics.

UNIT–II

Tensor Flow: variables, operations, placeholder Tensors, sessions – Navigating variable scopes and shared variables – Managing models over CPU and GPU – Logistic Regression in Tensor Flow– Training Logistic Regression model – Visualizing using Tensor Board – Building multilayer model in Tensor Flow.

UNIT– III

Training Deep Neural Networks: Introduction – Back propagation – Setup and Initialization issues – The vanishing and exploding gradient problems – Gradient Descent Strategies' – Batch Normalization–Teaching Deep Learners to Generalize: Introduction –The Bias- Variance trade-off – Generalization issues in model tuning and evaluation – Penalty based regularization – Ensemble methods – Early Stopping – Unsupervised pre-training – Continuation and Curriculum learning – Parameter sharing – Regularization in Unsupervised Applications.

UNIT– IV

Recurrent Neural Networks: Introduction – Architecture of Recurrent Neural Networks –The challenges of training recurrent Networks–Echo-State Networks– Long Short-Term memory – Gated Recurrent Units – Applications of Recurrent Neural Networks. Convolutional Neural Networks: Introduction – The Basic Structure of a Convolutional Network – Training a convolutional network –

Case studies of Convolutional Architectures – Visualization and Unsupervised Learning – Applications of Convolutional networks.

UNIT– V

Deep Reinforcement Learning: Introduction – Stateless Algorithms – The basic framework of Reinforcement Learning – Bootstrapping for value function learning– Policy Gradient Methods – Monte Carlo Tree Search – Case Studies – Practical Challenges associated with safety. Advanced Topics associated with Deep Learning: Generative Adversarial Networks (GAN) – Competitive Learning – Limitations of Neural Networks.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Charu C. Aggarwal, Neural Networks and Deep Learning, Springer 2018.

Reference Book(s):

1. Ian Good fellow, YoshuaBengio and Aaron Courville, Deep Learning, The MIT Press, 2016.
2. Francois Chollet, Deep Learning with Python, Manning Publications Co., 2018.
3. Josh Patterson, Adam Gibson, Deep Learning: A Practitioner's Approach 1st Edition, O'Reilly', 2017.

Course Outcomes:

- Demonstrate a solid understanding of neural network principles, architectures, and training methodologies.
- Develop and implement machine learning models using TensorFlow, including multilayer and logistic regression models.
- Apply advanced training techniques to improve deep neural network performance and generalization.
- Design and utilize RNN and CNN architectures to solve real-world sequential and image processing problems.
- Analyze and implement deep reinforcement learning algorithms and understand emerging trends in neural network research.

Course Number: MAIDS25032 **CC-XIV**

L-P: 5-0 **Credits: 4**

NATURAL LANGUAGE PROCESSING

Objectives:

- To understand the algorithms available for the processing of linguistic information and computational properties of natural languages.
- To conceive basic knowledge on various morphological, syntactic and semantic NLP tasks.
- To identify and apply the appropriate training in NLP.
- To classify Language modeling.
- To study the applications of NLP.

UNIT-I

Introduction to NLP: NLP – introduction and applications, NLP phases, Difficulty of NLP including ambiguity; Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English.

UNIT–II

Language Modeling: N-gram and Neural Language Models Language Modeling with N-gram, Simple N-gram models, Smoothing (basic techniques), Evaluating language models; Neural Network basics, Training; Neural Language Model, Case study: application of neural language model in NLP system development.

UNIT– III

Parts-of-speech Tagging Parts-of-speech Tagging: basic concepts; Tag set; Early approaches: Rule based and TBL; POS tagging using HMM, Introduction to POS Tagging using Neural Model.

UNIT– IV

Parsing Basic concepts Parts-of-speech Tagging Parts-of-speech Tagging: basic concepts; Tag set; Early approaches: Rule based and TBL; POS tagging using HMM, Introduction to POS Tagging using Neural Model. top down and bottom up parsing, treebank; Syntactic parsing: CKY parsing; Statistical Parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs.

UNIT– V

Semantics Vector Semantics; Words and Vector; Measuring Similarity; Semantics with dense vectors; SVD and Latent Semantic Analysis; Embedding from prediction: Skip-gram and CBOW; Concept of Word Sense; Introduction to WordNet.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. JurafskyDanand Martin James S. “Speech and Language Processing”,3rd Edition, 2018.

Reference Book(s):

1. Daniel Jurafsky and James H. Martin J.S., “Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.
2. Goldberg Yoav “A Primer on Neural Network Models for Natural Language Processing”.

Course Outcomes:

- Understand the fundamental concepts, challenges, and phases of Natural Language Processing and its key applications.
- Apply language modeling techniques, including N-gram and neural language models, to develop effective NLP systems.
- Demonstrate proficiency in parts-of-speech tagging using rule-based, statistical (HMM), and neural network approaches.
- Analyze and implement parsing techniques, including syntactic parsing with PCFG and probabilistic CKY algorithms.
- Comprehend semantic representation methods such as vector semantics, word embeddings, and utilize resources like WordNet for word sense disambiguation.

Course Number: MAIDS25033 **CC- XV**

L-P: 4-0 **Credits: 4**

SOCIAL MEDIA ANALYTICS

Objectives:

- To understand how accurately analyze voluminous complex data set in social media and other sources.
- To understand the models and algorithms to process large data sets.
- To apply supervised and unsupervised learning algorithms on social media.
- To discover community and follow information diffusion in social networks.
- To understand social behavior and recommendation challenges and methodologies.

UNIT I SOCIAL MEDIA MINING

Social Media Mining - Introduction – Atoms – Molecules – Interactions – Social Media mining Challenges - Graphs - Basics – Nodes – Edges – Degree of Distribution- Types – Directed – Undirected – Weighted - Graph Connectivity - Tress and Forests – Bipartite graphs – Complete Graphs – Sub graphs – Planar Graphs - Graph Representation - Graph Traversal Algorithms – Shortest path algorithms Dijkstra‟s - Spanning tree algorithms – Prims - Bipartite matching - FordFulkerson algorithm.

UNIT II SOCIAL NETWORK MODELS

Network Measures: Centrality – Transitivity, reciprocity – Balance and status – Similarity. Network Models: Properties – Random graphs – Small world models – Preferential attachment model.

UNIT III SOCIAL MEDIA COMMUNITIES

Social media Communities – Social Communities – Member based Detection – Node degree – Node Similarity – Node reachability - Group Based detection methods - balanced – robust - modular – dense - hierarchical - Spectral Clustering: Balanced Community algorithm Community Evolution - Evaluation.

UNIT IV INFORMATION DIFFUSION AND INFLUENCE IN SOCIAL MEDIA

Information Diffusion: Herd behaviour – Information cascades – Diffusion of innovations – Epidemics. Influence and Homophily: Measuring Assortativity – Measuring and modelling influence – Measuring and modelling homophily – Distinguishing influence and homophily.

UNIT V RECOMMENDATION AND BEHAVIOUR ANALYSIS IN SOCIAL MEDIA

Recommendation in Social Media: Challenges – Classical recommendation algorithms – Recommendation using social context – Evaluating recommendations. Behaviour Analysis: Individual behaviour – Collective behaviour. Events Analytics in Social Media.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Reza Zafarani, Mohammad Ali Abbasi, and Huan Liu, "Social Media Mining: An Introduction", Cambridge University Press, 2014.

Reference Book(s):

1. Matthew A. Russell, "Mining the Social Web". 2nd Edition. O'Reilly Media. 2013.
2. Jennifer Golbeck, Morgn Kaufmann, "Analyzing the Social Web", ISBN 978- 0124055315, 2013.
3. Ricardo Baeza-Yates and BerthierRibeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", 2ed, ACM Press Books, ISBN 978- 0321416919, 2011.
4. Charu C. Aggarwal, "Social Network Data Analytics". Springer. 2011.

E-Learning Resources:

- Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

Course Outcomes:

On successful completion of this course, students would be able to

- Understand the fundamentals of social media mining, including graph theory concepts and key algorithms for network analysis.
- Analyze social network models and apply measures such as centrality, transitivity, and reciprocity to study network properties.
- Identify and evaluate social media communities using member-based, group-based, and spectral clustering techniques.
- Explain the processes of information diffusion and influence in social media, including modeling herd behavior and homophily.
- Apply recommendation algorithms and conduct behavior analysis to interpret individual and collective social media interactions.

Course Number: MAIDS25034 **EC-IIIA**

L-P: 4-0 **Credits: 4**

SENSOR ANALYTICS

Objectives:

- To learn sensor analytics with model-based sensor data.
- To form topologies of WSNS.
- To create time series sensor using PCA.
- To understand the real time data analytics using sensor networks.
- To implement a reinforcement learning system.

UNIT I SENSOR DATA ANALYTICS OVERVIEW

An Introduction to Sensor Data Analytics. A Survey of Model-based Sensor Data Acquisition and Management: Introduction - Model-Based Sensor Data Acquisition - Model-Based Sensor Data Cleaning - Model-Based Query Processing - Model-Based Sensor Data Compression.

UNIT II QUERY PROCESSING

Query Processing in Wireless Sensor Networks: Introduction - Limitations of Sensor Nodes - Topologies of WSNS - Data Storage - Data Acquisition and Aggregation. Event Processing in Sensor Streams: Events and Event Processing - Event Processing in Sensor Streams - Event Processing over RFID Streams - Advanced Topics on Complex Event Processing for Sensor Streams.

UNIT III TIME SERIES SENSOR

Dimensionality Reduction and Filtering on Time Series Sensor Streams: Introduction - Broader Overview - Principal Component Analysis (PCA) - Auto-Regressive Models and Recursive Least Squares – MUSCLES - Tracking Correlations and Hidden Variables: SPIRIT - An Application-driven View: Putting Correlations to Work. Mining Sensor Data Streams: Introduction - Sensor Stream Mining Issues - Stream Mining Algorithms - Sensor Applications of Stream Mining - Conclusions and Research Directions.

UNIT IV REAL-TIME DATA ANALYTICS IN SENSOR NETWORKS

Real-Time Data Analytics in Sensor Networks: Introduction - Data Collection - Data Processing – Discussion. Distributed Data Mining in Sensor Networks: Introduction - Clustering in Wireless Sensor Networks - Classification in Wireless Sensor Networks - Outlier Detection in WSN.

UNIT V SOCIAL SENSING

Social Sensing: Introduction - Technological Enablers of Social Sensing - Data Collection, Architectural and System Design Challenges - Privacy Issues in Social Sensing - Trust in Social Sensing - Implied Social Networks: Inference and Dynamic Modeling - Trajectory Mining for Social Sensing - Social Sensing Applications - Future Challenges and Research Directions.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Charu. C. Aggarwal, “Managing and Mining Sensor Data”

Reference Book(s):

1. Sensor Data Analytics Challenges and Methods for Data-Intensive Applications by Felipe Ortega and Emilio López Cano(Eds.)
2. Sensor Data Analysis and Management - The Role of Deep Learning by A. Suresh

E-Learning Resources:

- Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

Course Outcomes:

On successful completion of this course, students would be able to

- Understand the principles of sensor data analytics, including model-based data acquisition, cleaning, and compression techniques.
- Analyze query processing methods and event detection strategies in wireless sensor networks and sensor streams.
- Apply dimensionality reduction and filtering techniques, such as PCA and recursive models, to time series sensor data.
- Implement real-time data analytics and distributed data mining approaches, including clustering, classification, and outlier detection in sensor networks.
- Explore social sensing concepts, addressing system design, privacy, trust issues, and applications in dynamic social environments.

Course Number: MAIDS25034 **EC-IIIB**

L-P: 4-0 **Credits: 4**

COMPUTER VISION

Objectives:

- To understand the fundamental concepts related to image processing and feature extraction etc.
- To study the concepts of edge detection techniques.
- To get familiar about image segmentation concept.
- To understand motion analysis and object tracking
- To apply the concepts to solve computer vision problems of different fields.

UNIT I:

Fundamentals of Image Formation, Transformation: Vision transformation, Geometric transformations, Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement-Histogram Processing.

UNIT II:

Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH

UNIT III:

Image Segmentation: Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, Texture Segmentation; Object Detection

UNIT IV:

Motion analysis: Background Subtraction and Modeling, Optical Flow, KLT, Spatio -Temporal Analysis, Dynamic Stereo; Motion parameter estimation

UNIT V:

Object tracking; Mean Shift tacking, Object Categorization, Content Based Image Retrieval, Action Recognition

Unit VI

Current Contours (for Continuous Internal Assessment Only): Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer- Verlag London Limited2011.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

Reference Book(s):

1. D.L.Baggioetal., ―MasteringOpenCVwithPracticalComputerVision Projects, Packt Publishing,2012.
2. E. R. Davies, ―Computer & Machine Vision, Fourth Edition, AcademicPress,2012.

E-Learning Resources:

- http://szeliski.org/Book/drafts/SzeliskiBook_20100903_draft.pdf

Course Outcomes:

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

- Understand the fundamentals of image formation, transformation techniques, and apply Fourier transform and filtering for image enhancement.
- Detect edges, lines, and corners using methods such as Canny, Hough Transform, Harris, SIFT, SURF, and HOG descriptors.
- Apply various image segmentation techniques including region growing, graph-cut, and texture segmentation for object detection.
- Analyze motion in videos using background subtraction, optical flow, and spatio-temporal methods for dynamic scene understanding.
- Implement object tracking algorithms and perform object categorization, content-based image retrieval, and action recognition tasks.

Course Number: MAIDS25034 **EC-IIIC**

L-P: 4-0 **Credits: 4**

GENERATIVE AI & LLM

Objectives:

- To grasp the foundational concepts of GenAI and LLMs
- To delve into prompt engineering, fine-tuning, and optimization strategies for LLMs.
- To assess the impact of LLMs across various applications and industries.
- To discuss the ethical implications and challenges of deploying GenAI technologies.
- To examine current trends and the future landscape of generative AI.

UNIT I INTRODUCTION TO GENERATIVE AI

Introduction to Generative AI & LLMs, LLM Use Cases and Tasks, Text Generation Before Transformers, Transformers Architecture, Generating Text with Transformers.

UNIT II PROMPT ENGINEERING AND PRETRAINED MODELS

Prompting and Prompt Engineering (Chain of Thought), RAG Technique for Retrieval, Generative Configuration, Generative AI Project Lifecycle, Pre-training Large Language Models, Computational Challenges of Training LLMs.

UNIT III FINE-TUNING AND EVALUATION

Instruction Fine-Tuning, Fine-Tuning on a Single Task, Multi-Task Instruction Fine- Tuning, Model Evaluation, Parameter Efficient Fine-Tuning (PEFT), PEFT Techniques: LoRA, Soft Prompts.

UNIT IV REINFORCEMENT LEARNING FOR LLM AND OPTIMIZATIONS

Aligning Models with Human Values, Reinforcement Learning from Human Feedback (RLHF), Obtaining Feedback from Humans, Reward Model, Fine-Tuning with Reinforcement Learning, Model Optimizations for Deployment.

UNIT V LLM-POWERED APPLICATIONS

Generative AI Project Lifecycle, Using the LLM in Applications, Interacting with External Applications, Helping LLMs Reason and Plan with Chain-of-Thought, Program-Aided Language Models (PAL), ReAct: Combining Reasoning and Action, LLM Application Architectures.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Edward R. Deforest, Prompt Engineering with Transformers and LLM, 2023.
2. Altaf Rehmani, Generative AI for Everyone, 2024.

Reference Book(s):

1. Palash Goyal, et al., Deep Learning for Natural Language Processing, Springer.
2. 2021. Denis Rothman, Transformers for Natural Language Processing, Packt Publishing, 2021.

E-Learning Resources:

- Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

Course Outcomes:

On successful completion of this course, students will be able to:

- Explain the principles of generative AI and the architecture of large language models.
- Implement prompt engineering and fine-tuning techniques effectively.
- Critically analyze the applications of LLMs in real-world scenarios.
- Evaluate models based on established benchmarks and propose improvements.
- Discuss ethical issues and challenges related to generative AI deployment.
- Predict future trends and advancements in the field of generative AI.

Course Number: MAIDS25035 **EC-IVA**

L-P: 4-0 **Credits: 4**

MACHINE LEARNING OPERATIONS (MLOPS)

Objectives:

- Understand the fundamentals and significance of MLOps, including the roles of different stakeholders involved.
- Explore key features of MLOps such as model development, deployment, monitoring, and lifecycle management.
- Learn best practices for preparing machine learning models for production, including risk evaluation, testing, and security.
- Study effective monitoring techniques, feedback loops, and governance frameworks for sustainable MLOps implementation.
- Analyze real-world MLOps applications through case studies in credit risk management and marketing recommendation systems.

UNIT I WHY MLOP?

Why Now and Challenges: Defining MLOps and Its Challenges - MLOps to Mitigate Risk - MLOps for Scale. People of MLOps: Subject Matter Experts - Data Scientists - Data Engineers - Software Engineers – DevOps - Model Risk Manager/Auditor - Machine Learning Architect.

UNIT II FEATURES OF MLOP

Key MLOps Features: A Primer on Machine Learning - Model Development - Productionalization and Deployment – Monitoring - Iteration and Life Cycle - Governance. Developing Models: What Is a Machine Learning Model? - Data Exploration - Feature Engineering and Selection – Experimentation - Evaluating and Comparing Models - Version Management and Reproducibility.

UNIT III PRODUCTION

Preparing for Production: Runtime Environments - Model Risk Evaluation - Quality Assurance for Machine Learning - Quality Assurance for Machine Learning - Key Testing Considerations - Reproducibility and Auditability - Machine Learning Security - Model Risk Mitigation. Deploying to Production: CI/CD Pipelines - Building ML Artifacts - Deployment Strategies – Containerization - Scaling Deployments - Requirements and Challenges.

UNIT IV MONITORING AND FEEDBACK

Monitoring and Feedback Loop: How Often Should Models Be Retrained? - Understanding Model Degradation - Drift Detection in Practice - The Feedback Loop. Model Governance: Who Decides What Governance the Organization Needs? - Matching Governance with Risk Level - Current Regulations Driving MLOps Governance - The New Wave of AI-Specific Regulations - The

Emergence of Responsible AI - Key Elements of Responsible AI - A Template for MLOps Governance.

UNIT V PRACTISING MLOP

MLOps in Practice: Consumer Credit Risk Management: Background: The Business Use Case - Model Development - Model Bias Considerations - Prepare for Production - Deploy to Production. MLOps in Practice: Marketing Recommendation Engines: The Rise of Recommendation Engines - Data Preparation - Design and Manage Experiments - Model Training and Deployment - Pipeline Structure and Deployment Strategy - Monitoring and Feedback.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Mark Treveil&Dataiku Team, "Introducing MLOps – How to Scale Machine Learning in Enterprises", 2020.

Reference Book(s):

1. David Sweenor, Steven Hillion, Dan Rope, DevKannabiran, Thomas Hill, Michael O'Connell, "MLOps: Operationalizing Data Science", 2020.
2. Noah Gift &alfredoDeza, " PracticalMLOps – Operationalizing Machine Learning Models", 2021.

E-Learning Resources:

- Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

Course Outcomes:

On successful completion of this course, students would be able to,

- Demonstrate a clear understanding of the challenges and opportunities in implementing MLOps in modern AI workflows.
- Apply MLOps principles to develop, deploy, and manage machine learning models efficiently and securely.
- Evaluate and mitigate risks associated with machine learning models through quality assurance and governance strategies.
- Monitor deployed models effectively, detecting drift and ensuring timely retraining and feedback integration.
- Design and implement MLOps pipelines tailored to real-world business use cases, ensuring ethical and responsible AI practices.

Course Number: MAIDS25035 **EC-IVB**

L-P: 4-0 **Credits: 4**

CLOUD COMPUTING

Objectives:

- To Introduce the Fundamentals of Cloud Computing.
- To be Familiar with the Cloud Architecture
- To Understand about Cloud Service Models
- To Know the Concept of Virtualization in Cloud Computing
- To Know About the Different Cloud Service Providers.

UNIT – I COMPUTING PARADIGMS

High-performance computing, parallel computing, distributed computing, cluster computing, grid computing, cloud computing, bio-computing, mobile computing quantum computing, and optical computing. Nano-computing.

UNIT – II CLOUD COMPUTING FUNDAMENTALS:

Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models.

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UNIT - III CLOUD COMPUTING ARCHITECTURE AND MANAGEMENT

Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure, Managing the Cloud application, Migrating, Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

UNIT – IV CLOUD SERVICE MODELS

Infrastructure as a Service, Characteristics of IaaS, Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers. Other Cloud Service Models.

UNIT – V CLOUD SERVICE PROVIDERS

EMC, EMC IT, Captiva Cloud Toolkit, Google Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue ,Service, Microsoft Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force, Sales Cloud, Service Cloud: Knowledge as a Service, Rack space, VMware, Manjra soft Aneka Platform.

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Essentials of Cloud Computing: K.Chandrasekhran , CRC press, 2014.

Reference Book(s):

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg andAndrzej M. Goscinski, Wiley, 2011.
2. MohakAgarwal, “Generative AI for Entrepreneurs in a Hurry”, 2023.

E-Learning Resources:

- Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

Course Outcomes:

- Understand ChatGPT applications.
- Appreciate the working of ChatGPT.
- Explore the features of Generative AI.
- Update writing skills in research.
- Design a chat bot.

Course Number: MAIDS25035 **EC-IVC**

L-P: 4-0 **Credits: 4**

AFFECTIVE COMPUTING

Objectives:

- To understand the fundamentals of human emotion theory.
- To detect the emotion from Human Signals
- To implement systems for emotion recognition using multimodal data.
- To analyze affective computing applications in real-world scenarios.
- To explore ethical issues, trends in affective technology.

UNIT – I FUNDAMENTALS OF AFFECTIVE COMPUTING

Introduction to Affective Computing -Historical perspective and key milestones -Applications in real-world domains (healthcare, education, HCI, etc.)-Emotion Psychology Emotion theories: Discrete Emotion Theory (Ekman), Dimensional Models (Valence-Arousal, Russell's Circumplex), Appraisal Theory-Emotion Design.

UNIT – IIEMOTION DETECTION FROM HUMAN SIGNALS

Facial Expression Analysis: FACS (Facial Action Coding System) - Tools: OpenFace, Affectiva, EmotionNet, Speech and Audio Analysis: Prosodic features (pitch, tone, MFCCs), Tools: OpenSMILE, Praat, Textual Emotion Recognition: Sentiment vs. emotion, Features and methods for Text Analysis, NLP models for emotion detection (BERT, LSTM)

UNIT – III PHYSIOLOGICAL AND MULTIMODAL EMOTION RECOGNITION

Physiological Signals: EEG, GSR, heart rate, respiration - Emotion datasets (DEAP, MAHNOB-HCI), Multimodal Emotion Recognition: Sensor fusion techniques, Temporal modeling (RNNs, LSTMs), Data Preprocessing and Feature Engineering

UNIT – IV EMOTION SYNTHESIS AND AFFECTIVE INTERFACES

Emotion generation in agents and robots, Affect-aware virtual agents and avatars, Emotion-driven interaction design, Affective gaming and storytelling, Adaptive systems based on emotional feedback

UNIT – V ETHICS, PRIVACY, AND FUTURE TRENDS

Ethics in Affective Computing- Ethical implications of emotion-aware systems, Emotion manipulation, consent, and surveillance, Bias and fairness in affective datasets and models, Current trends: Empathic AI, emotion in generative systems, affect in XR (AR/VR)

UNIT VI

Case studies (e.g., emotion detection in hiring, education platforms), Tools and Datasets:

Toolkits: OpenFace, OpenSMILE, EmoReact, Affectiva SDK, Weka, TensorFlow - Datasets: FER2013, DEAP, MAHNOB-HCI, EmoReact, MSP-IMPROV, IEMOCAP

Text Book(s):

1. Affective Computing by Rosalind W. Picard, MIT Press, 1997
2. Emotion-Oriented Systems: The Humaine Hand by Paolo Petta, Catherine Pelachaud, RoddyCowie 2010

Reference Book(s):

1. Affective Computing and Sentiment Analysis by AmitKonar, Springer, 2021
2. The Oxford Handbook of Affective Computing by Editors: Rafael Calvo, Sidney D'Mello, Jonathan Gratch, ArvidKappas, Oxford University Press, 2015

E-Learning Resources:

- http://nptel.ac.in/courses.php
- Research papers from journals and conferences: IEEE Transactions on Affective Computing, ACM ICMI, etc.

Course Outcomes:

By the end of the course, students will be able to:

- Understand the fundamentals of human emotion theory.
- Implement systems for emotion recognition using multimodal data.
- Analyze affective computing applications in real-world scenarios.
- Explore ethical issues surrounding affective technology.

Course Number: MAIDS25036P **CC-XVI**

L-P: 3-0 **Credits: 2**

DEEP LEARNING LAB

Objectives:

- To learn deep neural networks and apply for simple problems
- To Learn and apply Convolution Neural Network for image processing.
- To Learn and apply Recurrent Neural Network and its variants for text analysis To augment data using generative models
- To explore real world applications with deep neural networks

EXERCISES:

1. Solving XOR problem using Multilayer perceptron
2. Implement character and Digit Recognition using ANN.
3. Implement the analysis of X-ray image using auto encoders
4. Develop a code to design object detection and classification for traffic analysis using CNN.
5. Implement online fraud detection of share market data using any one of the data analytics tools.
6. Implement Sentiment Analysis using LSTM.
7. Implement the standard VGG-16 and 19 CNN architecture model to classify multi category image data set and check the accuracy.
8. Implement RNN for sentiment analysis on movie review.
9. Implement Bidirectional LSTM for sentiment analysis on movie reviews.
10. Implement generative adverbial network to generate realistic images. Use MNIST, fashion MNIST or any human face dataset.
11. Implement auto encoders for image denoising on MNIST, fashion MNIST or any suitable dataset.

Course Outcomes:

On successful completion of this course, students would be able to

- Apply deep neural network for simple problems.
- Apply Convolution Neural Network for image processing.
- Apply Recurrent Neural Network and its variants for text analysis.
- Apply generative models for data augmentation.
- Develop a real-world application using suitable deep neural networks

Course Number: MAIDS25037P **CC-XVII**

L-P: 3-0 **Credits: 2**

NATURAL LANGUAGE PROCESSING LAB

Objectives:

- To familiarize the students with practical aspects of processing Natural Language.
- To Understand the Logic of NLP Techniques.
- To Know the Implementation of NLP Techniques.
- To Apply Present Compatible Programming Language for NLP.

PRACTICAL LIST

1. Perform Tokenization by word and sentence using nltk.
2. Eliminate stopwords using nltk
3. Perform stemming using nltk
4. Perform parts of speech tagging using nltk.
5. Perform lemmatization using nltk
6. Perform chunking using nltk
7. Perform named entity recognition using nltk
8. Find Term Frequencies and Inverse Document Frequency(TF-IDF)
9. Program for CYK phrasing (Cocke younger-Kasami Parsing) And char parsing.
10. Find all Unigrams, Bigrams and Trigrams present in the given corpus.
11. Find the probability of the given 31 statement" This is My Cat "by taking the example corpus into consideration.
12. Use the Stanford named entity recognizer to extract entity from the documents. Use it programmatically and output for each document which named entities it contains and of which type.
13. Perform sentiment analysis and spam filter using NLP.

Course Outcomes:

- Implement common NLP tasks using Python and Natural Language Toolkit, NLTK
- Describe the concepts of morphology, syntax, semantics, discourse& pragmatics of Natural Language.
- Discover various linguistics relevant to NLP tasks.
- Analyze parsing in NLP.
- Develop systems for various NLP problems with moderate complexity

SEMESTER IV

Course Number: MAIDS25041 **CC-XVIII**

L-P: 0-0 **Credits: 14**

SEMESTER IV

MAJOR PROJECT

Objectives:

1. Each student has to undergo an individual project either in the Institution or in a reputed industry.
2. Internal Project Supervisor shall be allocated for each student.

Course Outcomes:

- Develop a model to achieve the project's goal.
- Demonstrate sound technical knowledge of the selected project topic.
- Undertake problem identification, formulation and solution.
- Design solutions to complex problems utilizing a systematic approach.
- Appreciate the steps involved in Software development process.

VALUE ADDED COURSES

Course Number: 25VAC01 **VAC-I**

SOFT SKILLS: PROFESSIONAL ENGLISH

Objectives:

- To improve the communication skills of the students
- To understand and demonstrate writing and speaking processes.
- Develop vocabulary and improve the accuracy in grammar
- To improve speaking processes through conducting meetings and report-writing.
- To understand and demonstrate writing and speaking processes through written communication, conducting meetings and report-writing.

UNIT I - INTRODUCTION

Meaning- Objectives- Importance -Principles of Communication-Forms of Communication- Process of Communication- Communication barriers- techniques for effective communication

UNIT II-BASIC ENGLISH COMMUNICATION

Parts of Speech- Meaning and its usage- Noun- Pronoun-Verbs-Types of Verbs- Adverb- Adjectives-Conjunction- Interjections-Parts of Sentence- Subject and Predicate

UNIT III – WRITTEN COMMUNICATION

Paragraph writing – Letter Writing –Essay writing - Principles-Inquiries-Circulars-Acknowledgement- Complaints- Job Application Letters-Bio-Data-Covering Letters, Interview letters, Letter of Reference .E-Mail

UNIT IV - MEETINGS

Conducting Meetings: Procedure-preparing Agenda, minutes, and resolutions–Conducting Seminars and Conferences

UNIT V - REPORT WRITING

Types of Business Reports- Format- Structure- Components of Report- Analysis of Sample Reports from Industry

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Communication Skills, by N. Gupta, K. Jain, P. Mahajan, SahityaBhawan Publications, 2022, revised edition
2. Communication skills 2nd Edition, Oxford University Press, 2015
3. Business Communication, N.Gupta,K.Jain,P. Mahajan, SahityaBhawan Publications, 2021.
4. UrmilaRai and S. M Rai , Effective Communication (Himalaya Publishing House)
5. Shirley Taylor, Communication for Business, Pearson Education, New Delhi
6. Businesscommunication,principlesandmethodsandTechniques,NirmalSingh,Deep,and Deep publications PvtLtd., 2018.
7. Business communication, Sri Jin Kushal, SunitiAhuja, VK Global Publications Pvt Ltd,2020.
8. Business communication, Meenakshi Raman, PrakashSingh, Oxford university press, 2016.
9. Foundations of Business communication, IndiaEdition, Dona.J. Young, TataMcGrawHill,2018.

Reference Book(s):

1. Professional communication, ArunaKoneru,TatamcgrawHill,2016

E-Learning Resources:

- https://www.edx.org/learn/business-communications
- https://learndigital.withgoogle.com/digitalunlocked/course/business- communication
- https://www.eduonix.com/courses/Office-Productivity/a-complete-guide-for- effective-business-communication
- https://www.futurelearn.com/courses/effective-communication

Course Outcomes:

- To provide an overview of Prerequisites to English Communication.
- Develop vocabulary and improve the accuracy in grammar
- Display competence in oral, written, and visual communication.
- Show an understanding of opportunities in the field of communication.
- Develop the confidence to speak in public
- Demonstrate positive group communication exchanges.

Course Number: 25VAC02 **VAC-II**

PROFESSIONAL ETHICS

Objectives:

- To create awareness on professional ethics and Human Values
- To create awareness on Engineering Ethics providing basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues
- To provide basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards.

UNIT I HUMAN VALUES

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS

Senses of ―Engineering Ethics‟ – Variety of moral issues – Types of inquiry – Moral dilemmas– Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy –Models of professional roles – Theories about right action – Self-interest – Customs and Religion - Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers - Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

UNIT VI

Current Contours (for Continuous Internal Assessment Only):

Contemporary Developments Related to the Course during the Semester Concerned.

Text Book(s):

1. Mike W. Martin andRoland Schinzinger,- Ethics in Engineering‖, Tata McGraw Hill, New Delhi,2013
2. R. Subramanian, - Professional Ethics‖, Oxford University Press, New Delhi, 2013
3. Govindarajan M, Natarajan S, Senthil Kumar V. S, - Engineering Ethics‖, Prentice Hall of India, New Delhi,2004

Reference Book(s):

1. Daniel Albuquerque, - Business Ethics, Oxford University Press, New Delhi, 2013.
2. Edmund G.Seebauer and Robert L. Barry, ―Fundamentals of Ethics, Oxford University Press, New Delhi, 2012.
3. Laura P. Hartman and Joe Desjardins, ―Business Ethics: Decision Making for Personal Integrity and Social Responsibility‖ McGraw Hill education, India Pvt. Ltd.,New Delhi2013.
4. World Community Service Centre, "Value Education", Vethathiri publications, Erode,2011.

E-Learning Resources:

- www.onlineethics.org
- www.nspe.org
- www.globalethics.org
- www.ethics.org

Course Outcomes:

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society
- Can analysis and have an idea about the Collective Bargaining, Confidentiality, Professional, Employee, Intellectual Property Rights
- Inculcate knowledge and exposure on Safety and Risk, Risk Benefit
- Understand the core values that shape the ethical behavior of an engineer and Exposed awareness on professional ethics and human values.