Annexure 14.3

Avinashilingam Institute for Home Science and Higher Education for Women
Deemed to be University Estd. u/s 3 of UGC Act 1956, Category 'A' by MHRD [now MoE]
Re-accredited with A++ Grade by NAAC. CGPA 3.65/4, Category I by UGC
Coimbatore - 641 043, Tamil Nadu, India

Department of Computer Science
(coordinated by Centre for Machine Learning and Intelligence, DST-CURIE-AI)

Master of Science
Artificial Intelligence
(Two years programme)

Programme Outcomes:

PO1: Understand the fundamental subjects to solve different problems towards various technological aspects that suites the current scenarios

PO2: Familiarize with the technical and professional skills to work with modern AI tools, resources, and software.

PO3: Apply AI techniques and algorithms to automate processes, enhance decision-making, and solve real-world problems.

PO4: Gain the ability to solve complex scientific problems using AI tools, derivations, and mathematical simulations.

PO5: Evaluate AI solutions that are developed and applied with ethical principles while promoting sustainability and social responsibility.

PO6: Develop AI-based employability skills to apply in technology, healthcare, finance, and business sectors.

Programme Specific Outcomes:

PSO1: Acquire depth knowledge in Artificial Intelligence tools and software.

PSO2: Implement the concepts of Artificial Intelligence in various domains.

PSO3: Experiment with Artificial Intelligence applications to explore and develop innovative solutions for real-world problems.

Master of Science
Artificial Intelligence
(Two years programme)
Scheme of Instruction and Examination
(For Students admitted from 2025-2026 and onwards)

Part	*Subject Code*	*Name of Paper/ component*	*Hours of instruction /week*		*Scheme Examination*				
			T	**P**	**Duration of exam**	**CIA**	**CE**	**Total**	**Credit**
First Semester									
I	25MAIC01	Introduction to Digital Intelligence	4		3	40	60	100	4
	25MAIC02	Artificial Intelligence	4		3	40	60	100	4
	25MAIC03	Internet of Things	4		3	40	60	100	4
	25MAIC04	Data Science	4		3	40	60	100	4
	25MAIC05	Computing Lab I -Internet of Things	-	6	3	40	60	100	3
	25MAIC06	Computing Lab II - RProgramming for Data Science	-	6	3	40	60	100	3
II		CSS/ Adult Education/ Community Engagement and Social Responsibility	2	-	-	-	-	-	-
Second Semester									
I	25MAIC07	Natural Language Processing	4		3	40	60	100	4
	25MAIC08	Computer Vision and Image Processing	4		3	40	60	100	4
	25MAIC09	Neural Network and Deep Learning	4		3	40	60	100	4
	25MAIC10	Computing Lab III - Computer Vision and Image Processing	-	6	3	40	60	100	3
	25MAIC11	Computing Lab IV -Deep Learning using Python	-	6	3	40	60	100	3
II		Interdisciplinary Course	4	-	3	100	-	100	4
		Professional Certification Courses							2
	25MXCSS1/ 25MXAED1/ 25MXCSR1	CSS/ Adult Education/ Community Engagement and Social Responsibility	2	-	2	-	-	-	2
Internship during Summer Vacation (1 month)									

Third Semester									
I	25MAIC12	Human Computer Interaction	3	-	3	40	60	100	3
	25MAIC13	Generative Artificial Intelligence	3	-	3	40	60	100	3
	25MAIC14	Big Data Analytics	3	-	3	40	60	100	3
	25MAIC15	Cyber Intelligence	3	-	3	40	60	100	3
	25MAIC16A/ 25MAIC16B/ 25MAIC16C	Elective Artificial Intelligence for Business / Artificial Intelligence for Home Science / Machine Learning for Chemistry and Biochemistry.	3	-	3	100	-	100	3
	25MAIC17	Computing Lab V- Generative Artificial Intelligence	-	6	3	40	60	100	3
	25MAIC18	Computing Lab VI - Data Visualization using Analytical Tools	-	4	3	40	60	100	2
	25MAIC19	Mini Project	1	-	-	100	-	100	2
	25MAIC20	Digital Health **(Self-Study Course)**	2	-	3	100	-	100	2
	25MAIC21	Internship	-	-	-	-	-	100	2
II		Multi-Disciplinary Course	2	-	3	100	-	100	2
Fourth Semester									
I	25MAIC22	Research Thesis/ Project/ Patent	-	30	-	100	100	200	20
								Total Credits	96

Other courses to be undergone by the student:

*** MOOC courses- 2 to 4 Credits – Credit transfer may be claimed.**

Minimum 96+2 credits to earn the degree.

** Students who exit at the end of 1st year shall be awarded a **Postgraduate Diploma.**

Courses offered to other PG Programmes:

1. **Interdisciplinary Course–**

   25MAII01-Machine Learning using Excel

2. **Multidisciplinary Course–**

   25MAIM01-Machine Learning for Biochemistry, Biotechnology

   25MAIM02-Machine Learning for Chemistry

   25MAIM03-Mobile Application Development

   25MAIM04–G-Suite for front office

Introduction to Digital Intelligence

Semester I **Hours of Instructions / Week: 4**
25MAIC01 **No. of Credits: 4**

Course Objectives:

1. To understand the basic concepts of Digital Intelligence
2. To understand fundamental concept of digital marketing
3. To enhance the knowledge about advantages of business with digital marketing.

Unit I: Introduction **- 12 Hrs**

Fundamentals of Intelligence - Meaning of intelligence, Architectural Thinking Framework to Unfold Digital Intelligence -Purpose, Vision, Strategy, Requirements, Use Cases, Current and Future State, Feasibility Trade-offs, Decisions, Context, Models; Digital Complexity - Purpose, Enterprise Environments, Managing Complexity, (Chapter summary and Take Away Points)*.

Unit II: Financial Intelligence for Digital **- 12 Hrs**

Digital Cost Awareness, Quality and Cost Concerns, Bill of Materials, Infrastructure and Maintenance Costs, Availability and Performance Costs, Availability and Performance Costs, Service Level Agreements, Digital Systems, Methodical Approach to Cost Management; Innovative & Inventive Intelligence - Innovation and Invention, Thinking Modes, Creating Innovation and Invention Culture, Design Thinking, Growth Mindset, Co-creation, Innovation and Invention Roadblocks; Smart Simplification - Reason for Simplicity, Communication Simplicity, User-Centric, Simplicity, Process Simplicity, Design Simplicity, Specification Simplicity, Simplicity for Technical Language, Governance Simplicity, (Data Simplicity)*.

Unit III: Digital Marketing **- 12 Hrs**

Developing Overall Digital Strategy - Grabbing the Attention of Customer - Discovering Business Model and Brand - Deciding which Marketing Campaign to Create - Crafting Offers That Sell – (Planning B2B Campaign Success)*.

Unit IV: Search Engine Optimization **- 12 Hrs**

Getting Started with SEO - Surveying the Search Engine Landscape - Search Results, Deconstructed - Search Engine–Friendly Web Site Makeover - Making Site Useful and Visible - Picking Powerful Keywords - Creating Pages That Search Engines Love - Using Structured Data Markup - Avoiding Things That Search Engines Hate - Getting Pages into the Search Engines - Submitting to the Directories – (Using Link Popularity to Boost Position)*.

Unit V: Social Media Marketing **- 12 Hrs**

Developing Strategic Mix - Creating a Podcast - Producing Video cast - Measuring Blogging, Podcasting, and Vlogging Metrics. Getting to Know Twitter - Communing with Like-Minded People - Twitter Applications and Other Delights - Using Twitter with Other Social Media Marketing - Measuring Twitter Metrics - Getting Around on Facebook - Using Facebook Features - Analyzing Facebook Metrics. Getting Started with LinkedIn - LinkedIn Nuts and Bolts - Maximizing LinkedIn – Measuring Results.(Delving into Data - Comparing Metrics from Different Marketing Techniques)* - Tallying the Bottom Line - Making Decisions by the Numbers - Staying Ahead of the Curve.

*** Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. Dr Mehmet Yildiz, (2019)"*Digital Intelligence An innovative framework to digital transformation capabilities*", S.T.E.P.S. Publishing, Australia, ASIN: B07XNB2259.
2. Ryan Deiss, Russ Henneberry, (2017)"*Digital Marketing For Dummies*,"John Wiley and Sons Ltd.
3. Jan Zimmerman, Deborah NG, (2017), "*Social Media Marketing All-in-One For Dummies*", 4th Edition, John Wiley and Sons Ltd.
4. Peter Kent, (2015)"*SEO For Dummies*", 6 edition, John Wiley and Sons Ltd.

E-Learning Resource:

1. https://www.dqinstitute.org/global-standards/#contentblock1

Course Outcomes:

CO1: Understands the basic concepts of Digital Intelligence
CO2: Become aware of the current Digital Financial Transformations
CO3: Understand the Plans and development of Digital marketing
CO4: Ability to do Search Engine Optimization
CO5: Familiarize to use social media for Marketing

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	M	L	M	L	L	M	M	L
CO 2	M	L	M	L	M	H	M	H	M
CO 3	M	M	L	L	M	H	M	M	L
CO 4	L	M	H	L	L	M	L	M	H
CO 5	L	H	M	L	M	H	L	M	M

Artificial Intelligence

Semester I **Hours of Instructions / Week: 4**

25MAIC02 **No. of Credits: 4**

Objectives:

1. To understand the fundamental concepts, techniques, applications of Artificial Intelligence and its implementation.
2. To explore the integration of AI with IoT and its applications in various domains, including data-driven decision-making and industrial automation.
3. To analyze ethical considerations, responsible AI practices, and governance frameworks for developing transparent and accountable AI systems.

Unit I: Artificial Intelligence: Foundations and Data Processing **- 12 Hrs**

AI Foundations-History, Turing Test, The Origin Story, Golden Age of AI, The Rise and Fall of Expert Systems, Neural Networks and Deep Learning, Technological Drivers of Modern AI, Structure of AI. Data – Data Basics, Types of Data, Big Data, Volume,Variety, Velocity, Databases and Other Tools, Data Process,

Unit II: Applications of Artificial Intelligence **- 12 Hrs**

AI overview, Advantages of AI systems, Challenges of AI systems. Types of AI. Philosophical Foundations – Week AI, Strong AI, The Risks of Developing Artificial Intelligence. Applications of AI, AI in Healthcare, AI in Finance, AI in Datasecurity, AI in Travel and Transport, AI in Robotics, AI in Agriculture, AI in E-commerce, and AI in Education. AI:The Present and Future.

Unit III: Artificial Intelligence for IoT **- 12 Hrs**

Definition of IoT - IoT reference model, IoT platforms, IoT verticals. Big data and IoT. Infusion of AI - Data science in IoT - Cross-industry standard process for data mining, AI platforms and IoT platforms. AI for Industrial IoT- (Introduction to AI powered Industries)*, Predictive maintanence using AI.

Unit IV: Artificial Intelligence Implementation **- 12 Hrs**

Approaches to implementing AI, The Steps for AI Implementation, Identify a Problem to Solve, The Right Tools and Platforms, AI Frameworks, Deploy and Monitor the AI System. The Future of AI – Autonomous Cars, The Weaponization of AI, Drug Discovery, Government, Artificial General Intelligence, Social Good.

Unit V: AI Ethics and Responsible AI **- 12 Hrs**

Introduction, Background of AI, Autonomy, Adaptability, Interaction. Ethical Decision Making – Ethical Theories, Values, Ethics in Practice, Implementing Ethical Reasoning. Responsible Research and Innovation, The Art of AI: Accountability, Responsibility, Transparency. (Governance for Responsible AI)*, codes of Conduct, Inclusion and Diversity, The AI Narrative.

*** Indicates Self – Stud Component**

Total Hours: 60

Reference Books:

1. Tom Taulli, Artificial Intelligence Basics, Apress, 2019.
2. Rashmi Priyadarshini, R. M. Mehra, Amit Sehgal, and Prabhu Jyot Singh, *Artificial Intelligence: Applications and Innovations*, CRC Press, 2023.
3. Amita Kapoor, (2019*), "Hands-On Artificial Intelligence for IoT"*, Packt Publishing.
4. Virginia Dignum, *Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way*, Springer, 2019.

E-Learning Resources:

- **https://www.ibm.com/topics/artificial-intelligence**
- **https://www.analyticsvidhya.com/blog/2021/06/real-world-applications-of-artificial-intelligence/**
- **https://www.weforum.org/agenda/2020/10/how-to-make-ai-more-ethical/**

Course Outcomes

CO1: Understand the fundamental concepts of Artificial Intelligence, its history, and the role of data processing

CO2: Apply AI techniques and its implementations in real-world applications across various domains.

CO3: Explore AI integration with IoT for smart automation and decision-making.

CO4: Implement AI solutions by selecting appropriate tools, frameworks, and methodologies while understanding deployment and monitoring processes.

CO5: Evaluate AI ethics and responsible AI practices for fairness and transparency.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	M	L	L	L	L	H	M	L
CO 2	M	H	H	M	L	H	M	H	H
CO 3	L	M	H	H	L	M	M	H	H
CO 4	L	H	H	H	M	M	H	H	M
CO 5	L	L	M	M	H	H	L	M	H

Internet of Things

Semester I **Hours of Instruction/Week: 4**

25MAIC03 **No. of Credits: 4**

Course Objectives:

1. To understand the fundamental concepts, architecture, and enabling technologies of the Internet of Things (IoT).
2. To learn IoT design methodologies, physical devices, and sensor integration for developing real-world applications.
3. To explore the role of Machine Learning and AI in IoT for data processing, analytics, and intelligent decision-making.

Unit I: Introduction to IoT **- 12 Hrs**

Introduction - Definition and Characteristics. Physical Design of IoT. Logical Design of IoT - Functional blocks, Communication models and APIs. IoT enabling technologies - WSN, Cloud Computing, Big data analytics, embedded systems. Domain Specific IoTs - Home, City, Environment, Energy, (Agriculture and Industry)*.

Unit II : IoT Design methodology **- 12 Hrs**

Introduction - Purpose and requirements specification, Process specification, Domain model specification, Information model specification, Service specification, IoT level specification, Functional view specification, Operational view specification, (Device and component integration)*, Application development.

Unit III: IoT Physical Devices and Endpoints **- 12 Hrs**

IoT Device - Building blocks of IoT. Exemplary Device: Raspberry PI. 12 About the Board. Linux on Raspberry PI. Raspberry PI Interfaces- Serial interfaces, SPI, I2C. Programming Raspberry PI with Python - Controlling and interfacing LED switches. Other IoT Devices -pcDuino, Cubie board. Sensors in IoT- Sensor, Functions of IoT Sensors, Classification of IoT Sensors, (Key Factors in Selecting IoT Sensors)*.

Unit IV: Machine Learning for IoT **-12 Hrs**

Machine Learning Techniques- Tools to Implement Machine Learning, Supervised Learning, Unsupervised Learning, Classification, Regression, Clustering. Data Analytics-IoT Data Sources, Data Processing, IoT Technologies, Optimizing Techniques. Steps of Steps of Data Preprocessing, (Data Reduction Schemes)*.

Unit V: IoT Cloud, AI Applications & Case Studies **- 12 Hrs**

(Introduction to Cloud Computing — Definition)*, IoT network architecture, and wearable Iota networks. Weather Reporting System, Smart Parking System, Air pollution Monitoring System, Smart Gas leakage system, Smart Anti-Theft System, and IoT printers. AI for Smart cities IoT- Smart Trafic management, Smart waste management, Smart policing, Smart lighting, Smart governance, Case studies: Adapting IoT for Smart Cities and the necessary steps.

*** Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti, *Internet of Things: A Hands-On Approach*. Universities Press, 2018, Original Work Published in 2015
2. Waher P. *Mastering Internet of Things.* Packt Publishing; 2018.
3. Kumar, N., & Makkar, A. *Machine Learning in Cognitive IoT.* Taylor & Francis Group (2020).
4. Buyya R, Dastjerdi AV. *Internet of Things: Principles and Paradigms.* Morgan Kaufmann; 2016.

E-learning Resources:

1. https://www.cavliwireless.com/blog/nerdiest-of-things/sensors-in-iot.html
2. IoT platform product architecture on Google Cloud | Cloud Architecture Center
3. https://www.geeksforgeeks.org/introduction-to-internet-of-things

Course Outcomes:

CO1: Understand the basics of IoT, its architecture, and key technologies.

CO2: Learn to design and develop IoT applications for real-world needs.

CO3: Explore IoT devices, sensors, and their integration with microcontrollers like Raspberry Pi.

CO4: Apply Machine Learning techniques for IoT data processing and decision-making.

CO5: Evaluate IoT cloud solutions, AI applications, and smart city case studies.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	M	L	M	L	L	H	M	L
CO 2	M	H	H	H	M	H	M	H	H
CO 3	M	H	H	M	L	M	H	H	H
CO 4	M	M	H	H	M	H	M	H	H
CO 5	L	M	M	M	H	M	L	M	M

Data Science

Semester I **Hours of Instructions / Week: 4**

25MAIC04 **No. of Credits:4**

Course Objectives:

1. To introduce necessary knowledge needed for data science.
2. To impart programming skills required to build data science applications.
3. To train the students to have understanding on the various applications of Data Science

Unit I: Introduction to Data Science **- 12 Hrs**

Concept of Data Science - Traits of Big data, Data- Wrangling- Feature Engineering- Exploratory Data Analysis, (Web Scraping)*, Analysis vs Reporting, build the model– presenting findings and building applications , Introduction to Data Mining,Data Warehousing, Basic Statistical descriptions of Data

Unit II: Mathematical Foundations **- 12 Hrs**

Linear Algebra - (Vectors, Matrices)*. Statistics - Describing a Single Set of Data, Correlation, Simpson's Paradox, Correlation and Causation. Probability Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem. Hypothesis and Inference - Statistical Hypothesis Testing, Confidence Intervals, Phacking, Bayesian Inference.

Unit III: Machine Learning **- 12 Hrs**

Overview of Machine learning concepts – Over fitting and train/test splits. (Types of Machine learning–Supervised, Unsupervised)*, Reinforced learning. Cluster Analysis Partitioning Method, Hierarchical Method, Density Based Method, Grid Based Method. Bayes Theorem, Linear Regression, Logistic Regression, Decision Trees ,Analysis of Time Series, Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks, Learning and Generalization, Overview of Deep Learning.

Unit IV: Reinforcement Learning **- 12 Hrs**

Reinforcement Learning terminology, Deep reinforcement learning. Simulated environments – OpenAI gym. Q-learning - Taxi drop-off using Q-tables. Q-Network - Taxi drop-off using Q-Network, (DQN to play an Atari game)*, Double DQN, Dueling DQN. Policy gradients - Pong using policy gradients, The actor-critic algorithm, Chatbots using Reinforcement learning, Movie recommendation system using reinforcement learning.

Unit V: Data Visualization **- 12 Hrs**

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting – Geographic Data with Basemap – Visualization with Seaborn. Applications of Data Science, (Weather Forecasting)*, Stock Market Prediction, Object Recognition, Real-time Sentiment Analysis, and Financial Frauds.

*** Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. Joel Grus (2015) ,*"Data Science from Scratch: First Principles with Python"*, O'Reilly Media.
2. Chantal D. Larose, Danie lT. Larose (2019), *"Data Science Using Python and R"*, First Edition, Wiley.
3. JainV.K.(2018), *"Data Science and Analytics "*, Khanna Publishing House, Delhi.
4. Lapan, M. (2024). *Deep reinforcement learning hands-on* (3rd ed.). Packt Publishing.
5. Jeeva Jose(2020),*"Introduction to Machine Learning"*, Khanna Publishing House, Delhi.

E-Learning Resources:

1. https://www.guru99.com/data-science-tutorial.html
2. https://nptel.ac.in/courses/110106072
3. http://www.deeplearningbook.org

Course Outcomes:

CO1: Understand the fundamentals of data science
CO2: Apply mathematical and statistical methods for data analysis and decision-making.
CO3: Learn and use machine learning techniques like supervised and unsupervised learning
CO4: Implement reinforcement learning models such as Q-learning and Deep Q-Networks (DQN).
CO5: Familiarize various tools used for Data Visualization

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	M	L	L	L	L	H	M	L
CO 2	M	H	M	H	M	L	M	H	M
CO 3	L	H	H	H	L	M	M	H	H
CO 4	L	M	H	H	M	M	H	H	M
CO 5	L	M	M	M	H	H	L	M	H

Computing Lab I - Internet of Things

Semester I **Hours of Instructions / Week: 6**
25MAIC05 **No. of Credits: 3**

Course Objectives:

1. To understand the fundamentals of sensor integration and microcontroller programming.
2. To learn to collect, transmit, and visualize sensor data using IoT platforms.
3. To explore basic Machine Learning techniques for analyzing real-world sensor data.

List of Programs:

1. Control an LED using a Touch sensor with Arduino UNO.
2. Activate a buzzer alarm upon motion detection using a PIR sensor and ESP8266 [NodeMCU].
3. Display temperature and humidity readings on an OLED by interfacing a DHT11 sensor with Arduino UNO.
4. Detect object color using a Color sensor with Arduino UNO and display the detected color on an OLED screen.
5. Display the current time and date on an LCD by interfacing a Real-Time Clock (RTC) module with Arduino.
6. Adjust LED brightness based on ambient light levels by interfacing an LDR sensor with ESP32[NodeMCU].
7. Detect fire using a flame sensor and trigger a buzzer alarm for immediate response using NodeMCU.
8. Create an Arduino-based attendance system that uses an RFID reader to log and display tag
9. Measure current fluctuations using a current sensor with Arduino UNO, and blink an LED when significant changes in current are detected.
10. Detect object movement using an IR sensor with Arduino UNO and display the object's proximity status (Far, Near, Very Close) on an OLED screen.
11. Collect voltage data using a voltage sensor and transmit it to a mobile device through a Bluetooth Module.
12. Collect water level data using a sensor connected to an Arduino, and transmit this data to the Blynk dashboard for visualizing in Blynk.Console.
13. Measure distance using an ultrasonic sensor with Raspberry Pi, send the data to the Blynk dashboard and visualize it in the Blynk App.

14. Collect pulse rate data using a heartbeat sensor with NodeMCU, send it to the ThingSpeak dashboard and visualize it using 2D Plot.
15. Collect motion detection data using a PIR sensor connected to a NodeMCU, send the data to the ThingSpeak dashboard, and visualize it using a histogram.
16. Detect gas leakage using an MQ135 sensor with ESP32[NodeMCU], send the data to ThingSpeak for monitoring, and trigger an email alert for critical gas levels.
17. Detect soil moisture levels using a soil moisture sensor with Raspberry Pi, send the data to the Blynk dashboard, and trigger an email.
18. Collect atmospheric data (temperature, humidity) using Raspberry Pi. Send the data to the ThingSpeak dashboard and calculate the average humidity level using MATLAB Analysis.
19. Obtain soil moisture, temperature, and humidity data using sensors connected to a Raspberry Pi, and apply machine learning techniques to determine when watering is necessary.
20. Create a system using a Raspberry Pi and camera module to detect objects with Machine Learning Techniques.

Total Hours: 90

Course Outcomes:

CO1: Apply microcontrollers like Arduino, NodeMCU, and Raspberry Pi to interface with sensors.
CO2: Design and deploy smart automation solutions using IoT and embedded systems.
CO3: Implement alert mechanisms such as email triggers and buzzer alarms for safety applications.
CO4: Develop real-time monitoring systems using IoT dashboards like Blynk and ThingSpeak.
CO5: Analyze sensor data using MATLAB and basic Machine Learning techniques.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	H	M	M	L	L	H	M	L
CO 2	M	H	H	H	M	H	M	H	H
CO 3	M	H	H	M	L	M	M	H	H
CO 4	M	M	H	H	M	H	M	H	H
CO 5	M	M	H	H	M	H	M	H	H

Computing Lab II - R Programming for Data Science

Semester I **Hours of Instructions / Week: 6**

25MAIC06 **No. of Credits: 3**

Course Objectives:

1. To understand and apply fundamental data manipulation and visualization techniques in R.
2. To explore key concepts in data science, including statistical analysis and pattern recognition.
3. To implement machine learning models for predictive analysis and decision-making.

List of Programs:

1. Program to expand a data frame by adding new rows and columns to existing data frame.
2. Program for file handling: create, read, write, rename, and copy different files.
3. Program to perform data exploration using functions like read(), summary(), nrow(), ncol(), and str().
4. Program to create a vector from a dataset, treat it as an object, and perform dot and cross products.
5. Program to implement loop functions using lapply(), sapply(), tapply(), apply(), and mapply().
6. Program to explore data using single-variable visualizations: unimodal, bimodal, histograms, density plots, and bar charts.
7. Program to explore data using two-variable visualizations: line plots, scatter plots, smoothing curves, and bar charts.
8. Program to perform data preprocessing operations: handling missing data and min-max normalization.
9. Program to create a dataset and conduct statistical analysis, including mean, median, variance, and hypothesis testing.
10. Program to Calculate the correlation matrix for all numerical variables in the 'mpg' dataset and display it using a heatmap.
11. Program to perform Principal Component Analysis (PCA) on the Iris dataset and visualize the first two principal components using a scatter plot, highlighting species-wise differences.
12. Program to perform time series analysis on a dataset to identify trends and seasonal patterns using R.
13. Program to derive relationship coefficients and summaries using linear regression on a any dataset.
14. Program to analyze the Iris dataset using logistic regression.
15. Program to implement clustering algorithms: k-means, k-medoids, and density-based clustering on any dataset.
16. Program to implement decision tree classifiers on any dataset.

17. Program to implement association rule mining algorithms on a market basket dataset.
18. Program to perform support vector machine analysis on a heart disease dataset and plot the results.
19. Program to implement a random forest classifier on a diabetes dataset and evaluate its performance.
20. Program to perform sentiment analysis on a text dataset using a Naïve Bayes classifier.

Total Hours: 90

Course Outcomes:

CO1: Perform data manipulation, exploration, and visualization using R.
CO2: Apply statistical methods to analyze datasets and derive meaningful insights.
CO3: Implement machine learning models such as regression, classification, and clustering in R.
CO4: Conduct time series analysis, association rule mining, and sentiment analysis on relevant datasets.
CO5: Develop practical solutions for real-world data science problems using R programming.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	M	M	M	L	L	H	M	L
CO 2	H	M	H	H	M	M	H	H	M
CO 3	M	H	H	H	M	H	M	H	H
CO 4	M	H	H	H	M	H	M	H	H
CO 5	M	H	H	H	M	H	M	H	H

Natural Language Processing

Semester II **Hours of Instructions / Week: 4**
25MAIC07 **No. of Credits: 4**

Course Objectives:

1. To understand the fundamentals on Natural Language Processing.
2. To provide the enhanced knowledge on Text mining
3. To master the python programming language skills for large unstructured text

Unit I: Natural Language processing, Document Retrieval and Information Extraction - 12 Hrs
NLP Definition - NLP and Linguistics - Linguistic Tools - Information Retrieval. Indexing Technology - Query Processing - Evaluating Search Engines - Attempts to Enhance Search performance - The future of Web searching. The Message Understanding Conferences – (Regular Expressions)* - Finite Automata in FASTUS - Pushdown Automata and Context-Free Grammars - Limitations of Current Technology and Future Research.

Unit II: Text categorization and Mining - 12 Hrs
Overview of Categorization Tasks and Methods - Handcrafted Rule Based Methods - Nearest Neighbor Algorithms - Combining Classifiers - Evaluation of Text Categorization Systems. Text Mining - Automatic Summarization –(Testing of Automatic Summarization Programs)* - Prospects for Text Mining and NLP.

Unit III: Processing Raw Text and Writing Structured Python Program - 12 Hrs
Accessing Text from the Web and from Disk- Strings: Text Processing at the Lowest Level - Text Processing with Unicode - Regular Expressions for Detecting Word Patterns – (Useful Applications of Regular Expressions)*- Normalizing Text - Regular Expressions for Tokenizing Text - Segmentation - Formatting: From Lists to Strings.

Unit IV: Categorizing, Tagging Words and Learning to Classify - 12 Hrs
Using A Tagger - Tagged Corpora - Mapping Words to Properties Using Python Dictionaries - Automatic Tagging - N-Gram Tagging - Transformation-Based Tagging - Determine the Category of a Word - Supervised Classification –(Further Examples of Supervised Classification)* - Evaluation - Naive Bayes Classifiers - Modeling Linguistic Patterns

Unit V: Extracting Information, Analyzing Sentences Structure and Meaning of Sentences - 12 Hrs
Information Extraction - Chunking - Developing and Evaluating Chunkers - Recursion in Linguistic Structure - Recursion in Linguistic Structure –(Name Entity Recognition)* - Relation Extraction. Analyzing Sentences Structure: Some Grammatical Dilemmas - Use of Syntax - Context-Free Grammar - Parsing with Context-Free Grammar - Dependencies and Dependency Grammar - Grammar Development - Natural Language Understanding - Propositional Logic - First-Order Logic - The Semantics of English Sentences - Discourse Semantics

*** Indicates Self - Study Component**
Total Hours: 60

Reference Books:

1. Steven Bird, Ewan Klein, and Edward Loper, "*Natural Language Processing with Python*", O'Reilly Media, Inc., Second Edition, 2009
2. Eisenstein, J. (2019). *"Introduction to Natural Language Processing"*, United Kingdom: MIT Press.
3. Godbole, A. M., Gunning, D., Chopra, R., Shah, M. B., Sadvilkar, N., Ghosh, S. (2020). *"The Natural Language Processing Workshop: Confidently Design and Build Your Own NLP Projects with this Easy-to-understand Practical Guide"*, United Kingdom: Packt Publishing.
4. Kochmar, E. (2022). "*Getting Started with Natural Language Processing*". United States: Manning.

E-Learning Resource:

1. https://nptel.ac.in/courses/106105158

Course Outcomes:

CO1:Understand the fundamentals of Natural Language Processing
CO2: Build the necessary knowledge on Text categorization and mining
CO3: Master the python programming skills for processing raw text data
CO4:Understand various processing involved in Tagging
CO5: Implement the techniques and tools used for extracting information

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	M	M	M	L	L	H	M	L
CO 2	H	M	H	H	M	M	H	H	M
CO 3	M	H	H	H	M	H	M	H	H
CO 4	M	H	H	H	M	H	M	H	H
CO 5	M	H	H	H	M	H	M	H	H

Computer Vision and Image Processing

Semester II **Hours of Instruction/Week: 4**
25MAIC08 **No. of Credits: 4**

Course Objectives:

1. To acquire fundamental knowledge in basic image processing and recognition.
2. To train the students in enhancement, analysis and inference based knowledge on feature extraction.
3. To acquire advanced knowledge in MATLAB to solve real world problems

Unit I: Image Formation and Digitization **-12 Hrs**

Digital Image Processing- Example of Fields that use Digital Image Processing - Fundamental Steps in Digital Image Processing - Components of an Image Processing System. Image Sampling and Quantization: Basic concepts in Sampling and Quantization - Representing the Digital Image – (Some basic relationship between pixels)*- Import and Export of Image using Matlab - Types of Color Space Conversion.

Unit II: Spatial Transformation and Enhancement **- 12 Hrs**

Spatial Transformation: Interpolation - Interpolation Methods - Image Resizing - Image Rotation - Image Cropping. Image Enhancement: Noise Removal - Linear Filtering - Adaptive Filtering –(Image Histogram)*. Image Smoothing: Image Averaging and Mean Filters - Ordered Statics Filters. Image Sharpening: High Pass Filter and Homomorphic Filtering.

Unit III: Image Analysis **- 12 Hrs**

Segmentation: Region Extraction – Pixel based Approach - Multi-level Thresholding - Local Thresholding. Region based Approach: Region Growing - Region Splitting - Region Merging - Split and Merge. Edge Detection: Derivative Operators –(Pattern Fitting Approach)* - Morphological Edge Detection - Edge Linking and Edge Following - Edge Element Extraction by Threshold - Edge Detector Performance - Corner Detection.

Unit IV: Feature Extraction and Recognition **- 12 Hrs**

Feature Extraction: Representation of Boundary, Medial Axis Transform & Thinning. Topological Attributes: Connectivity Numbers - Components Labelling - Component Counting - Computing Genus. Geometrical Attributes: Perimeter - Diameter of the Enclosing Circle - Area-Slope, Curvature and Straightness - Convexity. Object Recognition: Knowledge Representation –(Statistical Pattern Recognition)* - Neural Nets - Fuzzy Systems.

Unit V: Application of Image Processing **- 12 Hrs**

Face Recognition - Iris Recognition - Fingerprint Recognition - Medical Image Processing - Satellite Images - Remote Sensing – (Sleepiness Detection - Object Detection)*.

*** Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. Rafael C. Gonzalez and Richard E.Woods (2018), *"Digital Image Processing"*, Prentice Hall, Fourth Edition.
2. B.Chanda and D.Dutta Majumder (2011), *"Digital Image Processing and Analysis1"*, Prentice-Hall of India Pvt Ltd, Second Edition.
3. Madhuri A. Joshi (2017), *"Digital Image Processing An Algorithmic Approach"*, PHI Learning Pvt Ltd, Second Edition.
4. *Image Processing Toolbox*, User's Guide, The Math Works Inc, 2019.

E-Learning Resources:

1. https://www.tutorialspoint.com/dip/index.htm
2. https://www.mygreatlearning.com/blog/digital-image-processing-explained/

Course Outcomes:

CO1: Understand the importance of image processing and its digital formation
CO2: Build the knowledge about spatial transformation using MATLAB
CO3: Understands the various processes involved in the image analysis process.
CO4: Learn to implement various feature extraction techniques
CO5: Gain knowledge about various applications of image processing

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	M	M	L	M	L	H	M	L
CO 2	H	H	M	M	M	M	H	H	M
CO 3	H	H	H	M	M	H	H	H	H
CO 4	H	H	H	H	M	H	H	H	H
CO 5	M	H	H	H	H	H	M	H	H

Neural Network and Deep Learning

Semester II **Hours of Instructions / Week: 4**
25MAIC09 **No. of Credits: 4**

Course Objectives:

1. To attain basic knowledge on Neural Network
2. To train students in expressing knowledge.
3. To enable the students to learn and understand the deep networks and architecture.

Unit I: Neural Network **- 12 Hrs**

Neural Network – Layers in a Neural Network – Neurons – Model of Neurons Hyperparameters – Connections and weight of ANN – Bias term – Activation functions – Learning rate – Backpropagation – Overfitting – Gradient Descent – Loss functions – Network Architectures.

Unit II: Mathematical Building Block of Neural Network **- 10 Hrs**

Data Representation for Neural Network – The gears of Neural Network: Tensors operations – Element wise operations – Broadcasting – Tensor Product – Tensor Reshaping – (Geometric interpretation of tensor operations)* – Gradient Based Optimization.

Unit III: Deep Networks **- 12 Hrs**

Learning XOR – Gradient Based Learning – Hidden Units – Architecture Design. Regularization for Deep Learning: Parameter Norm Penalties - Data Augmentation – Noise Robustness – Semi supervised Learning – Multitask Learning – Early stopping – Parameter Tying and Parameter Sharing – Sparse Representation – Bagging and Other Ensemble Methods – Dropout – Adversarial Training – (Tangent Distance, Tangent Prop and Manifold Tangent Classifiers)*.

Unit IV: Convolutional Network **- 12 Hrs**

The Convolutional Operation – Pooling – Convolution and Pooling as an Infinitely Strong Prior – Variants of the Basic Convolution Function – Structured Output – (Data Types)* – Efficient Convolutional Algorithms – Random or Unsupervised Features – Neruoscientific Basic for Convolutional Networks.

Unit V: Recurrent and Recursive Nets **- 14 Hrs**

Unfolding computational Graphs – Recurrent Neural Network – (Bidirectional RNN)* – Encoder-Decoder Sequence to Sequence Architecture – Deep Recurrent Networks – Recurssive Neural Network.

*** Indicates Self - Study Component**
Total Hours: 60

Reference Books:

1. Simon Haykin. (2007). "*Neural Networks A comprehensive Foundation*", 2nd Editon, Pearson Education.

2. Vaibhav Verdhan . (2021), *"Computer Vision Using Deep Learning Neural Network Architecture with Python and Keras"*, Apress.

3. Francois Chollet. (2021). "*Deep Learning with Python*", 2nd Editon, Manning.

4. Ian Goodfellow, Yoshua Bengio and Aaron Courville. (2016). "*Deep Learning*". MIT Press.

Course Outcomes:

CO1: Familiarize the basic concept of neural network.
CO2: Attain the knowledge in mathematical concept of neural network.
CO3: Be familiar with fundamental of deep networks.
CO4: Get in depth knowledge on object convolutional network.
CO5: Understand the concept of deep learning model.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M	M	L	L	L	H	M	L
CO2	H	M	H	H	M	L	H	H	M
CO3	M	H	H	H	L	M	H	H	H
CO4	M	H	H	H	L	H	M	H	H
CO5	M	H	H	H	M	H	M	H	H

Computing Lab III - Computer Vision and Image Processing

Semester II **Hours of Instructions / Week: 6**
25MAIC10 **No. of Credits: 3**

Course Objectives:

1. To understand the fundamentals of image processing and computer vision techniques.
2. To learn how to apply image enhancement, segmentation, and feature extraction methods.
3. To explore deep learning approaches for image classification and object detection.

List of Programs:

1. Implement a Python program to read and save images while converting between RGB, HSV, and YCrCb color spaces using OpenCV.
2. Develop a Python program to split an image into individual color channels and merge them back, visualizing the effects.
3. Write a Python program to enhance a low-contrast medical image using CLAHE and apply Bilateral Filtering to smooth noise while preserving edges.
4. Implement a Python program to enhance edges in a medical image using the Unsharp Masking technique and compare before-after results.
5. Write a Python program to perform image segmentation using K-Means clustering.
6. Apply homomorphic filtering to enhance a low-contrast image and analyze its visibility improvements compared to histogram equalization.
7. Implement a thinning algorithm to extract the skeleton of binary images of handwritten character dataset.
8. Develop a Python program to segment the liver from an abdominal CT scan using a region growing algorithm with an interactive seed point.
9. Implement a Python program to segment a tumor from a brain MRI scan using global and adaptive thresholding, comparing their effectiveness.
10. Write a Python program to apply Sobel and Canny edge detection techniques on an X-ray or MRI scan and analyze the detected edges.
11. Develop a Python program to extract tumor boundaries using the morphological gradient operation with different structuring elements.
12. Implement a Python program to compute texture features (contrast, correlation, energy, homogeneity) from an MRI brain image using the Gray-Level Co-occurrence Matrix (GLCM).
13. Write a Python program to extract shape features (area, perimeter, circularity) from tumor regions and classify them as benign or malignant using SVM or Random Forest.
14. Develop a Python program to segment tumor regions in an MRI scan using the Fuzzy C-Means clustering algorithm for accurate region detection.
15. Implement a Bayesian classifier for classifying grayscale images into different categories based on extracted statistical features.
16. Write a program to apply affine transformations to skin cancer images to improve model generalization by training a CNN classifier on both original and transformed images.
17. Implement a Python-based face recognition system using a pre-trained CNN model with transfer learning.
18. Write a Python program to classify land cover types in satellite images using a CNN trained on datasets like EuroSAT or Landsat.

19. Develop a Python program for training a deep learning model for sleepiness detection using XML-annotated dataset.
20. Implement a Python program to detect and classify different objects in remote sensing images using a pre-trained object detection model.

Total Hours: 90

Course Outcome:

CO1: Implement image processing techniques such as filtering, edge detection, and segmentation.
CO2: Extract and analyze features from images for classification and pattern recognition.
CO3: Develop image enhancement techniques to improve visibility and contrast in images.
CO4: Apply machine learning and deep learning models for image classification and object detection.
CO5: Design and implement practical computer vision applications using OpenCV and deep learning frameworks.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	M	M	M	L	M	H	M	L
CO 2	H	M	H	M	L	M	H	M	M
CO 3	M	M	H	M	L	M	H	H	M
CO 4	H	H	H	H	M	H	H	H	H
CO 5	H	H	H	H	M	H	H	H	H

Computing Lab IV - Deep Learning using Python

Semester: II **Hours of Instructions / Week: 6**
25MAIC11 **No. of Credits: 3**

Course Objectives:

1. To understand the Deep Learning Fundamentals.
2. To have a Hands-on Experience with Advanced Deep Learning Models.
3. To Apply and Deploy the Deep Learning Models

List of Programs:

1. Program to implement a simple perceptron model for binary classification.
2. Program to implement a feedforward neural network with backpropagation.
3. Program to implement and visualize different activation functions (Sigmoid, ReLU, Tanh, Softmax).
4. Program to implement Gradient Descent and compare with Adam, RMSprop, and SGD optimizers.
5. Program to train a neural network and demonstrate overfitting by applying L1/L2 regularization to reduce it.
6. Program to perform element-wise operations, broadcasting, and reshaping tensors using NumPy and PyTorch.
7. Program to implement gradient-based optimization using PyTorch's Autograd.
8. Program to implement MSE, Cross-Entropy, and Hinge loss functions and visualize their effects.
9. Program to implement a simple backpropagation algorithm for a 2-layer network using NumPy.
10. Program to perform Hyperparameter Tuning.
11. Program to train a neural network to solve the XOR problem.
12. Program to apply transformations like rotation, flipping, and scaling using TensorFlow/Keras.
13. Program to implement and compare bagging, boosting, and stacking for classification.
14. Program to generate adversarial examples and test the robustness of a deep learning model.
15. Program to construct a CNN for image classification on MNIST/CIFAR-10.
16. Program to implement depthwise separable convolutions and compare with standard convolutions.
17. Program to implement and compare Max Pooling, Average Pooling, and Global Pooling.
18. Program to learn unsupervised features from images using autoencoders.
19. Program to implement a Bidirectional RNN with LSTMs in Keras.
20. Program to implement a Seq2Seq Model for Text Translation with Attention.

Total Hours: 90

Course Outcome:

CO 1: Apply Deep Learning Techniques for Real-World Problems

CO 2: Analyze and Optimize Deep Learning Models

CO 3: Develop and Train Advanced Neural Network Architectures

CO 4: Implement Reinforcement Learning for Decision-Making

CO 5: Deploy and Integrate Deep Learning Models in Applications

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	PSO 3
CO1	H	H	H	H	M	M	H	H	H
CO2	H	H	H	H	M	M	H	H	H
CO3	H	H	H	H	L	H	H	H	H
CO4	M	H	H	H	L	H	M	H	H
CO5	M	H	H	H	M	H	M	H	H

Human Computer Interaction

Semester III **Hours of Instructions Week: 3**
25MAIC12 **No. of Credits: 3**

Course Objectives:

1. To gain an overview of Human-Computer Interaction (HCI)
2. To become familiar with predicting user performance in various human-computer interaction tasks
3. To be aware of the importance of HCI for interactive computing system design

Unit I: Foundations of HCI **- 9 Hrs**

The Human: Input-output channels- Human memory- Reasoning and problem-solving; The Computer-Display device-Physical Control -Memory- processing, and network; The interaction: Models of interaction- interaction styles- (Paradigms for Interaction)*.

Unit II: Design and Software Process **- 9 Hrs**

Interaction Designs basics: The process of design- Iteration and prototyping- HCI in the software process: software life cycle- design rules: Principles to support usability- Implementation support-Evaluation Techniques: (Evaluation Through User Participation)* Universal design principles- Requirement for user support.

Unit III: Models and Theories **- 9 Hrs**

Cognitive Models: The Challenge Of Display-Based Systems- Socio-Organizational Issues And Stakeholder Requirements: Capturing Requirements-Communication And Collaboration Models-(Text-Based Communication)* Task Analysis- Dialog Notations And Design-Models Of The System-Modeling Rich Interaction

Unit IV: GROUPWARE **- 9 Hrs**

Groupware Systems: Computer-Mediated Communication-Meeting And Decision Support Systems-Shared Applications And Artifacts-Frameworks For Groupware: Integrating Communication And Work-Implementing Synchronous Groupware: Architectures For Groupware-(Graphical toolkits)*

Unit V: Ubiquitous Computing and Hypertext, Multimedia, and World Wide Web **- 9 Hrs**

Ubiquitous computing – virtual reality – augmented reality – information visualization. Hypertext definition – text, hypertext, and multimedia- (Application)*

*** Indicates Self-Study Component**
Total Hours: 45

Reference Books:

1. Dix, A. (2008). *"Human-Computer Interaction"* India: Pearson Education.
2. Dix, A. (2003)." *Human-computer Interaction"*. Germany: Pearson/Prentice-Hall.
3. *"Human-Computer Interaction Handbook":* Fundamentals, Evolving Technologies, and Emerging Applications, Third Edition. (2012). United States: CRC Press.

E-Learning Resources:

1. https://www.tutorialspoint.com/human_computer_interface/index.htm
2. https://www.w3computing.com/systemsanalysis/human-computer-interaction-intro/
3. https://www.interaction-design.org/literature/topics/human-computer-interaction

Course Outcomes:

CO1: Understanding the fundamentals of Human-computer interaction
CO2: Familiarize with how to design practice addresses the critical feature of an interactive system – usability from the human perspective
CO3: Be familiar with models that can be used during the interface design process.
CO4: Understand the groupware technology, what it can support, and how it can be classified.
CO5: Be familiar with computing and virtual reality, and understand the design and use of hypertext and multimedia systems.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M	M	L	M	L	H	M	L
CO2	H	H	M	L	H	M	H	H	M
CO3	M	H	H	M	H	M	H	H	M
CO4	M	H	H	H	M	H	M	H	H
CO5	M	H	H	H	M	H	M	H	H

Generative Artificial Intelligence

Semester III **Hours of Instruction/Week: 3**
25MAIC13 **No. of Credits: 3**

Course Objectives:

1. Understand the Fundamentals of Generative Artificial Intelligence.
2. Apply Generative Artificial Intelligence for Image and Text Generation
3. Explore Advanced Techniques and Real-World Applications

UNIT I: Introduction to Generative AI **- 9 Hrs**

Introduction to Generative AI – Evolutionary of Generative AI – Generative AI vs Traditional AI – Use of Generative AI models – Revolutionizing Society and Business ecosystem; Deep Learning Models: Single layer and Multi-layer Perceptron – Activation function – Cost function; Gradient descent algorithms: types – Backpropagation.

UNIT II: Generative AI for Images **- 9 Hrs**

Introduction to Computer Vision: Computer Vision architecture – Convolution neural network – convolution layer – padding – pooling layers – Fully connected layer. Representation learning – Autoencoders and variational autoencoders. Transforming Images with Gen AI: Generative modelling – Diffusion model – Evaluation metrics for image generation.

UNIT III: Generative AI for Text **- 9 Hrs**

Natural Language Processing – Sequence to sequence model. Large Language Models(LLM) Operations - Transformer Architecture: types – transformer components – Text generation using transformer. Open AI – Introduction – ChatGPT plugins – Pricing – Limitations of ChatGPT.

UNIT IV: Advanced Techniques and Applications **- 9 Hrs**

Prompt Engineering – In context learning and prompting – Prompt Engineering Techniques – Image Prompting – Prompt Injection – Prompt Engineering Challenges. Retrieval-Augmented Generation (RAG): RAG architecture – RAG benefits – RAG Challenges.

UNIT V: Case Sudies **- 9 Hrs**

Generative AI in Business and Industries: OpenAI's ChatGPT - Google's Bard & Gemini - GitHub Copilot. In Healthcare: AlphaFold (DeepMind) - IBM Watson Health - AI-Generated Medical Imaging. In Education & Research: AI Tutors - LLMs for Academic Research - Textbook & Content Generation. In Media and Entertainment: Deepfake Technology – Jukebox (OpenAI) – Scriptwriting with AI.

Total Hours: 45

Reference Books:

1. Bernard Marr, *(2024), "Gen AI in practice",* John Wiley & Sons Publication.
2. Amit Bahree, *(2024) " Gen AI in Action",* Manning Pubns Co.
3. Karthikeyan Sabesan, *(2025), "Gen AI for Everyone: Deep Learning, NLP and LLMs for creative & practical application.",* bpb publications.

E-Learning Resources:

1. https://www.coursera.org/learn/generative-ai-for-everyone
2. https://www.coursera.org/learn/generative-ai-genai
3. https://professionalprograms.mit.edu/online-program-generative-ai
4. https://online.stanford.edu/courses/xfm110-technical-fundamentals-generative-ai

Course Outcomes:

CO 1: Understand the Fundamentals of Generative AI
CO 2: Implement Deep Learning Models for AI Applications
CO 3: Apply Generative AI for Image and Text Processing
CO 4: Leverage Advanced AI Techniques for Optimization
CO 5: Analyze Real-World Applications and Ethical Considerations

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	PSO 3
CO1	H	M	H	M	M	L	H	M	M
CO2	H	H	H	H	M	H	H	H	H
CO3	H	H	H	H	M	H	H	H	H
CO4	H	H	H	H	M	H	H	H	H
CO5	M	H	H	H	H	H	M	H	H

Big Data Analytics

Semester III **Hours of Instruction/Week: 3**
25MAIC14 **No. of Credits: 3**

Course Objectives:

1. To enable the students to gain knowledge in Data Exploration, Visualization Techniques and Statistical Techniques.
2. To understand the concept of Big data platform, Hadoop and Map Reduce jobs.
3. To highlight on the various visualization and analytic methods using Tableau and Power BI.

Unit I: Introduction to Big Data & Business Intelligence **-9 Hrs**

Introduction to Big Data and its Characteristics (Volume, Variety, Velocity, Veracity, Value)* – Classification of Data – Business Intelligence (BI) Vs Big Data - Data Visualization for Big Data: Basic Visualization – Advanced Visualization – Advanced graphics using ggPlot2 – (Exploratory Data Analysis on Iris Dataset using R Programming)*

Unit II: Statistical Methods in Data Analysis **- 9 Hrs**

Measures of Central Value, Measures of Dispersion, Quantile, Rank, Skewness and Kurtosis, Normal Distribution, Binomial Distribution – (Analytics on Student Marksheet using Descriptive Statistics)* - Correlation Analysis – Coefficient of Correlation, Co-efficient of Covariance. Regression Analysis – Statistical Hypothesis Testing, Chi-Square Test, F-Test, Analysis of Variance – One Way, Two Way – (Implementation of Hypothesis Testing on Mobile Dataset.)*

Unit III: Big Data using Hadoop **- 9 Hrs**

IBM Big Data Strategy, Hadoop: History of Hadoop – Hadoop Echo System- Analysing Data with Hadoop – Hadoop Streaming – Hadoop Distributed File System(HDFS):The Design of HDFS – HDFS Concepts – Hadoop files system interfaces – Hadoop I/O: Compression – Serialization and File System Abstraction (HDFS I/O Operations) – Anatomy of a Map Reduce: Job Run – Job Scheduling – Shuffle and Sort – Task Execution – Map Reduce Types and Formats – (Map Reduce Features)*.

Unit IV: Data Visualization using Tableau and Power BI **- 9 Hrs**

Tableau Interface and Navigation – Connecting Tableau to Various Data Sources – Creating Basic Charts using Tableau – Power BI deployment models - Connecting Power BI to Big Data Sources – Creating Basic Visualizations and Reports – Introduction to DAX (Data Analysis Expressions)* for Custom Calculations – Power BI Filters, Slicers, and Interactive Dashboards.

Unit V: Advanced Analytics with Tableau & Power BI **- 9 Hrs**

Advanced DAX Calculations in Power BI – Advanced Calculations in Tableau (Index, Rank, Moving Averages)* - Connecting Tableau and Power BI to Hadoop, Spark, NoSQL Databases – Direct Query vs. Import Mode in Power BI – Live vs. Extract Data Connections in Tableau. **Case Studies:** Time Series Analysis and Forecasting, Geospatial Analysis and Mapping.

*** Indicates Self – Study Component**

Total Hours: 45

Reference Books:

1. *Subhashini Chellappan, Seema Acharya, (2019) , "Big Data and Analytics", Second Edition, Wiley Publication.*
2. *S.P. Gupta,(2017),"Statistical Methods", Forty Fourth Revised Edition, Sultan Chand and Sons, New Delhi.*
3. Tom White, *(2015), "Hadoop: The Definitive Guide"*, Fourth Edition, O'Reilly Media.
4. Greg Deckler, Brett Powell, *(2022),"Mastering Microsoft Power BI: Expert techniques to create interactive insights for effective data analytics and business intelligence", 2nd Edition. Packt Publishing*
5. Daniel G. Murray , (2016),*"Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software ", Second Edition, Wiley Publication.*

E-Learning Resources:

1. ***https://nptel.ac.in/courses/110/107/110107092/***
2. ***https://nptel.ac.in/courses/110107095/***
3. https://www.tableau.com/learn/training
4. https://learn.microsoft.com/en-us/power-bi/
5. *https://www.**coursera.org/courses?query=31aggle***

Course Outcomes:

CO1: Understand Big Data Fundamentals and Visualization Techniques.
CO2: Analyze the Statistical Methods for Data Analysis.
CO3: Implement Big Data Processing using Hadoop.
CO4: Develop Interactive Visualizations using Tableau and Power BI.
CO5: Perform Advanced Analytics & Big Data Integration on suitable case-studies.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	PSO 3
CO1	H	M	M	L	L	L	H	M	L
CO2	H	M	H	H	M	M	H	H	M
CO3	M	H	H	H	L	H	H	H	H
CO4	L	H	M	M	M	H	M	H	H
CO5	M	H	H	H	M	H	M	H	H

Cyber Intelligence

Semester: III **Hours of Instruction/Week: 3**

25MAIC15 **No. of Credits: 3**

Course Objectives:

1. To discuss about end protection tools to prevent data loss in various cyber attacks
2. To explore advanced technological system tools for data loss prevention tools and learns how to classify data in the database.
3. To identify and solve complex application security threats, and common vulnerability

Unit I: Cyber Attack and their Classifications **- 9 Hrs**

Introduction to cyber security, cyber-attacks & investigations – Cyber security basics – Security principles – Cyber-attack and their classifications – Cyber crimes – Data frauds – Analyses of crimes – Human behavior – Stylometry – Incident handling – Investigation methods – Criminal profiling – (Cyber trails)*

Unit II: Intelligence-Driven Security **- 9 Hrs**

Intelligence-Driven Security & CTI Lifecycle – Threat actors – Threat vectors – Threat hunting – Threat trending – Security information and event management (SIEM) – Indicators of compromise (IoC's) – Critical asset identification – (Internal and external hacker profiling and tracking)* - Case Study.

Unit III: Role of CTI **- 9 Hrs**

CTI Role in SOC – CTI Role in Incidence response – CTI Role in Risk analysis – Fraud prevention – CTI Frameworks – Security Intelligence – Application security and testing – Setting up collective intelligence framework (CIF) and trusted automated exchange of intelligence Information (TAXII) servers – (Intelligence strategy)*, process, and systems review – Case Study

Unit IV: Information versus Intelligence **- 9 Hrs**

Digital forensics and its challenges – Branches of digital forensics – Digital forensic investigation methods – Cyber law acts and amendments – Cyber laws – Basics information technology act 2000-amendments – Evidentiary value of e-mails / SMS – Cybercrimes and offences dealt with IPC-RBI act - IPRIN India – Jurisdiction of cyber crime – Creating awareness and health practices – Understanding threat intelligence data collection and acquisition – Level 1, level2, level3 – (analyzing and disseminating cyber threat intelligence)* - Case Study

Unit V: Interpretation and Analysis **- 9 Hrs**

Data loss prevention and Mobile Endpoint protection – Data security common pitfalls – Collecting cyber threat information: - Validation and prioritization: risk scores, tags for context, human assessment – Interpretation and analysis: reports, analyst skills, intelligence platform, customization. – Threat Analytics and Reporting – Threat dissemination and intelligence sharing – (DevSecOps overview – DevSecOps deployment)*

*** Indicates Self – Study Component**

Total Hours: 45

Reference Books:

1. Aaron Roberts (2021), "*Cyber Threat Intelligence: The No-Nonsense Guide for CISOs and Security Managers*", Apress.
2. Ali Dehghantanha, Mauro Conti, Toosk a Dargahi (2018), *Cyber Threat Intelligence*, Springer.
3. Valentina Palacin (2021), "*Practical Threat Intelligence and Data-Driven Threat Hunting: A hands-on guide to threat hunting*" Packt Publishing Limited.
4. Aaron Roberts (2021), "*Cyber Threat Intelligence: The No-Nonsense Guide for CISOs and Security Managers*", Apress.

E-Learning Resources:

1. https://www.ibm.com/training/badge/cybersecurity-threat-intelligence
2. https://www.group-ib.com/cybersecurity-education/technical-training-programs/threat-intelligence-analyst/
3. https://niccs.cisa.gov/education-training/catalog/cybertraining-365/certified-cyber-threat-intelligence-analyst

Course Outcomes:

CO1: Understand the different types of cyber attacks and its impact.
CO2: Enhance the intelligent driven security strategies to understand various threat factors.
CO3: Evaluate the role of cyber threat intelligence in the cyber era.
CO4: Provide actionable insights for cyber laws and amendments.
CO5: Understand the application of security threats and vulnerabilities through techniques like DevSecOps and security testing.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M	M	M	M	H	M	M	M
CO2	M	H	H	H	M	H	H	M	H
CO3	M	H	M	H	H	H	M	H	H
CO4	M	M	M	H	H	M	M	H	M
CO5	H	H	H	H	M	H	H	H	H

Artificial Intelligence for Business

Semester: III **Hours of Instruction/Week: 3**
25MAIC16A **No of Credits: 3**

Course Objectives:

1. To familiarize the basics concept of Artificial Intelligence.
2. To understand the importance of AI in Business environment.
3. To implement with the Google Spreadsheet and MS excel for business based problems.

Unit I: Introduction on AI in Business **- 9 Hrs**

Introduction about AI — Types of AI – Working process of AI – Applications of AI – Applications of AI in Business – Benefits of AI – Usages of AI in Business – Different field of AI — Machine Learning – Classification of Machine Learning – Machine Learning Algorithms – Deep Learning – Deep Learning Algorithms – (Difference between Machine Learning and Deep Learning)*.

Unit II: Data and Data Visualization **- 9 Hrs**

Big Data — Basics of Big Data – Types of Big Data – Characteristics of Big Data – Sources of Big Data – Data Science —Importance of Data Science – Data Science Process – Data Science Techniques – Lifecycle of Data Science – Difference between Big Data and Data Science – Data Visualization — Types of Data Visualization – Usages of Data visualization – (Data Visualization)*.

Unit III: Artificial Intelligence in e-Commerce **- 9 Hrs**

Business Challenges in AI – Business Opportunities in AI – AI in e-Commerce — Usages of AI in e-Commerce – AI Applications in e-Commerce – Benefits of AI in e-Commerce – Benefits of AI in e-Commerce – Chatbots –Usages of Chatbot in Business –Chatbot benefits for business – (Types of Chatbots in Business)*.

Unit IV: Data Analysis using Google Sheet **- 9 Hrs**

Introduction on Google Spreadsheet — Formulas in Google Sheet – Basics of the Google Spread sheet – Importing data from various sources in Google Sheet – Working with functions in Google Sheet – Filter the data in Google Sheet – (Data visualization in Google Sheet)*.

Unit V: Data Analysis using MS Excel **- 9 Hrs**

Wolfram Data Intelligence –Functions in MS Excel –Get the current stock market values from Wolfram Data Intelligence in MS Excel – Applying Count function – Count Blank function –Countif function in MS Excel – Applying Mean–Median–Average–Mode function on Wolfram Data Intelligence in MS Excel – Applying Standard Deviation function on Wolfram Data Intelligence in MS Excel – (Use of Correlation function on Wolfram Data Intelligence in MS Excel)*.

*** Indicates Self – Study Component**
Total Hours: 45

Reference Books:

1. Barrie Roberts, *"Beginner's Guide to Sheets"*, Independently published (June 14, 2020) ISBN-13:979-8653987212.
2. John Walkenbach, *"Microsoft Excel 2016 BIBLE"*, Wiley;1st edition (October 2015), ISBN-10:1119067510.

E-Learning Resources:

1. https://www.w3schools.com/googlesheets/index.php
2. https://edu.gcfglobal.org/en/googlespreadsheets/
3. https://zapier.com/learn/google-sheets/google-sheets-tutorial/
4. https://www.tutorialspoint.com/excel/index.htm
5. https://www.javatpoint.com/excel-tutorial

Course Outcome:

CO1: Understand the usage of AI in business.
CO2: Infer hidden data with data visualization.
CO3: Familiarize the role of AI in E-Commerce.
CO4: Implement Google spreadsheet and functions.
CO5: Master the data analysis functions using Excel.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M	H	M	M	H	H	H	M
CO2	M	H	H	M	H	M	H	M	H
CO3	H	M	H	M	M	H	H	H	M
CO4	M	M	M	M	L	H	M	M	M
CO5	M	H	M	M	M	H	M	H	H

Artificial Intelligence for Home Science

Semester: III **Hours of Instruction/week: 3**
25MAIC16B No of Credits: 3

Course Objectives:

1. To understand the Artificial Intelligence in Home Science .
2. To familiarize in working with 3D designing tools.
3. To learn about the usage of AI powered designing tools.

Unit I: Artificial Intelligence in Home Science **- 9 Hrs**

Introduction to Smart Home Technology – Benefit and Uses – Building Smart Home Using Machine Learning – Overview of AI in Food Science – Machine Learning for recipe creation, Nutrition Analysis , sensory analysis, (Food Quality analysis)*.

Unit II:AI in Computer Graphics **- 9 Hrs**

About Computer Graphics, Application of Computer Graphics, 2D Viewing, 3D Graphics, 3D Transformation, Difference between 2D and 3D, about 3D Modeling, AI in Computer Graphics, (AI based Interior designing Tool)*.

Unit III: AI Powered Interior Designing Tool **- 9 Hrs**

Design the outline map for the Home – Add Additional Partition for the Home Design – Design the Home Interior (hall, study room, bedroom) – Design the Kitchen Interior for the Home–(Design the Home Exterior look.)*

Unit IV: AI integrated Fashion Designing Tool **- 9 Hrs**

Design a Fashion Top for Women's wear – Design a Shirt for Menwear – Design Jumpsuits for Womenwear – Design a Pant for Women's wear– (Design a T-Shirt for Menswear)*.

Unit V: Artificial Intelligence in E-Commerce **- 9 Hrs**

E-Commerce Business Processes and Artificial Intelligence – Marketing, Transaction Processing, Service and Support. Using Commerce.AI for Product concept and Development. Using AI for Product Launches, Using AI for Consumer Insights, (Using AI for Product Tracking)*.

*** Indicates Self – Study Component**
Total Hours: 45

Reference Books:

1. *Kevin Night and Elaine Rich, Nair B., (2017), "Artificial Intelligence (SIE)", Third Edition, McGraw Hill.*
2. *Stephen Pentak, Richard Roth, (2012), "Design Basics: 2D and 3D", Cengage Learning; 8th edition, ISBN-13: 978-0495909972.*
3. *Richard Roth, Stephen Pentak, (2012), "Design Basics: 3D", Cengage Learning; 8th edition, ISBN-13: 978-0495915782.*
   Song, Jialu& Li, Yifei. (2018). "Artificial Intelligence and Modern Home Design", MATEC Web of Conferences.
4. *Pandharikar A, Bussler F. AI-Powered Commerce: Building the Products and Services of the Future with Commerce.AI. Packt Publishing; 2022.*
5. *Bhargava C, Sharma PK. Artificial Intelligence: Fundamentals and Applications. CRC Press; 2021.*

E-Learning Resources:

1. https://browzwear.com/vstitcher-first-steps/
2. https://support.planner5d.com/en/support/solutions/folders/36000220164
3. https://www.youtube.com/watch?v=pElbP7jBIW0
4. https://www.instructables.com/Draw-a-Floor-Plan-of-a-Room-or-House/
5. https://www.youtube.com/watch?v=3atS6PftD0U

Course Outcomes:

CO1: Get familiar with AI Applications in other platforms.
CO2:Analyse the importance of AI in Home science
CO3:Understand the basic components used for computer graphics.
CO4:Implementing the concept of AI integrated with 3D designing tools.
CO5:Implementing the concept of AI integrated with fashion designing tools

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M	H	M	M	H	H	M	M
CO2	M	H	M	M	M	M	M	H	M
CO3	H	H	H	M	L	M	H	M	M
CO4	M	H	H	H	M	H	H	H	H
CO5	M	H	H	H	M	H	H	H	H

Machine Learning for Chemistry and Biochemistry

Semester: III **Hours of Instruction /Week: 3**
25MAIC16C **No. of Credits: 3**

Course Objectives:

1. To understand the fundamentals of Machine Learning
2. To master in Google Colab environment
3. To implement machine learning in chemistry related problems.

UNIT I: Basics of Google Colaboratory - 9 Hrs

Introduction to Google Colab – Advantages of Google Colab – Features of Google Colab – GPU and TPU Facility in Google Colab – Colabpro – Installation of Google Colab – Starting up with New Colab Notebook – Setting the Notebook Name – Adding Cells and Entering Code in GoogleColab – Executing Code in Google Colab – Modifying Cell Order and Deleting Cell in Google Colab – Saving and Sharing Notebook in Google Drive –(Arithmetic Operations)*

UNIT II: Working with Google Colaboratory - 9 Hrs

Loading File System: Uploading Files from your Local File System – Downloading Files to your Local File System – Mounting Google Drive – Loading Image in Google Colab: Accessing Images from Google Drive – Accessing Images from Computer – Loading Imageset in Google Colab – Displaying a Single and Multiple Images in Google Colab – Loading Data in Google Colab: Accessing Data from Google Drive – Accessing Data from Computer – Loading Data from Google Colab–(Displaying Data using Colab)*.

UNIT III: Data Importing, Exporting and Visualization - 9 Hrs

Importing and Displaying Data from Kaggle – Importing and Displaying Data from Github - Importing and Extracting Zip Files in Google Colab – Saving and Sharing Notebook in Github – Exporting Code and Dataset to Github and Kaggle – Cloning Git Repository in Google Colab – Charting: Line Plotting – Bar Plotting – Scatter Plotting – Histogram – Pie Chart – Fill_between and alpha – Sub Plotting –(3D Graph – Saving Charts and Plots)*.

UNIT IV: Prediction of Chemical Formula and 3D Molecular Structure - 9 Hrs

Package Installation: RDKit- Numpy – Pandas – MatPOtlib. Data Accessing: Reading csv file using read_csv() – Importing and Visualization of chemical molecules – Unsupervised Learning: Regression. Performance Evaluation: Mean Square Error (MSE) –(Mean Absolute Error (MAE))*.

Unit V: Forecasting Oxidative Coupling ofMethane using Machine Learning - 9 Hrs

Package Installation: scikit-learn – TensorFlow. Data Accessing: Reading excel file using read_excel(). Data Preprocessing: Sorting and concatenating data using Pivot(). Unsupervised Learning: K-Mean Clustering – PCA. Supervised Learning: Support Vector Machine (SVM) – (Random Forests)*.

*** Indicates Self – Study Component**
Total Hours: 45

Reference Books:

1. Chris Albon. (2019). "*Machine learning with python cookbook*",.2nd edn. USA: O'Reilly Media, Inc.
2. John Paul Mueller, and Luca Massaron. (2019). "*Python for data science for dummies*". 2nd edn. New Jersey: John Wiley & Sons, Inc.
3. Google Colab (2020) *Google Colaboratory*. Available at: https://colab.research.google.com/notebooks (Accessed 10 November 2020)
4. Kaggle (2018) *Kaggle Repository*. Available at: https://www.kaggle.com/vladislavkisin/tutorial-ml-in-chemistry-research-rdkit-mol2vec (Accessed 8 September 2021)

Course Outcomes

CO1: Understand the fundamentals of Machine Learning
CO2: Fundamental knowledge about Google Colab environment
CO3: Experimental knowledge on Google Colab
CO4: Visualize the dataset for understanding the hidden knowledge
CO5: Implementation of prediction algorithm for 3D molecular structure.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	M	H	M	M	M	H	M	L
CO 2	M	H	M	M	L	M	M	H	L
CO 3	M	H	H	M	L	M	H	M	H
CO 4	M	M	H	M	M	H	H	M	H
CO 5	H	H	H	H	L	H	H	H	H

Computing Lab V – Generative Artificial Intelligence

Semester III **Hours of Instruction / Week : 6**
25MAIC17 **No. of Credits : 3**

Course Objectives:

1. To understand and Implement Fundamental AI Concepts
2. To apply Generative AI Techniques for Image & Text Generation
3. To explore Advanced AI Applications and Ethical Considerations

List Of Programs:

1. Program to generate an Image from Text using OpenAI's DALL·E.
2. Program for Style Transfer on an Image using Fast AI Model.
3. Program to convert edge drawings into photorealistic image using Pix2Pix model.
4. Program to fill missing parts of images using EdgeConnect model.
5. Program to fine-tune an image to create personalized images using DreamBooth model.
6. Program for Handwritten Digit Generation using a GAN (DCGAN) model.
7. Program for Image Captioning using BLIP (VLM)
8. Program for Text Generation using Llama 2 (LLM)
9. Program for Text Generation using LSTMs
10. Program to create Multimodal Q&A using GPT-4V (VLM + LLM)
11. Program to Document Q&A using Donut OCR (VLM) + LlaMA 2 (LLM)
12. Program for Image-to-Story Generator using BLIP-2 (VLM + LLM)
13. Program to create a Multimodal Chatbot using GPT-4V (VLM + LLM).
14. Program to compare an image with multiple text descriptions and find the most relevant one using CLIP model.
15. Program to generate a caption for an input image using BLIP-2 model
16. Program to ask a question about an image, and BLIP-2 should answer it.
17. Program to create a custom knowledge base using FAISS index (RAG) and retrieves relevant documents before generating an answer.
18. Program to retrieve documents from vector storage before generating an answer using LangChain.
19. Program to rewrite a sentence in a polite tone using FLAN-T5 model.
20. Program to Identify Prompt Injection Attacks

Total Hours: 90

Course Outcome:

CO 1: Understand and Implement Generative AI Models.

CO 2: Develop AI-Powered Image Processing Applications.

CO 3: Build and Optimize Natural Language Processing (NLP) Models.

CO 4: Integrate Multimodal AI for Real-World Applications.

CO 5: Implement AI Security and Ethical Considerations.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CO 1	H	M	H	M	M	H	H	M	M
CO 2	M	H	M	M	L	M	H	H	M
CO 3	M	H	H	M	L	H	H	M	H
CO 4	H	M	H	H	M	H	H	H	H
CO 5	M	M	M	M	H	H	M	M	L

Computing Lab VI – Data Visualization using Analytical Tools

Semester III **Hours of Instruction / Week: 4**
25MAIC18 **No. of Credits: 2**

Course Objectives:

1. To hands-on Implementation of Big Data Technologies
2. To develop Proficiency in Business Intelligence Tools
3. To apply Statistical and Analytical Techniques for Data-Driven Decision Making.

List of Programs:

1.Exploratory Data Analysis (EDA) on the Iris Dataset (Power BI & Tableau)
- Load the Iris dataset
- Create summary statistics and visualizations (scatter plots, histograms, boxplots)

2. Basic Visualization in Tableau & Power BI
- Create bar charts, line charts, and pie charts
- Apply filters and slicers

3.Advanced Data Visualization using ggPlot2 (Tableau & Power BI)
- Use ggplot2 style formatting in Tableau
- Implement custom visuals in Power BI

4. Business Intelligence vs. Big Data Analysis (Tableau & Power BI)
- Compare insights from structured (BI) and unstructured (Big Data) datasets

5. Descriptive Statistics on Student Marksheet Dataset (Power BI & Tableau)
- Calculate Mean, Median, Mode, Standard Deviation, and Variance
- Create Boxplots and Violin Plots

6. Correlation Analysis (Power BI & Tableau)
- Compute correlation matrix for student marks
- Visualize correlation heatmaps

7. Regression Analysis in Power BI & Tableau
- Implement Linear Regression to predict student performance

8. Hypothesis Testing on Mobile Dataset (Power BI & Tableau)
- Perform Chi-Square and T-Test on categorical data

9. ANOVA (One-Way & Two-Way) in Power BI & Tableau
- Conduct One-Way ANOVA on sales data across different regions

10. Setting Up Hadoop and HDFS Operations
- Perform basic HDFS commands (create, copy, move, delete files)

11. MapReduce for Word Count
- Implement a Hadoop MapReduce job to count words in a dataset

12. Sorting Large Datasets using MapReduce
- Implement MapReduce sorting

13. Analyzing Log Files using Hadoop Streaming
- Process and analyze server log files using MapReduce

14. Compression and Serialization in Hadoop
- Implement HDFS compression techniques

15. Performing Data Joins in Hadoop MapReduce

- Use MapReduce join to merge datasets

16. Executing Hive Queries on Big Data
    - Run SQL-like queries using Apache Hive
17. Processing NoSQL Data using Hadoop and Hbase
    - Connect Hadoop with Hbase and perform CRUD operations
18. Connecting Tableau and Power BI to Big Data Sources (Hadoop & Spark)
    - Integrate Power BI with Hadoop/Spark
    - Load and visualize large datasets
19. Creating Interactive Dashboards in Power BI & Tableau
    - Use slicers, filters, and drill-throughs
    - Implement interactive storytelling
20. Time Series Analysis & Forecasting in Tableau & Power BI
    - Use ARIMA, Exponential Smoothing for forecasting sales trends

Total Hours: 60

Course Outcome:

CO 1: Perform Exploratory Data Analysis (EDA) and Advanced Data Visualization.
CO 2: Apply Statistical and Machine Learning Techniques for Data Analysis.
CO 3: Develop Big Data Processing Skills using Hadoop and MapReduce.
CO 4: Integrate and Analyze Structured and Unstructured Data Sources.
CO 5: Create Interactive Dashboards and Forecasting Models.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	PSO 3
CO1	H	H	M	L	M	L	H	H	M
CO2	H	H	H	H	M	M	H	H	H
CO3	M	H	H	H	L	H	H	H	H
CO4	M	H	H	H	L	H	M	H	H
CO5	M	H	H	H	M	H	M	H	H

Digital Health
(Self-Study Course)

Semester III **Hours of instruction / Week: 2**

25MAIC20 **No. of Credits: 2**

Course Objectives:

1. To know about the basics of Digital Health.
2. To know about AI use in the healthcare systems.
3. To know about 3D products in healthcare system.

Unit I: Digital Health **- 4 Hrs**

Introduction of Digital Health – Vision – Benefits of Digital Health – Digital Health Initiatives – National Digital HealthMission – Ecosystem – Architecture – Applications of Digital Health – Learning Health System –Characteristics of Learning Health Care System

Unit II: Digital Health CareProducts **- 5 Hrs**

Categories of Digital Health Products and Services – Wearable Fitness Tracker — Smart health watches – Wearable ECG Monitors – Wearable Blood Pressure Monitor – Wearable Biosensor – mHealth –Telehealth – Telemedicine -Difference between mHealth vs telehealth -Difference between Telehealth vs Telemedicine

Unit II ML and DL in Healthcare **- 8 Hrs**

About machine Learning – Benefits of ML in Healthcare – Cognitive Computing – Trend of ML in Medical Health – Applications of ML in Pharma and Medicine – Applications of ML in Healthcare –Big Data – Benefits of Big Data in Healthcare – Features of Big Data in Healthcare– Methods for analysing Big Data in Healthcare – Applications of Big Data in Healthcare – Introduction on Deep Learning –Deep Learning Algorithms– Deep Learning in Clinical Image Analysis.

Unit IV: Artificial Intelligence in Healthcare **- 6 Hrs**

AI-assisted Robotic surgery – Virtual nursing assistant – Aid Clinical judgment diagnosis – Administrative task – Image Analysis–Develop Medicines – Analyses Unstructured Data – Forecast Kidney Disease – Contributes to Cancer Research and Treatment – Supports Health Equity – AI in Neuroscience – AI in Thoracic Surgery – AI in Cardiac Management.

Unit V: Robotics & 3D Printing in Healthcare **- 7 Hrs**

Role of Robots in Healthcare – Benefits of robots in Healthcare – Types of Robots in Healthcare– Surgical Robots –Exoskeletons – Care Robots – Hospital Robots –3D Printing for Healthcare – Preoperative planning – Customized Surgery – Designing medical devices – Improving surgical instruments – Creating Protheses – 3D Printed implants – 3D Digital Dentistry – Streamlining drug administration

Total Hours: 30

Reference Books:

1. Dac-Nhuong Le, Chung Van Le, Jolanda G. Tromp, GiaNhu Nguyen, (2018). "EmergingTechnologies for Health and Medicine - Virtual Reality, Augmented Reality, Artificial Intelligence, Internet of Things, Robotics, Industry 4.0", ISBN 978-1-119-50981-3
2. Thomas-Vazquez, Daniel & Singh, Deepti&Hatamleh, Muhanad&Tripathi, Anuj&Vishnoi, Tanushree& Bhat, Sumrita& Thompson, Andrew & Jason, Jeremy & Kim, Keekyoung&Gleadall, Andy & Ruiz, Laura. (2019). "3D Printing in Medicine and Surgery", Woodhead Publishing Series in Medicine, ISBN 978-0-85709-233-5.

E - Resources:

1. https://www.ncbi.nlm.nih.gov/books/NBK470260/
2. https://www.insiderintelligence.com/insights/wearable-technology-healthcare-medical- devices/
3. https://www.singlecare.com/blog/telehealth-vs-telemedicine/
4. https://www.mobihealthnews.com/news/contributed-top-10-use-cases-ai-healthcare
5. \https://www.researchgate.net/publication/330724271_Big_Data_in_Health_Care_Applic ations_and_Challenges
6. https://www.mobihealthnews.com/news/contributed-top-8-healthcare-uses-3d-printing
7. https://amfg.ai/2019/08/30/3d-printing-in-healthcare-where-are-we-in-2019/

Course Outcomes:

CO1: Get familiar with Digital Health.
CO2: Understand the working nature of the Wearable Devices used in Digital Health.
CO3: Knowledge on Machine Learning techniques used in healthcare system.
CO4: Knowledge on AI embedded Healthcare system.
CO5: Get familiar with 3D Model Products and Robots in healthcare systems.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	M	M	L	M	M	M	L	L
CO2	M	H	M	M	M	M	M	M	L
CO3	H	H	H	M	M	H	H	H	M
CO4	H	H	H	H	M	H	H	H	H
CO5	M	M	M	H	M	H	H	H	M