MVJCE CURRICULUM

FOR

M.Tech Artificial Intelligence and Data Science (2024 Scheme)

I SEMESTER

Semester: I		
Artificial Intelligence		
Course Code:	MVJSAD11	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course Learning Objectives:

- Define the foundational concepts of artificial intelligence and key problem-solving techniques.
- Explain the knowledge representation and reasoning techniques to solve complex problems in AI systems.
- Use machine learning algorithms to evaluate their performance in real-world applications.
- Build the applications of natural language processing and robotics to enhance human-computer interaction.
- Explore the ethical considerations and societal implications of AI technologies.

Module-1	8 Hours

Module 1:Introduction to Artificial Intelligence and Problem Solving, Definition and scope of AI, History and evolution of AI, Types of AI: Narrow AI vs. General AI, Problem formulation and problem-solving techniques, **AI in modern applications (e.g., AI in business, AI in autonomous vehicles).**

1. Search algorithms: Uninformed and informed search strategies, Heuristic search and constraint satisfaction problem

Module-2	8 Hours

Module 2: Knowledge Representation and Reasoning, Types of knowledge representation, Propositional logic and first-order logic ,Semantic networks and frames, Ontologies and their applications, Deductive and inductive reasoning, Rule-based systems and non-monotonic reasoning, Probabilistic reasoning and Bayesian networks, **Neural networks for knowledge representation (e.g., embeddings).**

Module-3	8 Hours

Module 3: Machine Learning, Introduction to machine learning, Supervised, unsupervised, and reinforcement learning, Common algorithms: Decision trees, SVM, neural networks ,Evaluation metrics for machine learning models ,Practical applications of machine learning in AI systems.

Module-4	8 Hours

Module 4: Natural Language Processing and Robotics, Basics of natural language processing (NLP), Text processing and language models, Sentiment analysis and language generation, Robotics fundamentals and sensor technologies, Robot kinematics, control, and applications of AI in robotics, **NLP techniques,AI tools for research.**

Module-5	8 Hours

Module 5: **Ethical and Societal Implications of AI,** Ethical considerations in AI development ,AI and job displacement ,Privacy concerns and data security, Bias and fairness in AI algorithms, Accountability and transparency in AI systems, The role of government and regulation in AI, Public perception and trust in AI technologies, Future of AI and its impact on society.

Case study on Gen AI, LLM and Microsoft Copilot

Course outcomes:

S.NO	Description	Bloom's Level	POS
CO1	Understand the fundamental concepts of Artificial Intelligence, including its history, scope, problem-solving techniques, and search algorithms.	L2	PO1, PO2, PO12
CO2	Apply knowledge representation techniques and reasoning methods for intelligent decision-making in AI systems.	L3	PO1, PO2, PO3, PO4
CO3	Analyze machine learning approaches, NLP, and robotics fundamentals for real-world AI applications.	L4	PO1, PO2, PO3, PO4, PO5
CO4	Evaluate ethical, legal, and societal implications of AI, including bias, accountability, and future impact, through case studies and critical assessment	L5	PO1, PO2, PO6, PO7, PO8, PO10, PO12

Textbooks:

1	Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig, 4th Edition (2021)
2.	"Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville third Edition.

Reference books:

1.	"Pattern Recognition and Machine Learning" by Christopher M. Bishop Edition: fourth Edition (2020)"Artificial Intelligence: Foundations of Computational Agents" by David L. Poole and Alan K. Mackworth Edition: third Edition (2021).

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**

to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the Outcome defined for the course.**

Semester End Examination:

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

The students will have to answer five full questions, selecting one full question from each module.

Web links and Video Lectures (e-Resources):

1. https://cs221.stanford.edu
2. https://www.kaggle.com/learn/machine-learning
3. https://www.youtube.com/playlist?list=PLkDaE6sXhPqQ5s2cW2g1iGgC4eD9W6xZ2
https://www.youtube.com/playlist?list=PLD6B6F0A3B1D4D3D8A7E3C5E8A7B2E0C

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical – activities which will enhancetheir skill. The prepared report shall be evaluated for CIE marks

CO PO MAPPING

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	2	-	-	-	-	-	-	-	-	-	2	1	-
CO 2	3	3	2	2	-	-	-	-	-	-	-	-	2	1
CO 3	3	3	2	2	2	-	-	-	-	-	-	2	2	2
CO 4	3	2	-	-	-	2	2	2	-	2	-	2	2	2

Mapping of COS and POS High-3, Medium-2, Low-1

Semester: I		
Data Science and Management		
Course Code:	MVJSAD12	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course Learning objectives:

Explain the foundational concepts of data science, including its history, significance, and the data science process.

Apply statistical methods and data analysis techniques to interpret and draw insights from complex datasets. Implement various machine learning algorithms and assess their performance using appropriate evaluation metrics in real-world scenarios.

Utilize data visualization tools and techniques to effectively communicate findings and insights to diverse audiences.

Module-1	8 Hours

Module 1: Introduction to RDBMS: Definition and Purpose of RDBMS Key Concepts: Tables, Rows, Columns, and Relationships, Importance of RDBMS in Data Management for Data Science, Overview of Data Science Importance of Data Science in Engineering, Data Science Process, Data Types and Structures.

Module-2	8 Hours

Module 2: Linear Algebra for Data Science, Algebraic View, Vectors and Matrices, Product of Matrix & Vector, Rank and Null Space, Solutions of Over determined Equations, Pseudo inverse, Geometric View, Vectors and Distances, Projections, Eigenvalue Decomposition.

Module-3	8 Hours

Module 3: Statistical Foundations, Descriptive Statistics, Notion of Probability, Probability Distributions Understanding Univariate and Multivariate Normal Distributions, Mean, Variance, Covariance, and Covariance Matrix, Introduction to Hypothesis Testing, Confidence Intervals for Estimates.

Module-4	8 Hours

Module 4: Optimization and Data Science Problem Solving, Introduction to Optimization Understanding Optimization Techniques, Typology of Data Science Problems, Solution Framework for Data Science Problems. Introduction to Data Science and R Tool, Introduction to R Programming, Basic Data Manipulation in R, Simple programs using R.

Module-5	8 Hours

Module 5: Regression and Classification Techniques, Linear Regression, Simple Linear Regression and Assumptions, Multivariate Linear Regression, Model Assessment and Variable Importance, Subset Selection, Classification Techniques, Classification using Logistic Regression, Reinforcement learning.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to

each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POsThe sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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

Semester End Examination:

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

The question paper will have ten full questions carrying equal marks.

Each full question is for 20 marks. There will be two full questions (with a maximum of four sub- questions)from each module.

- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

S.NO	Description	Bloom's Level	POS
CO1	Explain the fundamental concepts of RDBMS and data science, including data management processes, data types, and structures.	L2	PO1, PO2, PO12
CO 2	Apply linear algebra and statistical techniques such as eigenvalue decomposition, probability distributions, and hypothesis testing to data science problems	L3	PO1, PO2, PO4, PO5
CO 3	Analyze data science problems and apply optimization techniques and R programming for data manipulation and problem-solving.	L4	PO1, PO2, PO3, PO5, PO12
CO 4	Evaluate regression and classification models, assess variable importance, and interpret outcomes in data science applications.	L5	PO1, PO2, PO3, PO4, PO5, PO12

Course Outcomes:

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

Textbooks :	
1.	Kotu, V.,& Deshpande, B(2019). Data Science : Concepts and Practice.,Morgan Kaufmann
2.	"Data Science from Scratch: First Principles with Python" by Joel Grus, 2nd Edition (2019)
References :	
1.	An Introduction to Statistical Learning" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Toshigami, 2nd Edition (2021)

2.	"The Elements of Statistical Learning" by Trevor Hastie, Robert Toshigami, and Jerome Friedman, 2ndEdition (2009)
3.	"Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett, 2nd Edition (2013)

Sl. No.	Description
1	Demonstrate the ability to independently conduct research and development work to address practical engineering
2	Develop and deliver comprehensive technical presentations that effectively convey complex information to dive
3	Exhibit mastery in the specialized study area, surpassing the requirements of a relevant bachelor's program.
4	Analyze engineering problems critically and apply appropriate techniques, skills, and modern tools to develop
5	Collaborate effectively in teams while also functioning independently, recognizing opportunities for career advantage
6	Cultivate a proactive approach to continuous learning and professional development in response to evolving tec

Skill Development Activities Suggested

1. The students with the help of the course teacher can take up relevant technical activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

High- 3,

CO PO MAPPING:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	2	-	-	-	-	-	-	-	-	-	2	1	-
CO 2	3	3	-	2	2	-	-	-	-	-	-	-	2	1
CO 3	3	2	2	-	2	-	-	-	-	-	-	2	2	2
CO 4	3	2	2	2	2	-	-	-	-	-	-	2	2	2

High-3 , Medium-2, Low-1

Semester-1		
Data Structures & Algorithms for Problem Solving		
Course Code:	MVJSAD13	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course Learning Objectives:

1. To reduce development time and the resources required to maintain existing applications.
2. To increase code reuse and provide a competitive advantage through effective use of data structures and algorithms.

Module-1	8 Hours

Search Trees: Two Models of Search Trees. General Properties and Transformations. Height of a Search Tree. Basic Find, Insert, and Delete. Returning from Leaf to Root. Dealing with Non unique Keys. Queries for the Keys in an Interval. Building Optimal Search Trees. Converting Trees into Lists. Removing a Tree. Balanced
Search Trees: Height-Balanced Trees. Weight-Balanced Trees. (a, b)- And B-Trees. Red-Black Trees and Trees of Almost Optimal Height.

Module-2	8 Hours

Heaps: Balanced Search Trees as Heaps. Array-Based Heaps. Heap-Ordered Trees and Half Ordered Trees. Leftist Heaps. Skew Heaps. Binomial Heaps. Changing Keys in Heaps. Fibonacci Heaps. Heaps of Optimal Complexity. Double-Ended Heap Structures and Multidimensional Heaps. Heap-Related Structures with
Constant-Time Updates. Case Study: Optimizing Task Scheduling in a Distributed System Using
Various Heap Structures.

Module-3	8 Hours

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithmfor sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. Polynomials and the FFT: Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

Module-4	8 Hours

String-Matching Algorithms: Text Processing: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms. The Boyer- Moore Algorithm, Standard Tries, Compressed Tries, Suffix Tries.

Module-5	8 Hours

Dynamic programming, : DFS, BFS, topological sorting, shortest path algorithms, Approximation algorithms:
NP completeness, Reductions, coping with NP completeness, Approximation algorithms: The vertex cover problem, The travelling salesman problem, The set covering problem, The Subset- sum problem. Graph colouring.

Course Outcomes : Students will be able to:

S.NO	Description	Bloom's Level	POS
CO1	Understand the structure, properties, and operations of search trees and balanced search trees.	L2	PO1, PO2, PO3
CO 2	Apply advanced data structures such as heaps and heap-related structures for efficient task scheduling and optimization.	L3	PO1, PO2, PO3, PO4, PO5
CO 3	Analyze graph algorithms, polynomial representations, and FFT techniques for computational problem-solving	L4	PO1, PO2, PO3, PO4, PO5, PO12
CO 4	Evaluate string-matching algorithms and approximation algorithms for complex computational tasks, including NP-completeness challenges.	L5	PO1, PO2, PO3, PO4, PO5, PO6, PO7

Textbooks:

1.	Advanced Data Structures, Peter Brass, Cambridge University Press, 2008.

CO PO MAPPING:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	2	2	-	-	-	-	-	-	-	-	-	1	-
CO 2	3	3	2	2	2	-	-	-	-	-	-	-	2	1
CO 3	3	2	2	2	2	-	-	-	-	-	-	2	2	2
CO 4	3	2	2	2	2	2	2	-	-	-	-	2	2	2

High-3, Medium-2, Low-1

Semester: I		
PYTHON FOR DATASCIENCE		
Course Code:	MVJSAD14	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course Learning Objectives:

· Understand the foundational concepts of big data, data science, and statistical inference in modern engineering applications.

· Apply basic data science techniques including exploratory data analysis and key machine learning algorithms to real-world case studies.

· Analyze advanced machine learning algorithms, data wrangling techniques, and recommendation systems for practical deployment.

· Evaluate social network graphs, data visualization methods, and ethical considerations in data science to draw meaningful insights.

Module-1
Big Data and Data Science hype – and getting past the hype,– Datafication, Current landscape of perspectives, Skill sets. Needed Statistical Inference: Populations and samples, Statistical modelling, probability distributions, fitting a mode
Module-2
Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA,The Data Science Process, Case Study: Real Direct(online real estate firm). Three Basic Machine Learning Algorithms: Linear Regression, k-Nearest Neighbors (kNN), k-mean. Case Studies.
Module-3
Machine Learning Algorithm and Usage in Applications: Motivating application: Filtering Spam, Linear Regression and k-NN, Disadvantages , Naive Bayes ,Decision Tree Algorithm, Data Wrangling: APIs and other tools for scrapping the Web, web spidering and crawlers.
Module-4
Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system(Hands-on)
Module-5
Mining Social-Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighbourhood properties in graphs, Data Visualization: Basic principles, ideas and tools for data visualization. Data Science and Ethical Issues, Discussions on privacy, security, Extracting insights from visual data.

S.NO	LIST OF PROGRAMS	HOURS
1	Python Program to build machine learning model to solve real world regression problem	2
2	Given the Iris dataset,apply the K.Nearest Neighbors (KNN) algorithm to clasify the date and evaluate the performance of the model	2
3	Python code that demostrates a simple application of Gaussian NaiveBayes clasification	2
4	Python code to implement the Desion Tree algorithm to classify data from a dataset (e.g Titanic dataset)	2
5	To collect daa using APIs and perform basic data wragling tasks(using Beautiful Soup,requests and Pandas).	2
6	Build a content-based recommender system that recommends items based in the ir attributes (e.g genres,tags)	2

Course Outcomes: Students will be able to :

S.NO	Description	Bloom's Level	POS
CO1	Understand the fundamental concepts of big data, data science, statistical inference, and their roles in modern data-driven systems.	L2	PO1, PO2, PO3, PO12
CO 2	Apply data science techniques such as EDA, linear regression, kNN, and k-means to real-world datasets and case studies	L3	PO1, PO2, PO3, PO4, PO5, PO12
CO 3	Analyze advanced data science applications: data wrangling, recommendation systems, dimensionality reduction, and graph mining.	L4	PO1, PO2, PO3, PO4, PO5, PO6, PO12
CO 4	Evaluate data science ethics, data visualization, and extraction of insights from complex data, emphasizing privacy and security.	L5	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO12

Text Books

1.Doing Data Science Cathy O'Neil and Rachel Schutt, Straight Talk from The Frontline O'Reilly 2014 2.Skiena,S.S.(2017).The data science design manual.,Springer.

3..Mining of Massive DatasetsV2.1 Jure Leskovek, Anand Rajarama nand Jeffrey Ullman Cambridge University Press, 2nd Edition 2014.

Reference Books:

1. Data Mining: Concepts and Techniques Jiawei Han, MichelineKambe rand Jian Pei Morgan Kauffman, Third Edition, 2012

2. James, G.,Written,D.,Hastie,T.,Tibshirani,R.(2017).An Introduction to statistical learning with application in R, Springer

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

- Three Unit Tests each of 20 Marks
- Two assignments each of 20 Marks or one Skill Development Activity of 40 marks
- to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks

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

Semester End Examination:

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

The students will have to answer five full questions, selecting one full question from each module

CO PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	2	2	1	3
CO2	3	2	2	2	-	-	-	-	-	-	2	2	2	3
CO3	3	3	2	2	2	-	-	-	-	-	2	2	2	3
CO4	3	3	2	2	2	2	2	-	-	-	2	2	2	3

High-3, Medium-2, Low-1

Semester: I		
INTRODUCTION TO DEEP LEARNING		
Course Code:	MVJSAD15	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	4	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course objectives:

This course will enable students to

2. Illustrate the basic concept of neural networks and its practical issues
3. Outline the standard and regularization and optimization techniques for deep neural network
4. Implement the foundation layers of CNN
5. Implement a sequence model using recurrent neural networks
6. Use different neural network/deep learning models for practical applications

Module-1:	8Hrs

Introduction to neural networks -Single layer perceptron's, Multi-Layer Perceptron's (MLPs), Representation Power of MLPs, Activation functions - Sigmoid, Tanh, ReLU, SoftMax. , Risk minimization, Loss function, Training MLPs with backpropagation, Practical issues in neural network training - The Problem of Overfitting, Vanishing and exploding gradient problems, Difficulties in convergence, Local and spurious Optima, Computational Challenges. Applications of neural networks.

Module-2:	8Hrs

Introduction to deep learning, Deep feed forward network, Training deep models, Optimization techniques - Gradient Descent (GD), GD with momentum, Nesterov accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam. Regularization Techniques - L1 and L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Parameter initialization.

Module-3:	8Hrs

Convolutional Neural Networks – convolution operation, motivation, pooling, Convolution and Pooling as an infinitely strong prior, variants of convolution functions, structured outputs, data types, efficient convolution algorithms.

Module-4:	8Hrs

Recurrent neural networks – Computational graphs, RNN design, encoder – decoder sequence to sequence architectures, deep recurrent networks, recursive neural networks, modern RNNs LSTM and GRU.

Module-5:	8Hrs

Applications – computer vision, speech recognition, natural language processing, common word embedding: continuous Bag-of-Words, Word2Vec, global vectors for word representation (GloVe). Research Areas – autoencoders, representation learning, boltzmann machines, deep belief networks.

Course Outcomes: Students will be able to

S.NO	Description	Bloom's Level	POS
CO1	Understand the fundamental concepts of neural networks and challenges in training deep learning models.	L2	PO1, PO2, PO3, PO12
CO 2	Apply deep learning techniques, including convolutional and recurrent networks, to solve real-world problems in computer vision and NLP.	L3	PO1, PO2, PO3, PO4, PO5, PO12
CO 3	Analyze optimization and regularization techniques (GD, Adam, Dropout, etc.) for training robust deep learning models.	L4	PO1, PO2, PO3, PO4, PO5, PO6, PO12
CO 4	Evaluate emerging research areas (autoencoders, representation learning) and applications of deep learning in real-world contexts.	L5	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO12

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub- questions)from each module.
4. Each full question will have a sub-question covering all the topics under a module.

The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.

2. Neural Networks and Deep Learning, Aggarwal, Charu C.

3. Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms (1st. ed.). Nikhil Buduma and Nicholas Locascio. 2017. O'Reilly Media, Inc.

CO PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	2	2	1
CO2	3	3	2	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	2	2	-	-	-	-	-	2	2	2
CO4	3	3	3	2	2	2	2	2	-	-	-	2	2	2

High-3, Medium-2, Low-1

Semester: I		
ALGORITHMS & AI LABORATORY		
Course Code:	MVJSADL16	CIE Marks: 50
L: T:P:S	2:0:0:0	SEE Marks: 50
Credits:	2	Total :100
Hours:	26P	SEE Duration: 3 Hrs.

Course Learning Objectives: This course MCSL106 will enable students to:

Implement and evaluate Algorithm and AI in Python programming language.

Descriptions (if any):

Installation procedure of the required software must be demonstrated, carried out in groups. and documented in the journal.

LIST OF EXPERIMENTS:

1.	Implement a simple linear regression algorithm to predict a continuous target variable based on a given dataset.	2 Hours
2.	Develop a program to implement a Support Vector Machine for binary classification. Use a sample dataset and visualize the decision boundary.	2 Hours
3.	Develop a simple case-based reasoning system that stores instances of past cases. Implement a retrieval method to find the most similar cases and make predictions based on them.	2 Hours
4.	Write a program to demonstrate the ID3 decision tree algorithm using an appropriate dataset for classification.	2 Hours
5.	Build an Artificial Neural Network by implementing the Back propagation algorithm and test it with suitable datasets.	2 Hours
6.	Implementation of DFS for Water Jug Problem	2 Hours
7.	Create a program that calculates different distance metrics (Euclidean and Manhattan) between two points in a dataset. Allow the user to input two points and display the calculated distances.	2 Hours2 Hours
8.	Develop a program to implement the non-parametric Locally Weighted Regression algorithm, fitting data points and visualizing results.	2 Hours
9.	Implement a Q-learning algorithm to navigate a simple grid environment, defining the reward structure and analyzing agent performance.	2 Hours

Laboratory Outcomes: The student should be able to:

S.NO	Description	Bloom's Level	POS
CO1	Implement basic and advanced supervised learning algorithms (Linear Regression, SVM, ID3, ANN) using suitable datasets.	L3	PO1, PO2, PO3, PO5, PO12
CO 2	Analyze and evaluate algorithm performance using visualizations and metrics such as decision boundaries and distance metrics.	L4	PO1, PO2, PO3, PO4, PO5, PO12
CO 3	Develop and apply reasoning-based and non-parametric learning algorithms (Case-based reasoning, LWR) to practical data-driven problems.	L3	PO1, PO2, PO3, PO5, PO12
CO 4	Implement reinforcement learning algorithms (Q-learning) and graph-based algorithms (DFS) to address complex AI problem scenarios.	L3	PO1, PO2, PO3, PO5, PO6, PO12

Experiment distribution.
For laboratories having only one part: Students are allowed to pick one experiment fromthe lot with equal opportunity.
For laboratories having PART A and PART B: Students are allowed to pick oneexperiment from PART A and one experiment from PART B, with equal opportunity.
Change of experiment is allowed only once and marks allotted for procedure to be made zero ofthe changed part only.
Marks Distribution *(Courseed to change in accoradance with university regulations)*
For laboratories having only one part – Procedure + Execution + Viva-Voce:
15+70+15 =100 Marks For laboratories having PART A and PART B
Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

CO PO MAPPING:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	3	3	-	2	-	-	-	-	-	-	2	2	2
CO 2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO 3	3	3	3	-	2	-	-	-	-	-	-	2	2	2
CO 4	3	3	3	-	2	2	-	-	-	-	-	2	2	2

High-3, Medium-2, Low-1

II SEMESTER

Semester: II		
Internet of Things and Applications		
Course Code:	MVJSAD21	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L+24P	SEE Duration: 3 Hrs.

Course objectives :This course will enable students to

- Explore the knowledge on combination of functionalities and services of networking
- Explain the definition and significance of the Internet of Things.
- Discuss the architecture, operation and business benefits of an IoT solution.

Module-1:	8 Hrs

What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples-Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, OverThe-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.

TextBook:T1 Chapter:1,2

Module-2:	8 Hrs

Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards- Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M, Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Low power WPAN, Zigbee IP(ZIP),IPSO

TextBook:T1 Chapter:4,5

Module-3:	8 Hrs

Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M,Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity :IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6,Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6

TextBook:T1 Chapter:6,7,8,9

Module-4:	8 Hrs

Web of Things:Web of Things versus Internet of Things-Architecture Standardization for WoT-Platform Middleware for WoT- WoT Portals and Business Intelligence-Cloud of Things: Grid/SOA and Cloud Computing-Cloud Standards –Cloud of Things Architecture-Open Source e-Health sensor platform.

Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment,Agriculture, Productivity Applications.

TextBook: T2 Chapter:9

Module-5:	8Hrs

Data Analytics for IoT – Introduction, Apache Hadoop, Using Hadoop MapReduce for BatchData Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.

TextBook:T2 Chapter:10 ,11,12

List of Experiments of Internet of Things and Applications:

SL NO	LIST OF PROGRAMS	
1	Blinking of LED under different duty cycle timing with buzzer indication.	2 Hours
2 (A)	(A) LED/DC MOTOR ON/OFF Using Microswitch and relay module displaying LED status on Serial Monitor.	2 Hours
2(B)	(B)LED/DC MOTOR ON/OFF using relay module and controlling only through Serial Monitor without Microswitch.	2 Hours
3	Auto Fading of LED brightness through PWM.	2 Hours
4	LED Fading using Potentiometer displaying POT status value on Serial Monitor.	2 Hours
5	Simulation of Traffic light.	2 Hours
6	UP/DOWN decade counter.	2 Hours
7	Obstacle detector using IR module with visual indication and buzzer alarm.	2 Hours
8	Controlling lamp through relay using Light sensor using LDR module.	2 Hours
9	Distance measurement device using ultra sonic sensor with reverse parking anticollision warning LED indicator and alarm.	2 Hours
10	Detection of smoke with visual indication and buzzer alarm.	2 Hours
11	Displaying Humidity and Temperature using DTH-11/LM35 module in LCD using I2C protocol.	2 Hours
12	Write an Arduino code to demonstrate the controlling of lamp using relay module by PIR	2 Hours

		sensor.	
	13	Home automation Voice control of lamp/relay through blue tooth module.	2 Hours
	14	Home automation Controlling the watering of lawn/garden through automatic water motor sprinkler using soil sensor.	2 Hours
	15	Study experiments on home automation Home automation system for fire alarm using flame sensor to extinguish the fire automatically through water sprinkler system.	2 Hours
	16	Study experiments on home automation. To find the fitness of daily water quality using turbidity sensor and displaying 3 conditions namely CLEAR FIT FOR DRINKING, CLOUDLY CAN BE USED FOR WASHING and DIRTY UNFIT FOR DRINKING on I2C protocol LCD	2 Hours

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**

to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub- questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.

The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Building the Internet of Things with IPv6 and MIPv6: The Evolving
World of M2M Communications Daniel Minoli Wiley 2013
2. Internet of Things: A Hands-on Approach ArshdeepBahga, Vijay Madisetti UniversitiesPress 2015
3. The Internet of Things Michael Miller Pearson 2015 First Edition
Designing Connected Products Claire Rowland,Elizabeth Goodman et.al O'Reilly FirstEdition, 2015

Sl. No.	Description	Blooms Level
CO1	**Understand IoT concepts, architecture, frameworks, and key technologies influencing development.**	L2
CO2	Apply industry-standard IoT mechanisms for connectivity, security, and standardization in practical scenarios.	L3
CO3	Analyze various IoT communication protocols, network technologies, and application scenarios.	L4
CO4	Develop IoT-based solutions integrating cloud computing, data analytics, and real-world case studies.	L5

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.	PO1
2	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development..	PO2
3	Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.	PO3
4	Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.	PO4
5	Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern Engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.	PO5
6	The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.	PO6
7	Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.	PO7
8	Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.	PO8

9	Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences	PO9
10	Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.	PO10
11	Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.	PO11

Mapping of COS and POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3				2						3	3	
CO2	2	3	2		3	3						2		3
CO3			3	2	3		3	3						2
CO4	3		3		2				3	2	3		3	2

Semester: II		
Advances in Operating Systems		
Course Code:	MVJSAD22	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course objectives :This course will enable students to

Course Learning objectives:

The Students will be able to :

- Analyze the characteristics of operating systems for multiprocessor and multicomputer architectures.
- Understand and address the challenges related to designing operating systems.
- Explore the latest trends in developing mobile operating systems.
- Evaluate the implications of these trends on performance and user experience.

Module-1:	8 Hrs

Multiprocessor Operating Systems: System Architectures- Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation- Memory Management.

Application/Case study : Memory management in Linux.

Textbook 1: **Chapter 1**,2,3,6,7,9
Ref Book 4: Kai Hwang Chapters on Multiprocessor Systems & Heterogeneous Computing

Module-2:	8 Hrs

Distributed Operating Systems: System Architectures- Design issues – Communication models – clock synchronization – mutual exclusion – election algorithms- Distributed Deadlock detection.

Application/Case study : Deadlock detection algorithms and tools.

Textbook 1: Chapter 4,8 Ref Book 1:Chapter 2,3,4,7 Ref Book 5: Coulouris – *Distributed Systems,*

Module-3:	8 Hrs

Distributed scheduling - Distributed shared memory - Distributed File system – Multimedia file systems - File placement – Caching.

Application/Case study : Network Filesystem, SMB protocol.

Textbook 1 :Chapter 5,10

Module-4:	8 Hrs

Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives - Concurrency control algorithms.

Application/Case study : Read write locks, usage and implementation.

Textbook 1: Chapter 11, Ref Book 6: Jim Gray, Chapters 3 to 5,6,7

Module-5:	8Hrs

Mobile Operating Systems: ARM and Intel architectures - Power Management - Mobile OS Architectures - Underlying OS - Kernel structure and native level programming - Runtime issues- Approaches to power Management.

Application/Case study : Kernel IO path. Recent trends in Operating System design.

Ref Book 2: concept of General Overview of Android, iOS Ref Book 3:
Chapter 19
Ref Book 7: Android Internals, Power Management
Ref Book 8: Native level programming, Kernel, Runtime internals

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

3. Three Unit Tests each of **20 Marks**
4. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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

Semester End Examination:

5. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
6. The question paper will have ten full questions carrying equal marks.
7. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub- questions) from each module.
8. Each full question will have a sub-question covering all the topics under a module.

The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. M Singhal and NG Shivaratri , Advanced Concepts in Operating Systems, Tata McGraw Hill Inc, 2001

Reference Book

1. A S Tanenbaum, Distributed Operating Systems, Pearson Education Asia, 2001

Source Wikipedia, Mobile Operating Systems, General Books LLC, 2010

Skill Development Activities Suggested

Thestudentswiththehelpofthecourseteachercantakeuprelevanttechnical– activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)
At the end of the course the student will be able to :

CO	Description	Blooms Level	POS
1	Understand fundamental concepts of Multiprocessor Operating Systems, including architecture, design, and process management.	L2	PO1,PO2, PO6,PO12
2	Apply distributed file systems, shared memory techniques, and multimedia storage principles in real-world scenarios.	L3	PO3,PO4, PO5,PO7, PO8
3	Analyze distributed operating system architectures, synchronization mechanisms, and deadlock detection methods	L5	PO1,PO2, PO3,PO5, PO6
4	Develop database and mobile operating system solutions, integrating transaction control, kernel-level programming, and power management strategies.	L6	PO10,PO11

Mapping of COS and POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3				3						3	3	
CO2	3	3	2		3	2						3		3
CO3			3	3	3		3	3						2
CO4	3		2		3				3	3	3		3	3

Semester: II		
BIG DATA ANALYTICS		
Course Code:	MVJSAD23	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course objectives :This course will enable students to

- Explore the Hadoop framework and Hadoop Distributed File system
- Study HDFS and MapReduce concepts
- Employ MapReduce programming model to process the big data
- Explore the working of pig and SPARK tool

Module-1:	8 Hrs

Introduction to Big Data and Hadoop Ecosystem: Introduction to Big Data: Definition, characteristics, and challenges, Hadoop Overview: Evolution, ecosystem, and key components, Hadoop Distributed File System (HDFS): Architecture, blocks, Name Nodes & DataNode,File read/write data flow,Introduction to MapReduce: Programming model (Map, Shuffle, Reduce),Developing simple MapReduce jobs (Java and Streaming),Hadoop Execution: Job flow, combiners, and counters, Hadoop Streaming overview

Module-2:	8 Hrs

Hadoop YARN and I/O Management: Introduction to YARN: Architecture and application execution, YARN vs Traditional MapReduce, YARN Scheduling Policies: FIFO, Capacity Scheduler, Fair Scheduler, Hadoop I/O:Data Integrity and checksums, File compression: Codecs, usage in MapReduce, Serialization: Writable interface and formats, SequenceFile overview, File-based data storage and reading mechanisms in Hadoop

Module-3:	8 Hrs

MapReduce Development & Data Ingestion with Flume: Developing MapReduce Applications: Configuration API, setting up jobs, Local and cluster execution, Writing unit tests with MRUnit, Job Execution Flow:Job submission, task assignment, execution, Monitoring job progress, debugging using logs, MapReduce Workflows: Decomposing problems into multiple jobs, Introduction to Apache Oozie, Introduction to Apache Flume: Architecture (Source, Channel, Sink), HDFS Sink, data ingestion flows,
Integration with Hadoop ecosystem

Module-4:	8 Hrs

Data Formats and Tools – Pig and Spark, Apache Pig: Introduction, installation, execution, Pig Latin: structure, functions, expressions, Operators: Load, store, filter, group, join, sort, Comparison with RDBMS, Apache Spark: Spark application architecture: Jobs, stages, and tasks, Resilient Distributed Datasets (RDDs): Creation, transformations, actions, Persistence and caching, Shared variables: Broadcast and Accumulators, Job execution flow and Spark on YARN

Module-5:	8Hrs

Advanced Big Data Processing & Integration: Spark Continued: DAG construction, task execution, Introduction to DataFrames and Spark SQL (optional topic based on level), Data Input/Output Formats:, Input splits, record readers, multiple inputs, Output formats: text, binary, lazy output, Real-time Processing Fundamentals (Introductory): Brief overview of streaming tools (Kafka, Spark Streaming – conceptual only) Integration strategies for batch + streaming processing,

Applications of Big Data: Case studies in healthcare, e- commerce, social media, IoT

Suggested Learning Resources:
Text Books:

1.Hadoop: The Definitive Guide ,Tom White, O'Reilley 3rd Edition, 2012.

2.SPARK: The Definitive Guide, Bill Chambers MateiZaharia, O'Reilley 2018.

3.Alan Gates, "Programming Pig",1st Edition, O'Reilly Media, 2011. ISBN: 978-1449302641

4.Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia, "Learning Spark: Lightning-Fast Big Data Analysis", 1st Edition, O'Reilly Media, 2015. ISBN: 978-1449358624

References:

1.Apache Flume: Distributed Log Collection for Hadoop, D'Souza and SteveHoffman O'Reilley 2014.
2.Jure Leskovec, Anand Rajaraman, Jeff Ullman, "Mining of Massive Datasets", 3rd Edition, Cambridge University Press, 2020. ISBN: 978-1108476348
3.Vignesh Prajapati, "Big Data Analytics with R and Hadoop", 1st Edition, Packt Publishing, 2013. ISBN: 978- 1782163282
4.Chuck Lam, "Hadoop in Action", 1st Edition, Manning Publications, 2010. ISBN: 978-1935182191
5.Shiva Achari, "Big Data and Hadoop", 1st Edition, Wiley India, 2016. ISBN: 978-8126556688

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc20_cs92/

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understand the fundamentals of Big Data, Hadoop architecture, HDFS, and MapReduce programming model.	L3
CO2	Analyze the architecture and functionality of YARN, data serialization, file compression, and scheduling mechanisms.	L4
CO3	Develop and manage MapReduce jobs, workflows, and data ingestion processes using Flume and Oozie.	L5
CO4	Utilize Pig and Spark tools for big data manipulation, transformation, and execution.	L4
CO5	Evaluate advanced big data frameworks like Spark SQL and Streaming, and apply them in real-world case stu-dies.	L5

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2										2
CO2	3		2								
CO3	2		3		2						
CO4	3				2						
CO5	2				2						

Semester: II		
DECISION SUPPORT SYSTEM		
Course Code:	MVJSAD241	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course objectives :This course will enable students to • Recognize the relationship between business information needs and decision making • Select appropriate modeling techniques • Able to Analyze, design and implement a DSS	
Module-1:	8 Hrs
Introduction to decision support systems: DSS Defined, History of decision support systems, Ingredients of a DSS, Data and model management, DSS Knowledge base, User interfaces, User interfaces, The DSS user, Categories and classes of DSSs, Chapter Summary. Decisions and decision makers Decision makers: who are they, Decision styles, Decision effectiveness, How can a DSS help?, A Typology of decisions, Decision theory and simon's model of problem solving, Bounded decision making, The process of choice, Cognitive processes, Biases and heuristics in decision making.	
Module-2:	8 Hrs
Decisions in the organization: Understanding the organization, Organizational culture. Modelling decision processes: Defining the problem and its structures, Decision models, Types of probability, Techniques for forecasting probabilities, Calibration and sensitivity	
Module-3:	8 Hrs
Group decision support and groupware technologies: Group Decision making, the problem with groups, MDM support technologies, Managing MDM activities, the virtual workspace, chapter summary. Executive information systems: What exactly is an EIS, Some EIS history, Why area top executives so different?, EIS components, Making the EIS work, The future of executive decision making and the EIS.	
Module-4:	8 Hrs
Designing and building decision support systems: Strategies for DSS analysis and design, The DSS developer, DSS user interface issues, chapter summary. Implementing and integrating decision support systems: DSS implementation, System evaluation, The importance of integration, chapter summary.	
Module-5:	8Hrs
Creative decision making and problem solving What is creativity?, Creativity defined, The occurrence of creativity, Creative problem solving techniques, Creativity and the role of technology, chapter summary	

Suggested Learning Resources:

Text Books

1. *Decision support system*, George M.Marakas, PHI, 2011.

2. *Decision Support Systems*, Marakas, 2nd Edition, Pearson India, 2015.

Web links and Video Lectures (e-Resources):

https://www.coursera.org/lecture/business-intelligence-tools/decision-support-systems- video- lecture-E8P9x

Course outcome (Course Skill Set)

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

S.NO	Description	Bloom's Level	POS
CO1	Understand fundamental concepts of Decision Support Systems (DSS), decision-making models, and heuristic approaches.	L2	P01,PO2,PO12
CO2	Apply group decision support systems and executive information systems to manage decision-making workflows effectively.	L3	PO4, PO5, PO7, PO8
CO3	Analyze decision-making processes and typologies to evaluate how DSS can enhance decision effectiveness in organizations.	L4	PO2,PO3,PO5,PO6
CO4	Develop and implement creative Decision Support Systems (DSS) by integrating user interfaces, system evaluation, and innovative problem-solving techniques.	L5	PO3, PO5, PO9, PO10, PO11

Mapping of COS and POs:

COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	3				3						3	3	
CO2	3	2	3		3	2						2		3
CO3			3	3	2		3	2						3
CO4	3		3		3				3	2	3		3	3

Semester: II		
PREDICTIVE ANALYSIS		
Course Code:	MVJSAD242	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course objectives :This course will enable students to

- Explore various classification and regression models.
- Explore working of supervised and unsupervised algorithms.
- Identify the best working models to solve real world problems.

Module-1:	8 Hrs

Overview of Supervised Learning: Introduction, Variable Types and Terminology, Two Simple Approaches to Prediction: Linear Methods for Regression and Classification: Introduction, Linear regression models and least squares, , Subset selection , Shrinkage Methods, A Comparison of the Selection and Shrinkage Methods, Linear Discriminant Analysis, Logistic regression.

Module-2:	8 Hrs

Model Assessment and Selection: Bias, Variance, and model complexity, The Bias-variance Decomposition, Optimism of the training error rate, Estimate of In-sample prediction error, The Effective number of parameters, Bayesian approach and BIC, Cross- validation, Boot strap methods, Conditional or Expected Test Error.

Module-3:	8 Hrs

Additive Models, Trees, and Related Methods: Generalized additive models, Tree-Based Methods, Boosting and Additive Trees: Boosting Methods, Exponential Loss and AdaBoost, Example: Spam Data, Numerical Optimization via Gradient Boosting , Illustrations (California Housing , New Zealand Fish, Demographic Data)

Module-4:	8 Hrs

Neural Networks: Introduction, Fitting Neural Networks, Some Issues in Training Neural Networks Support Vector Machines: Introduction, The Support Vector Classifier, Support Vector Machines and Kernels Unsupervised Learning and Random forests: Association rules, Cluster analysis, Details of Random Forests, Random forests and analysis.

Module-5:	8Hrs

Assessing Performance of a classification Algorithm (t-test, McNemar's test, Paired t-test, F-test), Analysis of Variance, Creating data for analytics through designed experiments.

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

   The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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

Semester End Examination:

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

Suggested Learning Resources:

Text Books:

1. *The Elements of Statistical Learning-Data Mining, Inference, and Prediction Trevor Hastie*, Robert Tibshirani, Jerome Friedman Springer 2009.
2. *Introduction to Machine Learning*, E. Alpaydin PHI 2010.

Reference Books:

1. *Pattern Recognition and Machine Learning*, Christopher M. Bishop Springer 2007.
2. *All of statistics*, L.Wasserman Springer 2004.
3. *An Introduction to statistical learning with applications in R*, G. James, D. Witten, T. Hastie, R. Tibshirani Springer 2017

Web links and Video Lectures (e-Resources):

- https://www.udemy.com/tutorial/become-a-python-data-analyst/introduction-to-predictive- analytics- models/
- https://intellipaat.com/blog/what-is-predictive-analytics/
- https://www.youtube.com/watch?v=Kd0C-8q0HkI

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill.

Course outcome (Course Skill Set)

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

CO PO Mapping:

S.NO	Description	Bloom's Level	POS
CO1	Understand fundamental concepts of **Supervised Learning**, regression models, and classification techniques	L2	PO2, PO6, PO12
CO2	Apply **additive models, boosting methods, and tree-based techniques** to enhance learning performance.	L3	PO3, PO5, PO6, PO12
CO3	Analyze **model selection**, bias-variance trade-off, and evaluation techniques for machine learning models.	L4	PO7, PO8, PSO2
CO4	Develop **deep learning models, support vector machines, and classification performance assessment techniques** for practical applications.	L5	PO9, PO10, PO11, PSO1, PSO2

CO PO MAPPING:

COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2				3						3	2	1
CO2	3	3	2		3	3						3		3
CO3			3	3	2		2	3				1	1	2
CO4	3		3		3				3	2	3	1	3	3
High-3, Medium-2, Low-1														

Semester: II		
COMPUTER VISION		
Course Code:	MVJSAD243	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course objectives :This course will enable students to

- Explore the fundamentals of computer vision.
- Build skills to perform shape analysis and other computer vision operations

Module-1:	8 Hrs

CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

T1: ch1,2,5,6 Ref Textbook 1: ch2

Module-2:	8 Hrs

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

T1: ch3,7 Ref textbook1: ch4,5

Module-3:	8 Hrs

The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

T1: Ch 11,14 Ref textbook1 Ch 6,8

Module-4:	8 Hrs

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.

Textbook 1: Ch15,16 Ref textbook1 Ch 9,11

Module-5:	8Hrs

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric CameraCalibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment

Textbook 1: Ch2,3,12,18 Ref textbook1 Ch 3,13,15

Web links and Video Lectures (e-Resources):

- https://www.projectpro.io/data-science-in-python-tutorial/computer-vision-tutorial-for-beginners
- https://www.javatpoint.com/computer-vision

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill.

Course outcome (Course Skill Set)

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

Mapping of COS and POs

S.NO	Description	Bloom's Level	POS
CO1	Understand fundamental concepts of cameras, radiometry, shading, and color perception in imaging systems	L2	PO1, PO2, PO6,
CO2	Apply multiple-view geometry, segmentation techniques, and clustering approaches for image analysis.	L3	PO5,PO12, PSO2
CO3	Analyze linear filters, convolution, edge detection, and texture representation for image processing applications.	L4	PO7, PO8
CO4	Develop and implement camera models, tracking systems, and probabilistic segmentation algorithms for real-world imaging applications.	L5	PO5, PO9, PO10

CO PO MAPPING

COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	3				3						3	3	
CO2	3	2	2		3	2						2		3
CO3			3	2	3		3	2						3
CO4	3		3		3				3	2	3		3	3

High-3, Medium-2, Low-1

Semester: II		
DATABASE SECURITY		
Course Code:	MVJSAD244	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course objectives :This course will enable students to

- Identify contemporary practices of Database system security
- Demonstrate the knowledge and skills for administration of user, profiles, password policies, privileges and roles.
- Manage database security on application level.
- Protection of New Generation Database Systems,

Module-1:	8 Hrs

Introduction: Introduction to Databases, Security Problems in Databases Security Controls Conclusions. Security Models, Introduction, Access Matrix Model, Take-Grant Model, Acten Model, PN Model, Hartson and Hsiao's Model, Fernandez's Model, Bussolati and Martella's Model for Distributed databases.

T1:Ch1,2

Module-2:	8 Hrs

Security Models 2: Bell and LaPadula's Model, Biba's Model, Dion's Model, Sea View Model, Jajodia and Sandhu's Model, The Lattice Model for the Flow Control conclusion. Security Mechanisms: Introduction, User Identification/Authentication, Memory Protection, Resource Protection, Control Flow Mechanisms, Isolation, Security Functionalities in Some Operating Systems, Trusted Computer
System, Evaluation Criteria

T1:Ch2,3,4

Module-3:	8 Hrs

Security Software Design: Introduction, A Methodological Approach to Security, Software Design, Secure Operating System Design, Secure DBMS Design, Security Packages, Database Security Design

T1:Ch5,6

Module-4:	8 Hrs

Statistical Database Protection & Intrusion Detection Systems: Introduction, Statistics, Concepts and Definitions, Types of Attacks, Inference Controls, evaluation Criteria for Control Comparison, Introduction IDES System, RETISS System, ASES System Discovery.

T1:Ch7,8

Module-5:	8Hrs

Models For The Protection Of New Generation Database Systems1: Introduction, A Model for the Protection of Frame Based Systems, A Model for the Protection of

Object-Oriented Systems, SORION Model for the Protection of Object-Oriented Databases. Models For The Protection Of New Generation Database Systems 2: A Model for the Protection of New Generation Database Systems, the Orion Model, Jajodia and Kogan's Model, A Model for the Protection of Active Databases Conclusions T1:Ch9,10	

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub- questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.

The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

TEXT BOOKS

1. Database Security and Auditing Hassan A. Afyoun CENGAGE Learning 2009
2. Database Security Castano Pearson Education

REFERENCE BOOKS

1 Database security Alfred Basta, Melissa Zgola CENGAGE learning

web content: https://youtu.be/2YIhzk7tJI8

https://webuyusedtape.net/2022/08/11/why-data-security-is-important-in- dbms%EF%BF%BC/

web content: https://youtube/NdsP0yM1yTo

web content: https://www.howtonetwork.com/technical/security-technical/intrusion_detection_and_prevention/

Web links and Video Lectures (e-Resources):https://intellipaat.com/blog/importance-of-data-security/
https://www.youtube.com/watch?v=HBEw6eUzDSs
https://www.youtube.com/watch?v=D17lWqHy_3I
https://www.youtube.com/watch?v=6xedgVwYuAg&list=PLhPyEFL5u-i0XXGLJawaTNLiXxmSp24TR

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical – activities which will enhance their skill.

Course outcome (Course Skill Set)

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

SI.No.	Description	Blooms Level
CO1	Apply foundational concepts of database security and various security control mechanisms to mitigate vulnerabilities in database systems.	L3
CO2	Analyze classical and contemporary security models (e.g., Bell-LaPadula, Biba, Lattice) to assess their effectiveness in protecting database systems.	L4
CO3	Evaluate secure design principles in software and operating systems to develop robust database security architectures.	L5
CO4	Analyze statistical database protection methods and intrusion detection systems to prevent inference attacks and unauthorized access.	L4
CO5	Evaluate advanced security models for protecting object-oriented, active, and next-generation database systems in modern computing environments.	L5

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2										
CO2				3							
CO3					3						
CO4										3	
CO5	1				3						

High-3, Medium-2, Low-1

Semester: II		
BUSINESS INTELLIGENCE AND ANALYTICS		
Course Code:	MVJSAD251	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course objectives :This course will enable students to

- Be exposed with the basic rudiments of business intelligence system.
- Explore the modelling aspects behind Business Intelligence.
- Perceive the business intelligence life cycle and the techniques used in it.
- Be exposed with different data analysis tools and techniques.

Module-1:	8 Hrs
BUSINESS INTELLIGENCE Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence. T1:Ch1,2,14	
Module-2:	**8 Hrs**
KNOWLEDGE DELIVERY The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message. T1:Ch10,11	
Module-3:	**8 Hrs**
EFFICIENCY Efficiency measures – The CCR model: Definition of target objectives- Peer groups – Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis, outlier analysis T1:Ch6,7	
Module-4:	**8 Hrs**
BUSINESS INTELLIGENCE APPLICATIONS Marketing models – Logistic and Production models – Case studies. T1:Ch3,13	
Module-5:	**8Hrs**
FUTURE OF BUSINESS INTELLIGENCE: Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text	

Analytics – Advanced Visualization – Rich Report, Future beyond Technology. T1:Ch12 T2	

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub- questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.

The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

1. *Decision Support and Business Intelligence Systems*, Efraim Turban, Ramesh Sharda, Dursun Delen, , 9 th Edition, Pearson 2013.
2. *Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making*, Larissa T. Moss, S. Atre, Addison Wesley, 2003.

Reference Books:

1. *Business Intelligence: Data Mining and Optimization for Decision Making*, Carlo Vercellis ,Wiley Publications, 2009.
2. *Business Intelligence: The Savvy Manager's Guide*, David Loshin Morgan, Kaufman Second Edition, 2012.
3. *Successful Business Intelligence: Secrets to Making BI a Killer App*, Cindi Howson, McGraw- Hill, 2007.
4. *The Data Warehouse Lifecycle Toolkit*, Ralph Kimball , Margy Ross , Warren

Thornthwaite, Joy Mundy, Bob Becker, , Wiley Publication Inc.,2007

Web links and Video Lectures (e-Resources):

- https://data-flair.training/blogs/business-intelligence/
- https://www.tutorialspoint.com/management_information_system/business_intelligence_system.htm

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

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

Sl. No.	Description	BloomsLevel
CO1	Apply business intelligence concepts and architectures to support effective and timely decision-making using data-driven models.	L3
CO2	Analyze knowledge delivery techniques and visualization tools to tailor insights for different user types and reporting needs.	L4
CO3	Analyze efficiency measurement models and pattern recognition techniques such as clustering and outlier analysis in BI systems.	L4
CO4	Evaluate business intelligence applications in real-world domains like marketing and logistics through case-based analysis.	L5
CO5	Evaluate emerging trends and future technologies in business intelligence, including machine learning, text analytics, and advanced visualization tools.	L5

CO PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3										
CO2	2				2					1	
CO3			2		3						
CO4	3				2						
CO5	2		3								1

Assessment Details (both CIE and SEE)

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

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks** or **one Skill Development Activity of 50 marks** to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub- questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Semester: II		
ADVANCED DATABASE MANAGEMENT SYSTEM		
Course Code:	MVJSAD252	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course Learning objectives:

- Strong foundation in advanced database concepts from an industry perspective.
- The database management system contributes with advanced data modelling concepts like OOD Modelling and ORD Modelling.
- The advanced database system arranges query processing and transaction management concepts for object-relational database and distributed database.

Module-1	
Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, anomalies, dealing with constraint violations, Types and violations. Object and Object- Relational Databases: Overview of Object Database Concepts, Object Database Extensions to SQL, The ODMG Object Model and the Object Definition Language ODL, Object Database Conceptual Design, The Object Query Language OQL, Overview of the C++ Language Binding in the ODMG Standard.	
Teaching-Learning Process	Chalk and Talk/ PPT / Web resources
	T1: Ch3,5,11,12

Module-2	
Disk Storage, Basic File Structures, Hashing, and Modern Storage Architectures: Introduction, Secondary Storage Devices, Buffering of Blocks, Placing File Records on Disk Operations on Files, Files of Unordered Records (Heap Files), Files of Ordered Records (Sorted Files), Hashing Techniques, Other Primary File Organizations, Parallelizing Disk Access Using RAID Technology, Modern Storage Architectures. Distributed Database Concepts: Distributed Database Concepts, Data Fragmentation, Replication, and Allocation Techniques for Distributed	
Teaching-Learni ng Process	Chalk and Talk/ PPT / Web resources

	T2:Ch16,17,23
Module-3	
NOSQL Databases and Big Data Storage Systems: Introduction to NOSQL Systems, The CAP Theorem, Document- Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j. Big Data Technologies Based on MapReduce and Hadoop: What Is Big Data? Introduction to MapReduce and Hadoop, Hadoop Distributed File System (HDFS), MapReduce: Additional Details Hadoop v2 alias YARN, General Discussion.	
Teaching-Learning Process	Chalk and Talk/ PPT / Web resources
	T2:Ch24 , T3: ch20
Module-4	
Enhanced Data Models: Introduction to Active, Temporal, Spatial, Multimedia, and Deductive Databases: Active Database Concepts and Triggers, Temporal Database Concepts, Spatial Database Concepts, Multimedia Database Concepts, Introduction to Deductive Databases. Introduction to Information Retrieval and Web Search:Information Retrieval (IR) Concepts, Retrieval Models, Types of Queries in IR Systems, Text pre-processing, Inverted Indexing, Evaluation Measures of Search relevance, web Search and Analysis. Trends in Information Retrieval	
Teaching-Learning Process	Chalk and Talk/ PPT / Web resources
	T1 Ch26,27
Module-5	
Data Mining Concepts: Overview of Data Mining Technology, Association Rules, Classification, Clustering, Approaches to Other Data Mining Problems, Applications of Data Mining, Commercial Data Mining Tools. Overview of Data Warehousing and OLAP: Introduction, Definitions, and Terminology, Characteristics of Data Warehouses, Data Modelling for Data Warehouses, building a Data Warehouse, Typical Functionality of a Data Warehouse, Data Warehouse versus Views, Difficulties of Implementing Data Warehouses.	
Teaching - Learning Process	Chalk and Talk/ PPT / Case Study: https://www.researchgate.net/publication/47393965_Data_warehousing_and _data_mining_A_case_ study
	T1:Ch 28,29

Assessment Details (both CIE and SEE)

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

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks** or **one Skill Development Activity of 50 marks** to attain the COs and POs The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. Fundamentals of Database Systems,Elmasri and Navathe, Pearson Education2013.
2. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill, 3rd Edition, 2013.
3. Database System Concepts, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw Hill, 6th Edition, 2010.

Web links and Video Lectures (e-Resources):

1. https://link.springer.com/book/10.1007/978-3-7091-2704-9
2. https://www.youtube.com/watch?v=ywTn9qHyI9I
3. https://www.youtube.com/watch?v=_qbKMdqQS6E
4. https://www.youtube.com/watch?v=PqPkYmRSQ_w
5. https://www.researchgate.net/publication/47393965_Data_warehousing_and_data_mining_A _case_study

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

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

Course outcome (Course Skill Set)		
Sl. No.	Description	Blooms L
CO1	Apply relational and object-relational database concepts to design and manipulate structured data models effectively.	L3
CO2	Analyze storage and file structures, including hashing and distributed database techniques, to optimize data retrieval and system performance.	L4
CO3	Analyze the characteristics and design of NoSQL databases and big data frameworks such as Hadoop and MapReduce for scalable data processing.	L4
CO4	Evaluate advanced data models and information retrieval systems for their effectiveness in handling diverse and complex data types.	L5
CO5	Evaluate data mining techniques and data warehousing architectures for decision- making and knowledge discovery in large datasets.	L5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		3	3								
CO2			2	2							
CO3		3	3								
CO4		2									
CO5			2	1							

Semester: II		
CLOUD COMPUTING		
Course Code:	MVJSAD253	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course Learning objectives:

- Discuss the concepts, characteristics, delivery models and benefits of cloud computing.
- Explore the key technical, organizational and compliance challenges of cloud computing.
- Grasp the concepts of virtualization efficiently.
- Explore the security issues that arise from cloud computing architectures intended for delivering Cloud based enterprise IT services.

Module-1	8 Hours

Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open- source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

Teaching-Learning Process	Chalk and talk/PPT/case study/web content

T1: Ch1,2,3,4,10

Module-2	8 Hours

Cloud Computing: Application Paradigms.: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High- performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

Teaching-Learning Process	Chalk and talk/PPT/case study/web content
	T1: Ch5,8 T2: Ch14,15

Module-3	8 Hours
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems	
Teaching-Learning Process	Chalk and talk/PPT/case study/web content
	T1: Ch 6,7,11

Module-4	8 Hours
Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two- level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems	
Teaching-Learning Process	Chalk and talk/PPT/case study/web content
	T1: Ch9,12,13

Module-5	8 Hours
Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.	
Teaching-Learning Process	Chalk and talk/PPT/case study/web content
	T1:Ch14,15,16 T3:Ch6

Assessment Details (both CIE and SEE)

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

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks** or **one Skill Development Activity of 50 marks**
   to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub- questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. *Cloud Computing:Theory and Practice,* Dan C Marinescu Elsevier (MK), 2013.
2. *Computing Principles and Paradigms,* RajkumarBuyya , James Broberg, Andrzej Goscinsk,i Willey, 2014.
3. *Cloud Computing Implementation*, Management and Security John W Rittinghouse, James F Ransome, CRC Press, 2013.

Web links and Video Lectures (e-Resources):

- https://www.javatpoint.com/cloud-computing-tutorial
- https://www.tutorialspoint.com/cloud_computing/index.htm
- https://www.digimat.in/nptel/courses/video/106105167/L01.html (**Video Lectures**)

Skill Development Activities Suggested

- The students with the help of the course teacher can take up relevant technical – activities which will enhance their skill.

Course outcome (Course Skill Set)

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

S.NO	Description	Bloom's Level	POS
CO1	Understand **cloud computing fundamentals**, including delivery models, ethical concerns, vulnerabilities, and service providers.	L2	PO2, PO6, PO12, PSO1
CO2	Analyze **cloud computing applications, resource virtualization, workflows, and security challenges** in computing environments.	L3	PO3, PO5, PO6
CO3	Apply **cloud resource management techniques, scheduling algorithms, and virtualization optimization** to enhance efficiency.	L4	PO4, PO5, PO7, PO8, PSO2
CO4	Develop **secure cloud applications and adaptive cloud-based solutions** integrating trust models and privacy protocols.	L5	PO10, PO11, PSO1, PSO2

CO PO MAPPING

COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	P
CO1	3	2				3						3	2	
CO2	3	3	2		3	3						3		3
CO3				3	2		3	3						2
CO4	3		3		3				3	3	2		3	3

High-3, Medium-2, Low-1

Semester: II		
HEALTH CARE DATA ANALYTICS		
Course Code:	MVJSAD254	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Course Learning objectives:

- Data analytics promote the sharing of information and to ensure that the resultant insight and information is clearly defined and consistently interpreted throughout the HCO.
- The analyses investigate methods of improving the provision of clinical care, enhancing disease prevention, and measuring the effectiveness of various treatment options

Module-1	8 Hours
An Introduction to Healthcare Data Analytics, Electronic Health Records-A survey: Components of HER, Coding Systems, Benefits of HER, Barrier to Adopting HER Challenges, Phenotyping Algorithms.	
Teaching-Learning Process	Chalk and Talk/ PPT/ Web resources : https://www.fsm.ac.in/bigdata/csha.pdf
Module-2	8 Hours
Biomedical Image Analysis, Mining of Sensor Data in Healthcare, Biomedical Signal Analysis.	
Teaching-Learning Process	Chalk and Talk/ PPT/ Web resources : https://www.fsm.ac.in/bigdata/csha.pdf
Module-3	8 Hours
Natural Language Processing and Data Mining for Clinical Text, Mining the Biomedical.	
Teaching-Learning Process	Chalk and Talk/ PPT/ Web resources : https://www.fsm.ac.in/bigdata/csha.pdf
Module-4	8 Hours
Advanced Data Analytics for Healthcare: Review of Clinical Prediction Models, Temporal Data Mining for Healthcare Data, Visual Analytics for Healthcare, Privacy, Preserving Data Publishing Methods in Healthcare.	
Teaching- Learning Process Chalk and Talk/ PPT / Web resources : https://www.managedhealthcareexecutive.com/view/advanced-analytics-an-	

essential-tool-for- value- based-care-success

Module-5	8 Hours

Applications and Practical Systems for Healthcare: Data Analytics for Pervasive Health-Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer Assisted Medical Image Analysis Systems

Teaching-
Learning Process
Chalk and Talk/ PPT / Web resources : https://www.fsm.ac.in/bigdata/csha.pdf

Course outcome (Course Skill Set)
At the end of the course the student will be able to :

S.NO	Description	Bloom's Level	POS
CO1	Understand **healthcare data analytics concepts**, electronic health records, and phenotyping algorithms.	L2	PO1, PO2, PO6, PO12, PSO1
CO2	Apply **NLP, data mining techniques, and advanced analytics for healthcare prediction models**.	L3	PO1, PO2, PO3, PO5, PO6, PO12, PSO2
CO3	Analyze **biomedical image processing, sensor data mining, and signal analysis** in healthcare applications	L4	PO3, PO4, PO5, PO7, PO8, PSO2
CO4	Develop **practical healthcare systems integrating fraud detection, clinical decision support, and AI-driven medical imaging solutions**.	L5	PO10, PO11, PSO1, PSO2

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks** or **one Skill Development Activity of 50 marks** to attain the COs and POs The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks

scored will be proportionately reduced to 50.

2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub- questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.

The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Healthcare data analytics, Chandan K. Reddy and Charu C Aggarwal, Taylor & Francis 1 st Edition, 2015
2. Healthcare Analytics: From Data to Knowledge to Healthcare Improvement, Hui Yang and Eva K. Lee, Wiley 2016

Web links and Video Lectures (e-Resources):

1. https://www.fsm.ac.in/bigdata/csha.pdf

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

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

COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2				3						3	2	
CO2	3		3		2	3						3		2
CO3			3	3	2		3	2						3
CO4	3		2		3				3	2	3		3	2

High-3, Medium-2, Low-1

Semester: II		
MINI PROJECT WITH SEMINAR		
Course Code:	MVJSAD27	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	26P	SEE Duration: 3 Hrs.

Course objectives:

- To support independent learning and innovative attitude.
- To guide to select and utilize adequate information from varied resources upholding ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgment, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Mini-Project: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the
project report as per the norms avoiding plagiarism.

Course outcomes:

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

- Present the mini-project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills.
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

CIE procedure for Mini - Project:

The CIE marks awarded for Mini - Project, shall be based on the evaluation of Mini - Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.The marks awarded for Mini - Project report shall be the same for all the batch mates.

Semester End Examination

SEE marks for the mini-project shall be awarded based on the evaluation of Mini-Project

Report, Presentation skill and Question and Answer session in the ratio 50:25:25 by the examiners appointed by the University.

CO PO MAPPING

COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2				3						3	2	
CO2	2	3	3		3	2						3		3
CO3			3	3	2		2	3						3
CO4	3		3						3	3	3		3	2

High-3, Medium-2, Low-1

Semester: II		
Big Data Analytics Laboratory		
Course Code:	MVJSADl28	CIE Marks: 50
L: T:P:S	0:2:0:0	SEE Marks: 50
Credits:	2	Total :100
Hours:	26P	SEE Duration: 3 Hrs.

Course objectives:

- Practice java concepts required for developing map reduce programs.
- Impart the architectural concepts of Hadoop and introducing map reduce paradigm.
- Practice programming tools PIG and HIVE in Hadoop eco system.
- Implement best practices for Hadoop development.

Sl.NO	Experiments	
	• Install VMWare to setup the Hadoop environment and its ecosystems. • Implement the basic commands of LINUX Operating System – File/Directory creation, deletion, update operations.	
1	Implement the following file management tasks in Hadoop: i. Adding files and directories ii. Retrieving files iii. Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities	2Hours
2	Run a basic word count Map Reduce program to understand Map Reduce Paradigm.	2Hours
3	Write a Map Reduce program that mines weather data. Hint: Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented.	2Hours
4	Implement matrix multiplication with Hadoop Map Reduce	2Hours
5	Run the Pig Latin Scripts to find Word Count.	2Hours
6	Run the Pig Latin Scripts to find a max temp for each and every year.	2Hours
7	Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.	2Hours

Course outcomes (Course Skill Set):

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

- Professional Skills: The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.
- Problem-Solving Skills: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.
- Successful Career and Entrepreneurship: The ability to employ modern computer languages,
  environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40%of maximum marks in the semester-end examination (SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

Continuous Internal Evaluation (CIE):

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks** or **one Skill Development Activity of 50 marks** to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal
/external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by Examiners. General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%,

Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero. The duration of SEE is 03 hours

Semester: II		
SKILL ENHANCEMENT FOR RESEARCH EXCELLENCE-1 (Online)		
Course Code:	MVJSAD258	CIE Marks: 50
L: T:P:S	0:2:0:0	SEE Marks: 50
Credits:	1	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Courses preferred for skill enhancement :

Python essentials and libraries for data science
Master coding and emerging technologies or
Fullstack development bootcamp
Cloud architecture or cyber security, ethical and risk assessment.
Programming Combo Skill Program or Master Excel Data Analysis and Visualization

(VTU online skill enhancement courses are preferred)

The M.Tech Research Skills Development program equips students with essential skills for successful research and publication, including understanding research fundamentals, conducting literature reviews, selecting appropriate methodologies, writing proposals and papers, analyzing data, presenting findings, adhering to ethical standards, and engaging in networking and collaboration, culminating in the effective publication of only 1 research article to Scopus-indexed conferences.

Course objectives:

- To produce high-quality research papers that meet the standards of international conferences or peer-reviewed journals.
- To effectively identify suitable journals for publication based on the scope and impact of research findings.
- To demonstrate proficiency in writing and structuring research papers according to academic conventions.
- To engage in the peer review process, providing and receiving constructive feedback to enhance research quality.
- To develop skills for presenting research at conferences, including crafting effective abstracts and posters.
- To cultivate a strong understanding of ethical considerations in research and publication practices.
- To utilize citation management tools to organize references and ensure proper attribution in publications.
- To enhance collaboration skills for co-authoring papers and working within research teams.
- To stay informed about current trends and advancements in the field to ensure relevance in publications.
- To refine the ability to respond to reviewer comments and revise manuscripts effectively.
- To understand the importance of open access and alternative publication models in disseminating research.
- To build a professional network that supports research collaborations and publication opportunities.

Guidelines for Research paper preparation: Each student in a group of two members shall actively participate in carrying out the research work jointly, in constant consultation with the internal guide, mentors or co-guide, and external guide. They must prepare the project report as per the prescribed norms while ensuring plagiarism is avoided. A research group can have a maximum of two members.

1. Understanding Research Fundamentals
   - Definition of Research: Understand what constitutes research and its significance in technology and engineering.
   - Types of Research:

Basic Research: Focused on gaining comprehensive knowledge without immediate applications.

Applied Research: Aimed at solving specific problems.

Literature Review

- Conducting a Literature Survey:

Identify relevant academic papers, journals, and conference proceedings. Summarize key findings and methodologies from existing literature.

- Critical Analysis:
  Evaluate the strengths and weaknesses of existing research. Identify gaps in the literature that your research can address.

2. Research Methodology
   - Selecting a Research Topic:
     Choose a topic that aligns with your interests and current trends in technology.
   - Research Design:
     Decide on qualitative, quantitative, or mixed methods based on your research objectives.
   - Data Collection Techniques:
     Surveys, interviews, experiments, and simulations.
3. Writing Research Proposals
   - Structure of a Proposal:
     Introduction, Literature Review, Methodology, Expected Outcomes, and References.
   - Proposal Presentation:
     Practice presenting your proposal to peers and faculty for feedback.
4. Data Analysis
   - Statistical Tools:
     Familiarize yourself with tools like MATLAB, R, or Python for data analysis.
   - Interpreting Results:
     Learn to draw meaningful conclusions from your data and relate them back to your research questions.
5. Writing Research Papers
   - Structure of a Research Paper:
     Abstract, Introduction, Methodology, Results, Discussion, Conclusion, and References.
   - Academic Writing Skills:
     Focus on clarity, coherence, and proper citation of sources.
   - Peer Review Process:
     Understand the importance of peer review and how to respond to reviewers' comments.
6. Presentation Skills
   - Effective Communication:
     Develop skills to present your research findings clearly and confidently.
   - Use of Visual Aids:
     Incorporate slides, charts, and graphs to enhance your presentations.
7. Ethical Considerations in Research
   - Understanding Ethics:
     Familiarize yourself with ethical guidelines related to research

involving human subjects, data privacy, and plagiarism.

- Responsible Conduct of Research:
  Promote integrity and accountability in your research practices.

Submitting Manuscripts to Scopus-Indexed Conferences or Web of Science or Proceedings /Book Chapters

1. Identify Relevant Conferences
   - Research Scopus-Indexed Conferences:
     Use platforms like Conference Alerts, IEEE Xplore, or the Scopus website to find conferences in your field.
   - Check Conference Indexing:
     Ensure that the conference is indexed in Scopus by checking its official website or the Scopus database.
2. Prepare Your Manuscript
   - Follow Conference Guidelines:
     Each conference has specific formatting and submission guidelines. Adhere to these requirements.
   - Structure of the Manuscript:
     Title, Abstract, Introduction, Methodology, Results, Discussion, Conclusion and References.
   - Language and Clarity:
     Use clear and concise language. Consider having your manuscript proofread by peers or professionals.
   - Submission of manuscript, Registration and Presentation finally Publication

Course outcomes:

- At the end of the course the student will be able to:
- Produce High-Quality Research Papers: Create research papers that meet international conference and peer- reviewed journal standards.
- Identify Suitable Journals: Effectively select appropriate journals for publication based on research scope and impact.
- Proficiency in Writing: Demonstrate skill in writing and structuring research papers according to academic conventions.
- Engage in Peer Review: Actively participate in the peer review process by providing and receiving constructive feedback.
- Develop Presentation Skills: Acquire skills for presenting research at conferences, including crafting effective abstracts and posters.
- Understand Ethical Considerations: Cultivate a strong understanding of ethical issues in research and publication practices.
- Utilize Citation Management Tools: Use citation management tools to organize references and ensure proper attribution.
- Respond to Reviewer Comments: Refine the ability to address reviewer comments and revise manuscripts effectively.

The assessment for **Skill Enhancement for Research Excellence** will be divided

into **Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), each carrying 50 marks.**

Continuous Internal Evaluation (CIE) – 50 Marks

CIE shall be conducted **weekly** and will be assessed based on:

- **Base Papers Referred & Review** – 10 Marks
- **Presentations on Proposed Concepts** – 15 Marks
- **Preparation of Conference Papers (Preferably Scopus Indexed or Reputed Conferences)** – 25 Marks

Semester End Examination (SEE) – 50 Marks

- The SEE examiner may be appointed from the same college for evaluation.
- The candidate must present their research work before the examiner.
- Mandatory requirement: The candidate must have submitted a paper to a conference or accepted or presented at a reputed conference.
- Marks will be awarded based on:
- Research Presentation Quality – 25 Marks
- Clarity of Concept & Methodology – 15 Marks
- Conference Submission & Acceptance/Presentation – 10 Marks

III SEMESTER

Semester: III		
(Online Courses) 12 weeks duration (Online)		
Course Code:	MVJSAD31/32/33/34	CIE Marks: 50
L: T:P:S	3:0:0:0	SEE Marks: 50
Credits:	3	Total :100
Hours:	40L	SEE Duration: 3 Hrs.

Online VTU courses like

Artificial Intelligence and Machine Learning

Artificial Intelligence: Knowledge Representation And Reasoning
Introduction to Machine Learning
Machine Learning for Engineering and Science Applications
Deep Learning
Reinforcement Learning
Optimization for Machine Learning: Theory and Implementation
Natural Language Processing
Introduction to Large Language Models (LLMs)
Introduction To Soft Computing
AI: Constraint Satisfaction

Data Science and Analytics

Data Science for Engineers
Python for Data Science
Business Intelligence & Analytics
The Joy of Computing using Python
Programming, Data Structures And Algorithms Using Python
Data Analytics with Python etc

AI/Data Science Adjacent Topics (Security, Cloud, Systems)

Cloud Computing
Cloud Computing and Distributed Systems
Foundation of Cloud IoT Edge ML
Blockchain and its Applications
Information Security - 5 - Secure Systems Engineering
Privacy and Security in Online Social Media
Secure Computation: Part I
Systems and Usable Security