MVJCE CURRICULUM

FOR

M.Tech Computer Science and Engineering
(2024 Scheme)

I
SEMESTER

Course Title	**Artificial Intelligence**	**Semester**	**I**
Course Code	**MVJSCS11**	**CIE**	**50**
Total No. of Contact Hours	**3:0:2**	**SEE**	**50**
No. of Contact Hours/week	**30**	**Total**	**100**
Credits	**3**	**Exam. Duration**	**3 Hours**

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).**

- 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:

CO1	Explain the foundational concepts of artificial intelligence, including its history, types, and key problem-solving techniques.
CO2	Apply knowledge representation and reasoning techniques to solve complex problems in AIsystems.
CO3	Implement machine learning algorithms and evaluate their performance in real-worldapplications.
CO4	Explore the principles and applications of natural language processing and robotics to enhancehuman-computer

	interaction.
CO5	Understanding the Ethical and Societal Implications of AI

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 theOutcome 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 eachmodule.
- 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):

- https://cs221.stanford.edu
- https://www.kaggle.com/learn/machine-learning
- 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

Program outcomes

Sl. No.	Description	POs
1	Demonstrate the ability to independently conduct research and development work to address practical engineering problems.	PO1
2	Develop and deliver comprehensive technical presentations that effectively convey complex information to diverse audiences.	PO2
3	Exhibit mastery in the specialized study area, surpassing the requirements of a relevant bachelor's program.	PO3
4	Analyze engineering problems critically and apply appropriate techniques, skills, and modern tools to developinnovative solutions.	PO4
5	Collaborate effectively in teams while also functioning independently, recognizing opportunities for career advancement and research.	PO5

	6	Cultivate a proactive approach to continuous learning and professional development in response to evolving technologicall and scapes.	PO6

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

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2			2		
CO2			2	2	2	
CO3		2				
CO4	2					2
CO5			2			

Course Title	Data Science and Management	Semester	I
Course Code	MVJSCS12	CIE	50
Total No. of Contact Hours	3:0:2	SEE	50
No. of Contact Hours/week	30	Total	100
Credits	03	Exam. Duration	03

Course Learning objectives:

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

Apply statistical methods and data analysis techniques to interpret and draw insights from complexdatasets.

Implement various machine learning algorithms and assess their performance using appropriateevaluation metrics in real-world scenarios.

Utilize data visualization tools and techniques to effectively communicate findings and insights todiverse 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 inEngineering , 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)

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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 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:

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

Course outcomes:	
CO1	To familiarize the student with the basic taxonomy and terminology.
CO2	Develop programs related to error detection, CRC-CCITT, distance vector algorithm etc
CO3	Know how network delivers the packets to destination network
CO4	Know how switch happing between mobile towers and Functions of mobile networks
CO5	Guess the problems in audio/video transfer through network

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

- 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	Explore the foundational concepts of data science, history, significance, and process.	L3
CO2	Apply statistical methods and data analysis techniques to interpret and draw insights from complex datasets.	L3
CO3	Implement various machine learning algorithms and assess their performance using appropriate evaluation metrics in real-world scenarios.	L2
CO4	Utilize data visualization tools and techniques to effectively communicate findings and insights to diverse audiences.	L4

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2			2		
CO2			2	2	2	
CO3		2		2	2	
CO4	2					2

Course Title	Data Structures & Algorithms for Problem Solving	Semester	I
Course Code	MVJSCS13	CIE	50
Total No. of Contact Hours	2:0:2	SEE	50
No. of Contact Hours/week	30	Total	100
Credits	03	Exam. Duration	03

Course Learning Objectives:

- To reduce development time and the resources required to maintain existing applications.

1. To increase code reuse and provide a competitive advantage through effective use of data structuresand 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

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:	
CO1	Explain the concepts of search tree models and types and key problem solving techniques
CO2	Understand and implement tree structures for managing sets of intervals, including interval trees, segment trees, and trees for the union of intervals.
CO3	Evaluate the time complexity and performance of heap-based algorithms, especially for large-scale systems.
CO4	Apply efficient FFT algorithms and optimizations to large-scale problems in scientific computing, real-time applications, and multimedia processing.
CO5	Solve problems using text processing and different algorithms.

Textbooks:

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

PO2	PO 3	PO 4	PO 5	PO 6
		2		
	2		2	

2				
			1	
				1

High-3, Medium-2, Low-1

Course Title	Internet of Things	Semester	I
Course Code	MVJSCS14	CIE	50
Total No. of Contact Hours	2:0:2	SEE	50
No. of Contact Hours/week	40	Total	100
Credits	04	Exam. Duration	03

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.

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

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

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.

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.

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. 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

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2			2		
CO2			2	2	2	
CO3		2				
CO4	2					2
CO5			2			

Course Title	COMPUTER VISION	Semester	1
Course Code	MVJSCS15	CIE	50
Total No. of Contact Hours	3	SEE	50
No. of Contact Hours/week	30	Total	100
Credits	03	Exam. Duration	03

Course Objectives:

1. To impart the knowledge on image processing, segmentation and morphological operations on images.
2. To develop the ability to apprehend and implement various object identification, multi-camera views and depth estimation techniques.
3. To facilitate students to comprehend on various pattern and motion analysis schemes for machine vision applications.

Module-1

Fundamentals of Image Processing and Enhancement:

Image Formation physics, Image Digitization - Sampling and Quantization, Digital Image Properties, Pixel relationship, Image Enhancement- Spatial filtering

Module-2

Frequency domain, Multiresolution Analysis and Depth estimation and Multi-camera views:

Frequency Domain filtering, Image transforms - Frequency domain transformations - OCT, OFT, FFT, DWT - Haar Wavelet - Multiresolution analysis - Scale-invariant features.

Perspective, Binocular Stereopsis: Image Fusion, Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto- calibration

.

Module-3

Image Segmentation and Morphological operations: Thresholding - Edge Based Segmentation - Region Based Segmentation- Active Contour Models. Dilation and Erosion - Opening, Closing - Hit or Miss Transform-Thinning-Thickening-Skeletons and object marking

Module-4

Object Detection and motion analysis :Detection of known objects by linear filters - Detection of unknown objects - The Hough transform for the detection of lines - Corner detection. Surface Descriptions, Shape from Contours, Shape from Shading, Shape from Texture.

Motion analysis: Optical Flow - Detection and Correspondence of Interest Points - Detection of Motion Patterns - Video Tracking - Motion Models to aid tracking: Kalman Filters

Module-5

Pattern analysis: Clustering - K-Means - K-Medoids - Mixture of Gaussians, Classification - Discriminant Function,Linear Discriminant Analysis (LDA) and Quadratic Discriminant Analysis (QDA).**F1/FP algorithm,Generative Adversarial Networks (GANs)** Supervised, Un-supervised, Semi-supervised;

Classifiers - Bayes - KNN - ANN models; Application in Defect Analysis

Course Outcomes

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

1. Understanding of the fundamental principles and techniques of image processing and enhancement
2. Understanding of frequency domain filtering, multiresolution analysis, depth estimation, and multi-camera views.
3. Analyze images for diverse applications, enhancing their ability to process and interpret visual information effectively.
4. Analyze objects and motion in various types of images and video sequences.
5. Apply these techniques in various real-world applications,

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) fromeach 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

Text Books

1.Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th Edition, Cengage Learning, USA, 2014

2.Jurgen Beyerer, Fernando Puente Leon, Christian Frese,"Machine Vision Automated Visual Inspection: Theory, Practice and Applications", 2016, Springer.
2.Jurgen Beyerer, Fernando Puente Leon, Christian Frese,"Machine Vision Automated Visual Inspection: Theory, Practice and Applications", 2016, Springer.
3.Pattern Recognition and Machine Learning" by Christopher M. Bishop
Reference Books:
1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing (4th Edition), 2018. Computer Vision, A modern Approach by Forsyth and Ponce, Pearson Education, 2003
2. R. Szeliski, "Computer vision: algorithms and applications", ISSN 1868-095X, 2nd Edition.Springer Nature Switzerland AG, 2022.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2			2		
CO2	2		2			
CO3		2				
CO4	2					2
CO5			2	2		

Course Title	ALGORITHMS & AI LABORATORY	Semester	I
Course Code	MVJSCSL16	CIE	40
Total No. of Contact Hours	0:0:2	SEE	60
No. of Contact Hours/week	20	Total	03
Credits	2	Exam. Duration	3 Hours

Credits – 2

Course Learning Objectives: This course MSCSL16 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.

Programs List:

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

Laboratory Outcomes: The student should be able to:

Implement and demonstrate AI algorithms.
Evaluate different algorithms.

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

Course Title	Research Methodology and IPR	Semester	I
Course Code	MVJSCS17	CIE	-
Total No. of Contact Hours	3:0:0	SEE	-
No. of Contact Hours/week	-	Total	-
Credits	-	Exam. Duration	-

Course Learning Objectives:

- Introduce various technologies for conducting research.
- Choose an appropriate research design for the chosen problem.
- Explain the art of interpretation and the art of writing research reports.
- Explore the various forms of intellectual property, its relevance and business impact in the changing global businessenvironment.
- Discuss leading International Instruments concerning Intellectual Property Rights

Module-1:	8 Hours

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration

Module-2:	8 Hours

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developinga theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

Module-3:	8 Hours

Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.

Module-4:	8 Hours

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit,Cautions in Using Chi Square Tests

Module-5:	8 Hours

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS

Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing,

Text Books:

Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International, 4th Edition,2018...

Research Methodology a step-by-step guide for beginners. RanjitKumar, SAGE Publications, 3rd Edition, 2011

Reference Books:

Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005.
Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009.

Research Methodology a step-by-step guide for beginners .Ranjit Kumar, SAGE Publications, 3rd Edition, 2011

Course outcome (Course Skill Set)

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

Sl. No.	Description
CO1	Identify and Conduct research independently in suitable research field.
CO2	Choose research designs, sampling designs, measurement and scaling techniques and also different meth data collection.
CO3	Explore the Precautions in interpreting the data and drawing inferences.

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1		**x**		**x**		
CO2		**x**	**x**			
CO3					**x**	