SCHEME OF INSTRUCTION AND EXAMINATION
Minor in AIML

SNo	Course Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Examination			Credits	**To be offered Semester**
			L	**T**	**P**		**Hrs**	**CIE**	**SEE**		
Theory											
1	MR501CS	Principles of Data Engineering with Python	3	0	-	3	3	40	60	3	**V**
2	MR601CS	Machine Learning	3	0	-	3	3	40	60	3	**VI**
3	MR602CS	Artificial Intelligence	3	0	-	3	3	40	60	3	**VI**
4	MR701CS	Natural Language Processing	3	0	-	3	3	40	60	3	**VII**
5	MR702CS	Computer vision	3	0	-	3	3	40	60	3	**VII**
6	MR851CS	Project	0	0	6	6		50	100	3	**VIII**
			15	**0**	**6**	**21**	**15**	**250**	**400**	**18**	

MR501CS	Principles of Data Engineering with Python					
Prerequisites	Database Management Systems		L	T	P	C
			3	0	0	3
Evaluation	CIE	40 Marks	SEE		60 Marks	

Course Objectives :	
1.	To acquire, process, and manage different types of data using Python's file handling tools.
2.	To develop skills to analyze text data with regular expressions and Python's glob module.
3.	To enhance abilities to work with MySQL and MongoDB databases and handle numeric data with NumPy.
4.	To become proficient in using Pandas for data manipulation, including handling missing values and reshaping data.
5.	To master data visualization with PyPlot and Pandas and gain experience with tools like RapidMiner, Orange, SPSS, and Weka.

Course Outcomes : At the end of the course the student will be able to:	
1.	Read, write, and manage various file formats using Python modules for effective data handling.
2.	Process HTML and natural language text and apply regular expressions for pattern matching.
3.	Set up and manage MySQL and MongoDB databases, and handle numeric data with NumPy.
4.	Manipulate and analyze data with Pandas, including reshaping, handling missing values, and file I/O.
5.	Create and customize visualizations with PyPlot and Pandas, and use tools like RapidMiner, Orange, SPSS, and Weka for data analysis.

UNIT – I
Data Science: Data Analysis Sequence, Data Acquisition Pipeline, Report Structure.
Files and Working with Text Data: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Python os and os.pathModules.
Working with Text Data: JSON and XML in Python.

UNIT – II
Working with Text Data: Processing HTML Files, Processing Texts in Natural Languages.
Regular Expression Operations: Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions, Regular Expression with *glob* Module.

UNIT – III
Working with Databases: Setting Up a MySQL Database, Using a MySQL Database: Command Line, Using a MySQL Database, Taming Document Stores: MongoDB.
Working with Tabular Numeric Data(Numpy with Python): NumPy Arrays Creation Using *array()* Function, Array Attributes, NumPy Arrays Creation with Initial Placeholder Content, Integer Indexing, Array Indexing, Boolean ArrayIndexing, Slicing and Iterating in Arrays, Basic Arithmetic Operations on NumPy Arrays, Mathematical Functions in NumPy, Changing the Shape of an Array, Stacking and Splitting of Arrays, Broadcasting in Arrays.

UNIT – IV
Working with Data Series and Frames: Pandas Data Structures, Reshaping Data, Handling Missing Data, Combining Data, Ordering and Describing Data, Transforming Data, Taming Pandas File I/O.

UNIT – V
Plotting: Basic Plotting with PyPlot, Getting to Know Other Plot Types, Mastering Embellishments, Plotting with Pandas. Use of basic tools like RapidMiner, Orange, SPSS, Weka.

References:	
1.	Data Science Essentials in Python: Collect, Organize, Explore, Predict, Value. Dmitry Zinoriev, The Pragmatic Programmers LLC, 2016
2.	Introduction to Python Programming**.** Gowrishankar S., Veena A. CRC Press, Taylor & Francis Group, 2019

Suggested Readings:	
1.	Python for Everybody: Exploring Data Using Python 3. Charles R Severance, 2016.
2.	Python Data Analytics – Data Analysis and Science using Pandas, matplotlib and the Python Programming Language. Fabio Nelli, Apress, 2015.
3.	Website Scraping with Python. Using BeautifulSoup and Scrapy. GáborLászlóHajba, Apress, 2018.
4.	Machine Learning with Python Cookbook:.Practical Solutions from Preprocessing to Deep Learning. Chris Albon, O'Reilly 2018

MR601CS	MACHINE LEARNING					
Prerequisites	Artificial Intelligence		L	T	P	C
			3	0	0	3
Evaluation	CIE	40 Marks	SEE		60 Marks	

Course Objectives :	
1.	To introduce the basic concepts of machine learning and range of problems that can be handled by machine learning.
2.	To introduce the concepts of instance based learning and decision tree induction
3.	To introduce the concepts of linear separability ,Perceptron and SVM
4.	To learn the concepts of probabilistic inference, graphical models and evolutionary learning
5.	To learn the concepts of ensemble learning, dimensionality reduction and clustering

Course Outcomes : At the end of the course the student will be able to:	
1.	Apply different machine learning techniques.
2.	Select suitable model parameter for different machine learning technique
3.	Design & implement machine learning algorithms to real world applications
4.	Evaluate learning methods to develop the research based solutions in different domains.
5.	Build different clustering models in real time applications.

UNIT – I

Introduction: Learning, Types of Machine Learning, Machine Learning Examples, Decision Tree Learning.

Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm.

Learning with Trees: Decision Tree Learning.

Linear Discriminants: Learning Linear Separators, The Perceptron Algorithm, Margins.

UNIT – II

Estimating Probabilities from Data, Bayes Rule, MLE, MAP.

Naive Bayes: ConditionalIndependence, Naive Bayes: Why and How, Bag of Words.

Logistic Regression: MaximizingConditional likelihood, Gradient Descent.

Kernels: Kernalization Algorithm, Kernalizing Perceptron.

Discriminants: The Perceptron, Linear Separability, Linear Regression.

Multilayer Perceptron (MLP): Going Forwards, Backwards, MLP in practices, Deriving back Propagation.

UNIT – III

Support Vector Machines: Geometric margins, Primal and Dual Forms, Kernalizing SVM. **Generalization & Overfitting:** Sample Complexity, Finite Hypothesis classes, VC Dimension Based Bounds.

Some Basic Statistics: Averages, Variance and Covariance, The Gaussian, The Bias-Variance Tradeoff Bayesian learning: Introduction, Bayes theorem. Bayes Optimal Classifier, Naive Bayes Classifier. **Graphical Models:** Bayesian networks, Approximate Inference, Making Bayesian Networks, Hidden Markov Models, The Forward Algorithm, Monte-Carlo Markov Chains.

UNIT – IV
Model Selection & Regularization: Structural Risk Minimization, Regularization, k-Fold Cross **Validation. Linear Regression:** Linear regression, minimizing squared error and maximizing data Likelihood. **Neural Networks:** Back Propagation. Evolutionary Learning: (Genetic Algorithm)

UNIT – V
Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison. **Dimensionality Reduction:** Linear Discriminant Analysis, Principal Component Analysis. **Interactive Learning:** Active Learning, Active Learning, Common heuristics, Sampling bias, Safe Disagreement Based Active Learning Schemes. **Semi-Supervised Learning:** Semi-supervised Learning, Transductive SVM, Co-training **Reinforcement Learning:** Markov Decision Processes, Value Iteration, and Q-Learning.

References:	
1.	Tom M. Mitchell, Machine Learning, Mc Graw Hill, 1997
2.	Chistopher Bishop, Pattern recognition and Machine Learning, Springer 2006.
3.	Stephen Marsland, Machine Learning - An Algorithmic Perspective, CRC Press, 2009

Suggested Readings:	
1.	Machine Learning using Python, Manaranjan Pradhan, U Dinesh Kumar, Willey Publications.
2.	Machine Learning for Text and Image Data Analysis: Practical Approach with Business Use Cases

MR602CS	ARTIFICIAL INTELLIGENCE					
Prerequisites	Data Structure		L	T	P	C
			3	0	0	3
Evaluation	CIE	40 Marks	SEE		60 Marks	

Course Objectives :	
1.	To learn basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning
2.	To Investigate applications of AI techniques in intelligent agents, expert systems, artificialneural networks and other machine learning models.
3.	To explore the current scope, potential, limitations, and implications of intelligent systems.
4.	To equip with a solid understanding of expert systems, probabilistic reasoning, and fuzzy logic.
5.	To understand neural networks their applications, and the link between connectionist and symbolic AI, with a focus on practical chatbot development.

Course Outcomes : At the end of the course the student will be able to:	
1.	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
2.	Demonstrate awareness and a fundamental understanding of various applications of AItechniques in intelligent agents, expert systems, ANN's and ML models.
3.	Demonstrate ability and limitations and implications on Society.
4.	Design and implement expert systems that manage uncertainty using probabilistic reasoning, Bayesian networks, and fuzzy logic.
5.	Design and apply neural networks, including recurrent and Hopfield networks, and develop chatbots using connectionist AI techniques.

UNIT – I

Introduction to Artificial Intelligence: Introduction, Brief History, Intelligent Systems, foundations of AI, Sub-Areas of AI, Applications, Tic-Tac Game Playing, Development of AI Languages, Current Trends in AI.

Agents: Agents and Environments, Good Behavior: The concept of Rationality, Performance measures, The nature of Environments, The Structure of Agents, Simple agents, Rational agents, problem solving agents, intelligent agents.

UNIT – II

Solving Problem by Searching: Problem-Solving Agents, Searching for Solutions, Uninformed search strategies.

Informed Search and Exploration: Informed Search Strategies, Heuristic Functions, Local-Search Algorithms and Optimization Problems.

Adversarial Search: Games, Optimal Decisions in Games, Alpha-Beta Pruning, Iterative Deepening.

UNIT – III

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Predicate Logic, Logic Programming.

Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Knowledge Representation using Frames.

UNIT – IV
Probabilistic Reasoning Expert System: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert System versus Traditional Systems, Rule-Based Expert Systems. **Uncertainty Measures:** Introduction, Probability Theory, Bayesian Belief Networks. **Fuggy Logic Systems:** Introduction, Crisp Sets, Fuzzy Sets, Fuzzy Terminology, Fuggy Logic Control, Neuro Fuzzy Systems.

UNIT – V
Connectionist Models: Introduction: Hopfield Networks, learning in Neural Networks, Applications of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI and Symbolic AI. **Chatbots.**

References:	
1.	Artificial Intelligence, Saroj Kaushik, Cengage Learning, 2011
2.	Artificial Intelligence, 3rd Edition, Elaine Rich, Kevin Knight, Shivashankar B Nair, Tata McGraw Hill., 2019
3.	Artificial Intelligence-A Modern Approach, 2nd Edition, Stuart Russell, Peter Norvig, 2016.

Suggested Readings:	
1.	Artificial Intelligence: Foundations of Computational Agents , David L. Poole and Alan K. Mackworth
2.	Introduction to Artificial Intelligence , Wolfgang Ertel

MR701CS	NATURAL LANGUAGE PROCESSING					
Prerequisites	Python Programming, Deep Learning		L	T	P	C
			3	0	0	3
Evaluation	CIE	40 Marks	SEE		60 Marks	

Course Objectives :	
1.	To introduce to basic concepts of Natural Language processing.
2.	To understand morphological processing, and syntactic parsing methods.
3.	To learn probabilistic NLP and classification of text using Python‟s NLTK Library.
4.	To have a thorough understanding of sentence structure analysis.
5.	To equip students with practical skills in natural language processing (NLP) by exploring various applications.

Course Outcomes : At the end of the course the student will be able to:	
1.	To write Python programs to manipulate and analyze language data.
2.	To understand key concepts from NLP and linguistics to describe and analyze language.
3.	To apply the appropriate data structures and algorithms in NLP.
4.	To classify texts using machine learning.
5.	To implement and apply NLP techniques for topic modeling, text classification, sentiment analysis, speech processing, language detection, translation, and speech synthesis.

UNIT – I

Language Processing and Python: Computing with Language: Texts and Words, A Closer Look at Python: Texts as Lists of Words, Computing with Language: Simple Statistics, Back to Python: Making Decisions and Taking Control, Automatic Natural Language Understanding **Accessing Text Corpora and Lexical Resources:** Accessing Text Corpora, Conditional Frequency Distributions, Lexical Resources, WordNet

UNIT – II

Processing Raw Text: Accessing Text from the Web and from Disk, Strings: Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions, Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation, Formatting: From Lists to Strings.

Categorizing and Tagging Words: Using a Tagger, Tagged Corpora, Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging, Transformation Based Tagging, How to Determine the Category of a Word

UNIT – III

Learning to Classify Text: Supervised Classification, Evaluation, Naive Bayes Classifiers Extracting Information from Text: Information Extraction, Chunking, Developing and Evaluating Chunkers, Recursion in Linguistic Structure, Named Entity Recognition, Relation Extraction.

UNIT – IV

Analyzing Sentence Structure:

Some Grammatical Dilemmas, What‟s the Use of Syntax. Context-Free Grammar, Parsing with Context-Free Grammar, Dependencies and Dependency Grammar, Grammar Development, Building Feature-Based Grammars.

UNIT – V
NLP Applications: Topic modeling, Text classification, Sentiment analysis, Word sense disambiguation, Speech recognition and speech to text, Text to speech, Language detection and translation

References:	
1.	Steven Bird, Ewan Klein, and Edward Lope, " Natural Language Processing with Python", O"Reily, 2009.
2.	Akshay Kulkarni, Adarsha Shivananda, " Natural Language Processing Recipes: Unlocking Text Data with Machine Learning and Deep Learning using Python", Apress, 2019.
3.	Introduction to Natural Language Processing - A Practical Guide for Beginners,

Suggested Readings:	
1.	Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit, Steven Bird, Ewan Klein, and Edward Loper
2.	Deep Learning for Natural Language Processing, Palash Goyal, Sumit Pandey, and Karan Jain

MR702CS	COMPUTER VISION					
Prerequisites	**Python, Machine Learning**		**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Evaluation	**CIE**	**40 Marks**	**SEE**		**60 Marks**	

Course Objectives :	
1.	To learn the basic concepts of computer vision.
2.	To gain knowledge on image representation and analysis.
3.	To understand motion estimation.
4.	To build object recognition models.
5.	To categorize and evaluate different applications.

Course Outcomes : At the end of the course the student will be able to:	
1.	Implement fundamental image processing techniques required for computer vision.
2.	Understand Image formation process.
3.	Perform various analysis on image to extract features form Images.
4.	Develop applications using computer vision techniques
5.	Apply knowledge in real time scenarios.

UNIT – I

INTRODUCTION TO COMPUTER VISION

Image Processing, Computer Vision and Computer Graphics, Computer Vision.

Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality.

UNIT – II

IMAGE REPRESENTATION AND ANALYSIS

Image representation, Image processing techniques like color and geometric transforms, Edge-detection Techniques, Filtering, Mathematical operations on image and its applications like convolution, filtering.

UNIT – III

MOTION ESTIMATION

Introduction to motion, Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion and models.

UNIT – IV

OBJECT RECOGNITION

Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition.

UNIT – V

APPLICATIONS

Photo album, Face detection, Face recognition, Eigen faces, Active appearance and 3D shape models of faces Application: Surveillance, foreground background separation, particle filters, Chamfer matching, tracking, and occlusion, combining views from multiple cameras, human gait analysis.

Application: Invehicle vision system: locating roadway, road markings, identifying road signs, locating pedestrians

References:	
1.	Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2.	Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
3.	R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.

Suggested Readings:	
1.	D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
2.	Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010.

MR851CS	Major Project(Specific for Minor Programme)					
Prerequisites			L	T	P	C
			0	0	6	3
Evaluation	CIE	50 Marks	SEE		100 Marks	

Course Objectives: The aim of project work is to implement Concepts learned in Previous Courses.

1. To enhance practical and professional skills.
2. To familiarize tools and techniques of systematic Literature survey and documentation
3. To expose the students to industry practices and team work.
4. To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes:

Student will able to :

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems
2. Evaluate different solutions based on economic and technical feasibility
3. Effectively plan a project and confidently perform all aspects of project management
4. Demonstrate effective written and oral communication skills

The department will appoint a project coordinator who will coordinate the following:

Project monitoring at regular intervals.

All projects will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor.

The first review of projects for 25 marks can be conducted after completion of five weeks.

The second review for another 25 marks can be conducted after 12 weeks of instruction.

Common norms will be established for the final documentation of the project report by the respective

departments. The students are required to submit draft copies of their project report within one week

after completion of instruction.