VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI

Scheme of Teaching and Examinations

M.Tech., in CSE

Artificial Intelligence and Machine Learning

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

Semester- 1

Artificial Intelligence			
Course Code	**MCS101**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	03	Exam Hours	03

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

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

Module-2

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.

Module-3

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

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.

Module-5

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.

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:

- 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

Suggested Learning Resources:

Books

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).

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 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	Explain the foundational concepts of artificial intelligence, including its history, types, and key problem-solving techniques.	L2
CO2	Apply knowledge representation and reasoning techniques to solve complex problems in AI systems.	L3
CO3	Implement machine learning algorithms and evaluate their performance in real-world applications.	L2
CO4	Explore the principles and applications of natural language processing and robotics to enhance human-computer interaction.	L4

Program Outcome of this course

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	Analyse engineering problems critically and apply appropriate techniques, skills, and modern tools to develop innovative 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 technological landscapes.	PO6

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	x			x		x
CO2			x		x	
CO3		x				
CO4	x					x

Semester- 1

Data Science and Management			
Course Code	**MCS102**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	03	Exam Hours	03

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

Module 1: Introduction to Data Science and R Tool, Overview of Data Science Importance of Data Science in Engineering , Data Science Process , Data Types and Structures, Introduction to R Programming, Basic Data Manipulation in R, Simple programs using R. Introduction to RDBMS: Definition and Purpose of RDBMS
Key Concepts: Tables, Rows, Columns, and Relationships, SQL Basics: SELECT, INSERT, UPDATE, DELETE Importance of RDBMS in Data Management for Data Science

Module-2

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

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

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

Module-5

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.

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

- Two Unit Tests each of **25 Marks**
- 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:

- 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

Suggested Learning Resources:

Books

Textb o o k s :

1. "Python for Data Analysis" by Wes McKinney, 2nd Edition (2018)
2. "Data Science from Scratch: First Principles with Python" by Joel Grus, 2nd Edition (2019)

Reference Books:

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, 2nd Edition (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)

Web links and Video Lectures (e-Resources):

- https://www.coursera.org/specializations/jhu-data-science
- https://www.kaggle.com/learn/data-science
- https://www.edx.org/professional-certificate/harvardx-data-science
- https://www.youtube.com/playlist?list=PL4cUxeGkcC9g1s4L6G8p8Fq5XK6Pq7b1k

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

Program Outcome of this course

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	Analyse engineering problems critically and apply appropriate techniques, skills, and modern tools to develop innovative 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 technological landscapes.	PO6

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	x			x		x
CO2			x		x	
CO3		x				
CO4	x					x

Semester- 1

Data Structures & Algorithms for Problem Solving			
Course Code	**MCS103**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

- Streamline development processes to effectively reduce the time and resources required for maintaining existing applications.
- Enhance code reusability to provide a competitive advantage through the strategic use of data structures and algorithms.

Module-1

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. Top-Down Rebalancing for Red-Black Trees.

Module-2

Tree Structures for Sets of Intervals. Interval Trees. Segment Trees. Trees for the Union of Intervals. Trees for Sums of Weighted Interval. Trees for Interval-Restricted Maximum Sum Queries. Orthogonal Range Trees. Higher-Dimensional Segment Trees. Other Systems of Building Blocks. Range-Counting and the Semigroup Model. Kd-Trees and Related Structures.

Module-3

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.

Module-4

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for 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-5

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

- Two Unit Tests each of **25 Marks**
- 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:

- 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

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Suggested Learning Resources:

Books

Text Books:

1. Advanced Data Structures, Peter Brass, Cambridge University Press, 2008.
2. Kenneth A. Berman. Algorithms. Cengage Learning. 2002.
3. T. H Cormen, C E Leiserson, R L Rivest and C Stein. Introduction to Algorithms. PHI, 3rd Edition, 2010

Reference Books:

1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4 th Edition, 2014, Pearson.
2. Data structures with Java, Ford and Topp, Pearson Education.
3. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan. Fundamentals of Computer Algorithms. Universities press. 2nd Edition, 2007
4. Data structures and Algorithms in Java, M.T.Goodrich, R.Tomassia, 3rd edition, Wiley India Edition.

Web links and Video Lectures (e-Resources):

- https://www.coursera.org/learn/advanced-data-structures
- https://nptel.ac.in/courses/106106133
- https://pages.cs.wisc.edu/~shuchi/courses/787-F07/about.html
- https://www.youtube.com/watch?v=0JUN9aDxVmI&list=PL2SOU6wwxB0uP4rJgf5ayhHWgw7akUWSf

Skill Development Activities Suggested

- The students with the help of the course teacher can take up relevant technical activities which will enhance their skills. 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	Analyse and apply fundamental data structures and algorithms to solve complex computational problems effectively	L3
CO2	Evaluate and implement various searching, sorting to optimize algorithm performance.	L4
CO3	Design and analyse advanced tree and graph algorithms, including balanced search trees and graph traversal methods, to address real-world applications	L5

Program Outcome of this course

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	Analyse engineering problems critically and apply appropriate techniques, skills, and modern tools to develop innovative 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 technological landscapes.	PO6

Mapping of COS and POs

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

Semester - 1

(IPCC) Machine learning			
Course Code	**MCS104I**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hrs Theory + 10 hrs Lab	Total Marks	100
Credits	04	Exam Hours	03

Course objectives:

- Explain the fundamental concepts of machine learning, including types of learning, evaluation metrics, and the concepts of overfitting and under fitting.
- Design and implement decision tree algorithms, and analyze their performance in various problem domains
- Implement clustering algorithms such as K-means and hierarchical clustering, and analyze their results in various datasets.

MODULE-1

Introduction: Introduction to Machine Learning: Introduction. Different types of learning, Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation, Concept of over fitting, under fitting, Bias and Variance. Linear Regression: Introduction, Linear regression, Simple and Multiple Linear regression, Polynomial regression, evaluating regression fit

MODULE-2

Decision tree learning: Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning, Python exercise on Decision Tree. Instance based Learning: K nearest neighbor, the Curse of Dimensionality, Feature Selection: forward search, backward search, univariate , multivariate feature selection approach, Feature reduction (Principal Component Analysis) , Python exercise on kNN and PCA. Recommender System: Content based system, Collaborative filtering based.

MODULE-3

Probability and Bayes Learning: Bayesian Learning, Naïve Bayes, Python exercise on Naïve Bayes, Logistic Regression. Support Vector Machine: Introduction, the Dual formulation, Maximum margin with noise, nonlinear SVM and Kernel function, solution to dual problem.

MODULE-4

Artificial Neural Networks: Introduction, Biological motivation, ANN representation, appropriate problem for ANN learning, Perceptron, multilayer networks and the back propagation algorithm,

MODULE 5

Ensembles: Introduction, Bagging and boosting, Random forest, Discussion on some research papers. Clustering: Introduction, K-mean clustering, agglomerative hierarchical clustering, Python exercise on k-mean clustering.

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Basic exercises on Python Machine Learning Packages such as Numpy, Pandas and matplotlib.
2	Given a dataset. Write a program to compute the Covariance, Correlation between a pair of attributes. Extend the program to compute the Covariance Matrix and Correlation Matrix.

3	Given a set of sample points in N dimensional feature space. Write a program to fit the points with a hyper plane using Linear Regression. Calculate sum of residual error.
4	Write a program that provides option to compute different distance measures between two points in the N dimensional feature space. Consider some sample datasets for computing distances among sample points
5	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
6	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Python ML library classes can be used for this problem.
7	Write a program to implement feature reduction using Principle Component Analysis
8	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
9	Given a dataset for classification task. Write a program to implement Support Vector Machine and estimate it test performance

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

CIE for the theory component of IPCC

1. Two Tests each of **25 Marks**
2. Two assignments each of **25 Marks/One Skill Development Activity of 50 marks**
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for **10 marks**. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test at the end /after completion of all the experiments shall be conducted for **50 marks** and scaled down to **05 marks.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

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SEE for IPCC

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
4. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 40% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50. (Student has to secure an aggregate of 50% of maximum marks of the course (CIE+SEE)

Suggested Learning Resources:

Books

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill.
2. Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020.

Reference Book(s):

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press,

Web links and Video Lectures (e-Resources):

- **https://www.youtube.com/watch?v=KNAWp2S3w94**
- **https://onlinecourses.nptel.ac.in/noc23_cs18/preview**
- **https://srmap.edu.in/wp-content/uploads/2021/12/2021-2023-M_Tech-Syllabus.pdf?x60836**

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Conduct hands on sessions for different machine learning techniques with some datasets
- Encourage students to build and train various machine learning models

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Demonstrate an understanding of machine learning principles and their applications in real-world scenarios.	L2
CO2	Analyze the strengths and weaknesses of different machine learning approaches and justify the choice of methods for specific tasks	L2
CO3	Collaborate on research discussions and critically analyze recent advancements in machine learning through literature review.	L3

Program Outcome of this course

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	Analyse engineering problems critically and apply appropriate techniques, skills, and modern tools to develop innovative 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 technological landscapes.	PO6

Mapping of COS and POs

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

Semester- 1

Data Mining and Business Intelligence			
Course Code	**MCS105F**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

- Assessment the technologies for decision making, automated decision systems, and sentiment analysis methods
- Describe business intelligence, analytics, and decision support systems
- Demonstrate Multiple Criteria Systems for making decisions and methods for predictive modelling

Module-1

Introduction and Data Preprocessing :Why data mining, What is data mining, What kinds of data can be mined, What kinds of patterns can be mined, Which Technologies Are used, Which kinds of Applications are targeted, Major issues in data mining .Data Preprocessing: An overview, Data cleaning, Data integration, Data reduction, Data transformation and data discretization

Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief

Introduction to Big Data Analytics.

Teaching-Learning Process	**Chalk and talk/PowerPoint presentation/Web resources.**

Module-2

Introduction and Definitions, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.

Teaching-Learning Process	**Chalk and talk/PowerPoint presentation/Web resources.**

Module-3

Basic Concepts of Neural Networks, Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process,, Sentiment Analysis, Speech Analytics.

Teaching-Learning Process	**Chalk and talk/PowerPoint presentation/Web resources.**

Module-4

Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spreadsheets, Mathematical programming optimization, Decision Analysis with Decision Tables and Decision Trees, Multi-Criteria Decision Making With Pairwise Comparisons.

Teaching-Learning Process	**Chalk and talk/PowerPoint presentation/Web resources.**

Module-5

Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications ofExpert Systems, Structure of Expert Systems, Knowledge Engineering, and Development of Expert Systems.

Teaching-Learning Process	**Chalk and talk/PowerPoint presentation/Web resources.**

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.

Suggested Learning Resources:

Text Books

1. Ramesh Sharda, Dursun Delen, EfraimTurban, J.E.Aronson,Ting-Peng Liang, David King, "Business Intelligenceand Analytics: System for Decision Support", 10th Edition, Pearson Global Edition.

Reference books

1. Data Analytics: The Ultimate Beginner's Guide to Data Analytics Paperback – 12 November 2017by EdwardMiz

Web links and Video Lectures (e-Resources):

- https://shorturl.at/iuAT0
- https://www.coursera.org/courses?query=business%20intelligence

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical activities which will enhance their skills. 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	Explain the significance of data mining and identify the various types of data and patterns that can be mined.	L2
CO2	Apply data preprocessing techniques to prepare datasets for analysis, including cleaning and transformation.	L3
CO3	Analyze the phases of the decision-making process and evaluate the capabilities and classifications of Decision Support Systems.	L4
CO4	Develop neural network models and apply sentiment analysis techniques to real-world data.	L3

Program Outcome of this course

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 develop innovative 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 technological landscapes.	**PO6**

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**x**					**x**
CO2	**x**					
CO3			**x**			
CO4		**x**		**x**	**x**	

ALGORITHMS & AI LABORATORY			
Course Code	MCSL106	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0	SEE Marks	50
Credits	2	Exam Hours	03

Course objectives:

- Implement and evaluate Algorithm and AI in Python programming language.

Sl.NO	Experiments
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 retrieval method 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 Backpropagation algorithm and test it with suitable datasets.
6	Implement a KNN algorithm for regression tasks instead of classification. Use a small dataset, and predict continuous values based on the average of the nearest neighbours.
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	Implement the k-Nearest Neighbour algorithm to classify the Iris dataset, printing both correct and incorrect predictions.
	Demonstration Experiments (For CIE) if any
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 analysing agent performance.

Course outcomes (Course Skill Set):

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

- Implement and demonstrate AI algorithms.
- Evaluate different algorithms.

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):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- **Total marks scored by the students are scaled down to 30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 01 tests for 100 marks, test shall be conducted after the 14th week of the semester.
- In test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- **The test marks is scaled down to 20 marks** (40% of the maximum marks).

The Sum of **scaled-down** marks scored in the report write-up/journal and marks of test is the total CIE marks scored by the student.

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

Suggested Learning Resources:

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