Artificial Intelligence			
Course Code	MCS101	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:2	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.

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

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.

Teaching- LearningProcess	Chalk and talk/PPT/case study/web content

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.

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

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.

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

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.

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

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

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

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

Semester End Examination:

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

Suggested Learning Resources:

Text 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

Mapping of COS and Pos

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

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

Data Science and Management			
Course Code	MCS102	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	4:0:2	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

1. Explain the foundational concepts of data science, including its history, significance, and the data science process.
2. Apply statistical methods and data analysis techniques to interpret and draw insights from complex datasets.
3. Implement various machine learning algorithms and assess their performance using appropriate evaluation metrics in real-world scenarios.
4. 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

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

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.

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

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.

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

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.

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

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.

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

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

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

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

Semester End Examination:

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

Suggested Learning Resources:

Text Books:

Mapping of COS and Pos

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

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

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

Mapping of COS and Pos

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

Data Structures & Algorithms for Problem Solving			
Course Code	MCS103	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives:

- To reduce development time and the resources required to maintain existing applications.
- To increase code reuse and provide a competitive advantage through effective 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.

Teaching Learning Process	Chalk and talk/PPT/web content

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.

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

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.

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

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.

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

Module-5

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

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

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

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

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

Semester End Examination:

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

Suggested Learning Resources:

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

Text 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, SartajSahni, 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	Analyze and apply fundamental data structures and algorithms to solve complex computational problems effectively	L4
CO2	Evaluate and implement various searching, sorting to optimize algorithm performance.	L5
CO3	Design and analyze advanced tree and graph algorithms, including balanced search trees and graph traversal methods, to address real-world applications	L5

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

Program Outcome of this course

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

Python for Data Science			
Course Code	MCS104A	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	4:0:2	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	03	Exam Hours	03

Module-1

Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets. Needed Statistical Inference: Populations and samples, Statistical modelling, probability distributions, fitting a model, - Introduction to R, Overview of RDBMS ,Relational Model, Concepts of Tables, Rows, and Columns Keys: Primary, Foreign, Unique ,Relationships: One-to-One, One-to-Many, Many-to-Many 3. SQL Fundamentals, Introduction to SQL, Data Definition Language (DDL),CREATE, ALTER, DROP Data Manipulation Language (DML),SELECT, INSERT, UPDATE, DELETE.

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

Module-2

Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA,The Data Science Process, Case Study: Real Direct (online real estate firm). Three Basic Machine Learning Algorithms: Linear Regression, k-Nearest Neighbors (kNN), k-means

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

Module-3

One More Machine Learning Algorithm and Usage in Applications: Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scrapping the Web

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

Module-4

Feature Generation and Feature Selection (Extracting Meaning from Data): Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system

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

Module-5

Mining Social-Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs, Data Visualization: Basic principles, ideas and tools for data visualization. Data Science and Ethical Issues, Discussions on privacy, security, ethics, Next-generation data scientists

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

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Textbook/Reference Books

	Title of the book	Author Name	Publisher' sName	Publication year
Textbook(s):				
1	Doing Data Science	Cathy O'Neil and Rachel Schutt, Straight Talk from The Frontline	O'Reilly	2014
2	Mining of Massive DatasetsV2.1	Jure Leskovek, AnandRajaramanand Jeffrey Ullman	Cambridge University Press, 2nd Edition	2014
Reference Book(s):				
1	Data Mining: Concepts andTechniques	Jiawei Han, MichelineKamberand Jian Pei	Morgan Kauffman, Third Edition,	2012

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
- Two Tests each of 20 Marks
-
- Two assignments each of 10 Marks/One Skill Development Activity of 20 marks
- 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. The15 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.
- .
- SEE for IPCC
- Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)
- The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- 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)

Mapping of COS and Pos

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

<table>
<tr><th colspan="4">DEEP LEARNING</th></tr>
<tr><td>Course Code</td><td>MCS105A</td><td>CIE Marks</td><td>50</td></tr>
<tr><td>Teaching Hours/Week (L:P:SDA)</td><td>3:2:0</td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Total Hours of Pedagogy</td><td>40 hours Theory + 10 hours Lab</td><td>Total Marks</td><td>100</td></tr>
<tr><td>Credits</td><td>04</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Course objectives:

1. Figure out the context of neural networks and deep learning
2. Know how to use a neural network
3. Explore the data needs of deep learning
4. Have a working knowledge of neural networks and deep learning</td></tr>
<tr><td colspan="4">MODULE-1</td></tr>
<tr><td colspan="4">Machine Learning Basics: Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimator, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Decent, building a Machine Learning Algorithm, Challenges Motivating Deep Learning.</td></tr>
<tr><td>Teaching-Learning Process</td><td colspan="3">Chalk and board /PPT / web contents</td></tr>
<tr><td colspan="4">MODULE-2</td></tr>
<tr><td colspan="4">Deep Feedforward Networks: Gradient-Based Learning, Hidden Units, Architecture Design, BackPropagation. Regularization: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, SemiSupervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging, Dropout.</td></tr>
<tr><td>Teaching-Learning Process</td><td colspan="3">Chalk and board /PPT / web contents</td></tr>
<tr><td colspan="4">MODULE-3</td></tr>
<tr><td colspan="4">Optimization for Training Deep Models: How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms. Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates. Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features.</td></tr>
</table>

Teaching-Learning Process	Chalk and board /PPT / web contents / Case study
MODULE-4	
Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks. Long short-term memory	
Teaching-Learning Process	Chalk and board /PPT / web contents/ Case study

MODULE 5
Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies, Example: Multi-Digit Number Recognition. Applications: Vision, NLP, Speech.

Teaching-Learning Process	Chalk and board /PPT / web contents / Case study.

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

Sl.NO	Experiments
1	**Build Machine Learning model to solve real world regression problems.**
2	Build machine learning model to real world binary classification problems.
3	Build simple model to understand over fitting and under fitting conditions.
4	Build simple convolution network to identify hard written character recognition.
5	Analyze performance metrics of the machine learning model.

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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 **20 Marks**
2. Two assignments each of **10 Marks/One Skill Development Activity of 20 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**.

SEE for IPCC

Theory SEE will be conducted by 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:

Text Books:

1. Deep Learning Lan Good fellow and Yoshua Bengio MIT Press https://www.deeplearn ingbook.org/ 2016.

Reference Books:

2. Neural Networks: Systematic Introduction Raúl Rojas 1996.
3. Pattern Recognition and machine Learning Chirstopher Bishop 2007.

Web links and Video Lectures (e-Resources):

- https://www.simplilearn.com/tutorials/deep-learning-tutorial
- https://www.kaggle.com/learn/intro-to-deep-learning
- https://www.javatpoint.com/deep-learning

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	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.	L1
CO2	Implement deep learning algorithms and solve real-world problems.(can be attained through assignment and CIE)	L4
CO3	Execute performance metrics of Deep Learning Techniques. (can be attained through assignment and CIE)	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	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**	**x**				
CO3	**x**		**x**			

ALGORITHMS & AI LABORATORY			
Course Code	MCSL106	**CIE Marks**	40
Number of Contact Hours/Week	0:0:2	**SEE Marks**	60
Total Number of Lab Contact Hours	36	**Exam Hours**	03
Credits – 2			
Course Learning Objectives: This course MCSL106 will enable students to:			
• Implement and evaluate Algorithm and AI in Python programming language.			
Descriptions (if any):			
Installation procedure of the required software must be demonstrated, carried out in groups. and documented in the journal.			
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 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 neighbors.		
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 Neighbor algorithm to classify the Iris dataset, printing both correct and incorrect predictions.		
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.			
Conduct of Practical Examination:			

- 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 one experiment 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)*
    q) For laboratories having only one part – Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks
    r) For laboratories having PART A and PART B
        i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
        ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

Research Methodology and IPR			
Course Code	MRMI107	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

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 business environment.
- Discuss leading International Instruments concerning Intellectual Property Rights.

Module-1

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

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

Module-2

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, Developing a 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,

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

Module-3

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.

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

Module-4

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

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

Module-5

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,

Teaching-Learning Process	Chalk and talk/PPT

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

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

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

Semester End Examination:

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

Suggested Learning Resources:

Text Books:

- *Research Methodology: Methods and Techniques*, C.R. Kothari, Gaurav Garg, New Age International, 4th Edition, 2018.. Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture," PHI, 6th Edition
- *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.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=A7oioOJ4g0Y&list=PLVf5enqoJ-yVQ2RXUl6mCfLPf3J_JUfoc

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 method 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	