Semester- III

Introduction to Generative AI			
Course Code	**MMCF311A**	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	3

Course Learning objectives:

- Understand the Fundamentals of Generative AI
- Master in Core Generative AI Models: GANs, VAEs, and Diffusion Models
- Develop Practical Skills in Generative AI Using Popular Frameworks
- Explore the Ethical Implications and Social Impact of Generative AI
- Apply Generative AI to Real-World Applications

Module-1
Introduction to AI and Machine Learning-Types of Generative Models (e.g., LLM,SLM,GANs, VAEs, Autoregressive Models)- Neural Networks: Basic Architecture, Backpropagation, Activation Functions-Deep Learning Basics and its Applications-Unsupervised vs. Supervised Learning
Module-2
Introduction to Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs)-Understanding the Generator-Discriminator Architecture in GANs-Latent Space Representation and Loss Functions-Training Strategies, Optimization, and Hyperparameter Tuning-Applications and Case Studies in Image, Video, and Text Generation-Diffusion Models and their Use in Modern AI Art Generation
Module-3
Introduction to TensorFlow and PyTorch for Generative AI Building GANs and VAEs from Scratch Hands-on Projects: Generating Images, Music, and Text - Model Evaluation Techniques (FID Score, Inception Score, BLEU Score) - Fine-tuning Pretrained Models for Specialized Applications
Module-4
Ethical Challenges in AI: Bias, Fairness, and Accountability- Deepfakes and Synthetic Media: Risks and Regulations - AI in Content Creation: Copyright, Ownership, and Creativity - Data Privacy in Generative AI Systems - Bias and Fairness in Training Data: Identifying and Mitigating
Module-5
AI in Digital Art and Content Creation - Music Generation Using Neural Networks - Healthcare Applications: Drug Discovery and Medical Imaging - Natural Language Generation (NLG) and Chatbots - Case Studies: Generative AI in Gaming, Fashion, and Virtual Reality

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

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

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

Semester-End Examination:

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

Suggested Learning Resources:

Books

1. **Gohil, P.** (2019). *Machine learning with Tensor Flow*. BPB Publications.
2. **Akerkar, R.** (2020). *Deep learning: A practitioner's approach*. Springer.
3. **Arora, R.** (2021). *Artificial intelligence: A guide for thinking humans*. Wiley India Pvt. Ltd.
4. **Schwab, K.** (2017). *The fourth industrial revolution* (Indian edition). Penguin Random House India.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=rwF-X5STYks
- https://www.youtube.com/watch?v=6aZiboOfYRA
- https://www.youtube.com/shorts/W5nwke7iw8c
- https://www.youtube.com/watch?v=t64TZ5S-IeY
- https://www.youtube.com/watch?v=Hv4oyBthaqs

Skill Development Activities Suggested

AI-Generated Art and Creativity

- **Objective:** Encourage creativity using generative models.
- **Task:** Have students use AI models like StyleGAN or DeepDream to generate unique pieces of art. Encourage them to experiment with the style transfer and image manipulation capabilities of these models.
- **Outcome:** Students will explore the intersection of AI and creativity, understanding how generative AI can be used in the arts.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understand the Fundamentals concepts of Generative AI	L2
CO2	Identify the performance of generative models using metrics	L2
CO3	Analyze the ethical implications of generative AI	L4
CO4	Apply algorithms to build and train generative models using frameworks	L3
CO5	Compare the performance of various generative AI architectures	L3

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1						
CO2	2				1			
CO3		2						1
CO4	2				2			
CO5					2	1		

Semester- III

Artificial Neural Networks			
Course Code	**MMCF311B**	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	3

Course Learning objectives:

- Understand the Fundamentals of Artificial Neural Networks
- Learn the Training Process of Neural Networks
- Explore Different Neural Network Architectures
- Implement Neural Networks Using Frameworks
- Understand Practical Applications and Limitations of Neural Networks

Module-1

Overview of Artificial Intelligence and Machine Learning - What are Neural Networks? Introduction to Neurons and Perceptrons - Structure of an ANN: Layers (Input, Hidden, Output)- Activation Functions: Sigmoid, ReLU, Tanh - Introduction to Feedforward Networks

Module-2

Forward Propagation and Loss Functions - Introduction to Gradient Descent and Backpropagation Learning Rate and Optimization Algorithms (e.g., Stochastic Gradient Descent, Adam) - Overfitting and Regularization Techniques (e.g., Dropout, L2 regularization) - Introduction to Epochs and Batch Processing

Module-3

Single-Layer vs. Multi-Layer Perceptrons (MLPs) - Convolutional Neural Networks (CNNs) for image processing - Recurrent Neural Networks (RNNs) for sequence data - Autoencoders and their applications - Introduction to Transfer Learning

Module-4

Introduction to TensorFlow and PyTorch- Implementing a Simple Neural Network with PyTorch/TensorFlow - Data Preprocessing and Loading Datasets - □ Training, Testing, and Evaluating Models - Hyperparameter Tuning and Model Optimization

Module-5

Applications of Neural Networks in Image Recognition, Natural Language Processing, and Time Series Prediction-Neural Networks for Classification vs. Regression-Common Pitfalls in Neural Network Training-Ethical Considerations and Model Interpretability-Future Trends in Neural Networks and Deep Learning

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

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

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

Semester-End Examination:

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

Suggested Learning Resources:

Books

1. **Deepa, S. N.** (2020). *Artificial Neural Networks: A Practical Approach*. Wiley India Pvt. Ltd.
2. **Patel, M., & Patel, A.** (2019). *Artificial Neural Networks: Applications and Implementations*. BPB Publications
3. **Gupta, S. K.** (2017). *Introduction to Neural Networks using MATLAB 6.0*. Tata McGraw-Hill Education.

Weblinks and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=jmmW0F0biz0
- https://www.youtube.com/watch?v=mlk0rddP3L4
- https://www.youtube.com/watch?v=oJNHXPs0XDk
- https://www.youtube.com/watch?v=Wo5dMEP_BbI&list=PLQVvvaa0QuDcjD5BAw2DxE6OF2tius3V3
- https://www.youtube.com/watch?v=rEDzUT3ymw4

Skill Development Activities Suggested

- The students will implement a simple **Feedforward Neural Network (FNN)** to classify the **MNIST dataset** (handwritten digits) using **TensorFlow** or **PyTorch**.
- The task will involve loading the dataset, pre-processing the data, defining the neural network architecture, training the model, and evaluating its performance.
- Have students use AI models like StyleGAN or DeepDream to generate unique pieces of art. Encourage them to experiment with the style transfer and image manipulation capabilities of these models.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understand the principles of Neural Networks	L2
CO2	Analyze the feed-forward neural networks	L4
CO3	Identify different types of models of neural networks	L3
CO4	Implement ANN using frameworks	L4
CO5	Compare different applications of artificial neural networks	L4

Mapping of COS and Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2							
CO2	2				2			
CO3		2						
CO4		2						
CO5		2				2	2	

Semester- III

Natural Language Processing			
Course Code	**MMCF311C**	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	3

Course Learning objectives:

- Understand the Fundamentals of Natural Language Processing
- Learn Text Pre-processing Techniques
- Implement Basic NLP Models
- Explore Word Embeddings and Advanced NLP Models
- Understand NLP Applications and Real-World Use Cases

Module-1

Introduction to NLP: Definition and scope - Basic Linguistic Concepts: Syntax, Semantics, and Pragmatics - Language Models: Unigram, Bigram, and N-grams - Overview of NLP Tasks: Text classification, Named Entity Recognition (NER), Sentiment Analysis, etc. - Key Applications of NLP: Machine Translation, Speech Recognition, Chatbots

Module-2

Text Cleaning: Removing special characters, punctuation, stop words, and irrelevant data - Tokenization: Word-level and sentence-level tokenization - Stemming and Lemmatization: Understanding and applying common text normalization techniques - Text Vectorization: Bag-of-Words (BoW), TF-IDF, Word Embeddings (Word2Vec, GloVe) - Part-of-Speech (POS) Tagging: Introduction to syntactic categories

Module-3

Introduction to Machine Learning for NLP: Supervised vs. Unsupervised Learning - Building a Text Classification Model: Naive Bayes, Logistic Regression, and SVM for text classification - Sentiment Analysis: Using basic machine learning models for sentiment classification - Introduction to Deep Learning for NLP: Feedforward Neural Networks for text - Evaluating NLP Models: Accuracy, Precision, Recall, and F1-score

Module-4

Word Embeddings: Introduction to Word2Vec and GloVe - Semantic Analysis: Understanding word similarity, cosine similarity, and vector-based word representations - Neural Networks for NLP: Simple architectures like RNNs and LSTMs -Introduction to Transformer Models: Basic understanding of BERT and GPT - Language Representation Models and Fine-tuning

Module-5

Named Entity Recognition (NER): Techniques for identifying entities in text-Text Summarization: Extractive vs. Abstractive Summarization-Machine Translation: Introduction to rule-based, statistical, and neural machine translation systems-Chatbots and Conversational AI: Building simple conversational agents using NLP-Ethical Considerations: Bias in NLP models and ethical implications of NLP applications

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

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

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

Semester-End Examination:

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

Suggested Learning Resources:

Books

1. **Kumar, V., & Dey, L.** (2019). *Introduction to Natural Language Processing*. Wiley India Pvt. Ltd..
2. **Sahani, M., & Dey, L.** (2021). *Natural Language Processing: Techniques and Applications*. McGraw-Hill Education.
3. **Rai, M. (2019).** *Foundations of Natural Language Processing*. Oxford University Press.
4. **Prasad, R., & Rani, N.** (2020). *Natural Language Processing with Python: A Practical Guide*. BPB Publications.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=aeOLjFe256E&list=PLD392E2ACAEF0C689
- https://www.youtube.com/watch?v=zG8AJhVy5NY&list=PLD392E2ACAEF0C689&index=2
- https://www.youtube.com/watch?v=dBEpW4h2Gig&list=PLD392E2ACAEF0C689&index=6
- https://www.youtube.com/watch?v=kfssS6bD5FQ&list=PLD392E2ACAEF0C689&index=7
- https://www.youtube.com/watch?v=iWbkjwe-xag&list=PLD392E2ACAEF0C689&index=12

Skill Development Activities Suggested

- Students will use **Python** and **scikit-learn** (or another machine learning library) to implement a **text classification model**. The task involves preprocessing text data, feature extraction using TF-IDF, training a machine learning model, and evaluating its performance.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understand the basic concepts of Natural Language Processing	L2
CO2	Apply text pre-processing techniques	L3
CO3	Apply Machine Learning Algorithms to NLP Tasks	L3
CO4	Implement and train word embedding models (Word2Vec, GloVe) on text corpora	L4
CO5	Analyze the ethical considerations in NLP applications	L4

Mapping of COS and Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**2**							
CO2	**2**		**2**					
CO3	**2**				**2**			
CO4	**2**				**1**			
CO5	**1**	**1**						**2**

Semester- III

Deep Learning Fundamentals			
Course Code	**MMCF311D**	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	3

Course Learning objectives:

- Understand the fundamentals of deep learning
- Understanding the working of Convolutional Neural Networks and RNN in decision making.
- Illustrate the strength and weaknesses of many popular deep learning approaches.
- Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems

Module-1

Introduction: What is a Neural Network? The Human Brain, Models of a Neuron, Neural Networks Viewed As Directed Graphs, Feedback, Network Architectures

Rosenblatt's Perceptron: Introduction, Perceptron, The Perceptron Convergence Theorem, Relation Between the Perceptron and Bayes Classifier for a Gaussian Environment.

Textbook 1: Introduction 1, (1- 6), Ch 1, (1.1 - 1.4)

Module-2

Multilayer Perceptrons: Introduction, Some Preliminaries, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR Problem, Heuristics for Making the Back- Propagation Algorithm Perform Better, Computer Experiment: Pattern Classification, Back Propagation and Differentiation.

Textbook 1: Ch 4, (4.1- 4.8)

Module-3

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under Constrained Problem, Dataset Augmentation, Semi-Supervised Learning.

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 Rate.

Textbook 2: Ch 7, (7.1 – 7.6), Ch 8, (8.1 – 8.5)

Module-4

Convolution 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, The Neuroscientific Basic for Convolutional Network, Convolutional Networks and the History of Deep Learning.

Textbook 2: Ch 9, (9.1 – 9.11)

Module-5

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to- Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs.

Textbook 2: Ch 10, (10.1-10.6), 10.10

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

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

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

Semester-End Examination:

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

Suggested Learning Resources:

Textbooks

1. Simon Haykin, Neural networks and Learning Machines, Third Edition, Pearson, 2016
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

Reference book

3. Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning, 2009
4. N.D. Lewis, "Deep Learning Made Easy with R: A Gentle Introduction for Data Science", January 2016
5. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly publications

Weblinks and Video Lectures (e-Resources):

https://www.deeplearningbook.org/lecture_slides.html
https://www.youtube.com/watch?v=VyWAvY2CF9c
https://www.youtube.com/watch?v=7sB052Pz0sQ
https://www.youtube.com/watch?v=Mubj_fqiAv8
https://www.coursera.org/learn/neural-networks-deep-learning
https://onlinecourses.nptel.ac.in/noc20_cs62/preview

Skill Development Activities Suggested

- Mini projects (2 to 4 students) using Deep Learning concepts

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understanding Deep Learning Fundamentals	L2
CO2	Design and Implementation of Neural Networks	L3
CO3	Optimization and Performance Tuning	L3
CO4	Application of Advanced Deep Learning Architectures	L4

Mapping of COS and Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1							
CO2		2		2				
CO3								
CO4			1,2					3

Semester- III

Introduction to Machine Learning			
Course Code	**MMCF311E**	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	3

Course Learning objectives:

- To understand the basic theory underlying machine learning, types, and the process.
- To become familiar with data and visualize univariate, bivariate, and multivariate data using statistical techniques and dimensionality reduction.
- To understand various machine learning algorithms such as similarity-based learning, regression, decision trees.
- To familiarize with learning theories, probability-based models, and reinforcement learning, developing the skills required for decision-making in dynamic environments.

Module-1

Introduction to Machine Learning: Need for Machine Learning, Machine Learning Explained, Machine Learning in Relation to Other Fields, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process, Machine Learning Application.

Understanding Data: Introduction, Big Data Analytics and Types of Analytics, Big Data Analysis Framework, Descriptive Statistics, Univariate Data Analysis and Visualization, Bivariate Data and Multivariate Data.

Textbook 1: Ch 1, 1.1-1.7, Ch 2, 2.1-2.6

Module-2

Understanding Data: Multivariate Statistics, Essential Mathematics for Multivariate Data, Overview of Hypothesis, Feature Engineering and Dimensionality Reduction Techniques.

Basics of Learning Theory: Introduction to Learning and its Types, Introduction to Computation Learning Theory, Design of a Learning System, Introduction to Concept Learning, Induction Biases, Modelling in Machine Learning.

Textbook 1: Ch 2, 2.7-2.10, Ch 3 3.1 – 3.6

Module-3

Similarity-based Learning: Introduction to Similarity or Instance-based Learning, Nearest-Neighbor Learning, Weighted K-Nearest-Neighbor Algorithm, Nearest Centroid Classifier, Locally Weighted Regression (LWR).

Regression Analysis: Introduction to Regression, Introduction to Linearity, Correlation, and Causation, Introduction to Linear Regression, Validation of Regression Methods, Multiple Linear Regression, Polynomial Regression, Logistic Regression.

Textbook 1: Ch 4, 4.1 – 4.5, Ch 5, 5.1 – 5.7

Module-4

Decision Trees Learning: Introduction to Decision Tree Learning model, Decision Tree Induction Algorithms, Validating and Pruning of Decision Trees.

Bayesian Learning: Introduction to Probability-based Learning, Fundamentals of Bayes Theorem, Classification Using Bayes Model.

Textbook 1: Ch 6, 6.1 – 6.3, Ch 8, 8.1 – 8.3

Module-5

Artificial Neural Networks: Introduction, Biological Neurons, Artificial Neurons, Perceptron and Learning Theory, Types of Artificial Neural Network.

Reinforcement Learning: Overview and Scope of Reinforcement Learning, Components of Reinforcement Learning, Q-Learning.

Textbook 1: Ch 10, 10.1-10.5, Ch 14, (14.1, 14.2, 14.4, 14.9)

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

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

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

Semester-End Examination:

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

Suggested Learning Resources:

Textbooks

1. S Sridhar and M Vijayalakshmi, "Machine Learning", Oxford University Press, 2021.
2. M N Murty and Ananthanarayana V S, "Machine Learning: Theory and Practice", Universities Press (India) Pvt. Limited, 2024.

Reference Books

3. Tom M. Mitchell, "Machine Learning," McGraw-Hill Education, 2013.
4. Miroslav Kubat, "An Introduction to Machine Learning," Springer, 2017.

Web links and Video Lectures (e-Resources):

https://www.universitiespress.com/resources?id=9789393330697
https://onlinecourses.nptel.ac.in/noc23_cs18/preview
https://www.geeksforgeeks.org/machine-learning/
https://www.w3schools.com/python/python_ml_getting_started.asp
https://www.tutorialspoint.com/machine_learning/index.html

Skill Development Activities Suggested

- Course project by taking suitable machine learning-based real-world application problem

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understanding ML Fundamentals	L2
CO2	Applying ML Algorithms	L3
CO3	Model Evaluation and Optimization	L3
CO4	Practical Implementation and Problem-Solving	L4

Mapping of COS and Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1							
CO2		2		3				
CO3								
CO4			2					2

Semester- III

Computer Vision			
Course Code	**MMCF311F**	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:

- Understand the Fundamentals of Computer Vision
- Implement Feature Extraction and Object Recognition
- Analyze Motion and Video Processing Techniques and Apply Deep Learning in Computer Vision

Module-1

Introduction to Computer Vision and Image Representation: Basics of Computer Vision and its applications, Digital images: Pixels, resolution, and color models, Image formation and perception Visualizing pixel intensity distributions, Working with pixel-based operations, Introduction to video processing

Module-2

Feature Detection and Image Processing Techniques: Edge detection techniques (Sobel, Canny) Line and corner detection, Gaussian kernels and filters, Delaunay mesh segmentation, Voronoi mesh applications in vision.

Module-3

Shape and Object Recognition: Contour detection and shape analysis, Feature extraction methods Maximal nucleus clusters and Lowe keypoints, Image segmentation techniques, Introduction to object tracking in videos

Module-4

Computational Geometry and Machine Vision: Concepts of computational topology in vision Linear filtering and transformations, Spatial relationships and image transformations, Use of graphs and meshes in object representation, Real-time and offline video analysis

Module-5

Advanced Topics and Applications: Deep learning for computer vision (basics) , Convolutional Neural Networks (CNNs) overview, Applications in biometrics, medical imaging, and robotics . Future trends in computer vision , Case studies and project discussions

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 **oneSkill Development Activity of 50 marks** to attain the COs and POs

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

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

Semester-End Examination:

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

Suggested Learning Resources:

Books

1. Peters, J. F. (2017). *Foundations of computer vision: Computational geometry, visual image structures, and object shape detection*. Springer International Publishing
2. Szeliski, R. (2022). *Computer vision: Algorithms and applications* (2nd ed.). Springer.
3. Forsyth, D. A., & Ponce, J. (2011). *Computer vision: A modern approach* (2nd ed.). Pearson.

Web links and Video Lectures (e-Resources):

- . https://www.youtube.com/channel/UCf0WB91t8Ky6AuYcQV0CcLw
- https://www.youtube.com/watch?v=2w8XIskzdFw
- https://16385.courses.cs.cmu.edu/spring2021/lectures
- https://github.com/kuzand/Computer-Vision-Video-Lectures

Skill Development Activities Suggested

Implementing Basic Image Processing Techniques: Activity: Perform image transformations like grayscale conversion, blurring, edge detection (Sobel, Canny), and thresholding using OpenCV.

Feature Detection and Key point Matching: Activity: Implement SIFT, SURF, and ORB algorithms to detect features in images and match them between two scenes.

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understanding Image Processing Fundamentals	L2
CO2	Apply Feature Extraction and Object Recognition techniques	L3
CO3	Understand Motion Analysis and Video Processing methods	L2
CO4	Utilize deep learning models like CNNs for image classification and segmentation.	L3
CO5	Evaluate the performance of different computer vision techniques for practical applications.	L4

Mapping of COS and Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	**2**							
CO2	**2**							
CO3	**2**							
CO4	**2**							
CO5		**2**						