

Wks Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
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Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	40	60	2.5 hrs

Continuous Internal Evaluation Pattern:

Attendance : 5 marks

Continuous Assessment Test : 20 marks

Continuous Assessment Assignment : 15 marks

SYLLABUS**Module 1 (14 hrs)**

Introduction to Computer Vision. Digital Image Formation and Representation. Image Processing Basics: Image filtering and smoothing, Edge detection (Sobel, Canny), Image transformations. Feature Extraction Techniques: SIFT, SURF (conceptual), HOG features. Image Classification using Traditional ML: Feature engineering, SVM and k-NN for vision tasks.

Module 2 (14 hrs)

Review of Neural Networks, Convolutional Neural Networks (CNNs): Convolution and pooling operations, Activation functions. Advanced CNN Architectures (Conceptual Study): LeNet, AlexNet, VGG, ResNet. Transfer Learning and Fine-Tuning. Performance Evaluation Metrics (Precision, Recall, F1-score, IoU).

Module 3 (14 hrs)

Object Detection Concepts, R-CNN Family (Overview): R-CNN, Fast R-CNN, Faster R-CNN. YOLO (You Only Look Once) Architecture. Image Segmentation. Semantic vs Instance Segmentation, U-Net Architecture. Applications in autonomous driving and medical imaging.

Module 4 (14 hrs)

Vision Transformers (Introduction). Generative Models in Vision: Autoencoders, GANs (Overview). Video Analytics and Action Recognition (Introduction). Model Optimization: Data augmentation, Regularization, Hyperparameter tuning. Ethical Issues in AI Vision Systems. Mini Project / Case Study Discussion.

Text Books:

9. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT Press.
10. Szeliski, R. (2022). Computer vision: Algorithms and applications (2nd ed.). Springer.
11. Prince, S. J. D. (2012). Computer vision: Models, learning, and inference. Cambridge University Press.

Reference Books:

- Chollet, F. (2021). Deep learning with Python (2nd ed.). Manning Publications.
- Géron, A. (2022). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow (3rd ed.). O'Reilly Media.
- Rosebrock, A. (2018). Deep learning for computer vision with Python. PyImageSearch.

END SEMESTER EXAMINATION – MODEL QUESTION PAPER

Course Code	25HAMT401
Course Name	AI FOR COMPUTER VISION
Max. Marks: 60	Duration: 2.5 Hours

Part A (Answer all questions. Each question carries 3 marks)				
Qn No	Question	Marks	CO	BL
1.	Explain edge detection techniques: Sobel and Canny edge detectors.	3	CO1	L2
2.	Describe the HOG (Histogram of Oriented Gradients) feature extraction technique.	3	CO1	L2
3.	Explain the convolution operation in CNNs and the role of activation functions.	3	CO2	L2
4.	Describe transfer learning and fine-tuning with an example of a pre-trained CNN.	3	CO2	L2
5.	Explain the YOLO architecture for object detection.	3	CO3	L2
6.	Compare semantic segmentation and instance segmentation with examples.	3	CO3	L2
7.	Explain Vision Transformers (ViT) and their significance in computer vision.	3	CO4	L2
8.	Describe ethical issues in AI vision systems with examples.	3	CO4	L2

Part B (Answer any one full question from each Module. Each carry 9 marks)

Qn No.	Question	Marks	CO	BL
Module I				
9.a	Explain image processing basics: image filtering, smoothing, and image transformations with examples.	5	CO1	L2
9.b	Describe image classification using traditional ML: feature engineering, SVM, and k-NN for vision tasks.	4	CO1	L3
OR				
10	Explain SIFT and HOG feature extraction techniques. Discuss digital image formation and representation.	9	CO1	L2
Module II				
11.a	Illustrate Convolutional Neural Networks in detail: convolution, pooling operations, and activation functions. Describe the ResNet architecture.	5	CO2	L3
11.b	Illustrate precision, recall, F1-score, and IoU as performance evaluation metrics for image classification.	4	CO2	L3
OR				
12	Describe advanced CNN architectures: LeNet, AlexNet, VGG, and ResNet. Explain transfer learning and fine-tuning with a practical example.	9	CO2	L2
Module III				
13	Explain the R-CNN family: R-CNN, Fast R-CNN, and Faster R-CNN. Describe their working principle and compare their efficiency.	9	CO3	L2
OR				
14.a	Explain U-Net architecture for image segmentation. Describe its applications in medical imaging.	5	CO3	L2
14.b	Explain the YOLO architecture and describe its application in autonomous driving.	4	CO3	L3
Module IV				
15.a	Explain Generative Adversarial Networks (GANs) and Autoencoders for generative vision tasks.	5	CO4	L2
15.b	Describe model optimization techniques: data augmentation, regularization, and hyperparameter tuning.	4	CO4	L3
OR				
16	Apply advanced computer vision techniques to develop an AI vision solution. Discuss Vision Transformers, video analytics, ethical considerations, and model optimization.	9	CO4	L3

