Course Code: CSE—	Course Title: Deep Learning for Computer Vision			Programme: B. Tech. (CSE)
Type of Course: Program Elective	Prerequisites: • Artificial Intelligence • Introduction to Data Science • Probability and Statistics			Total Contact Hours: 40
Year/Semester: 3/Even	Lecture Hrs/Week: 3	Tutorial Hrs/Week: 0	Practical Hrs/Week: 0	Credits: 3

Learning Objective:

Deep Computer Vision (DCV) has attracted exciting applications such as image restoration, synthesis, and style transfer. This course provides insights into how to develop applications using DCV. Students enrolled in this research-based course should have some **Deep learning and Python programming** background. The course is divided into five units. The first unit provides an introduction to the DCV. The second unit discusses advanced tools for computer vision tasks. The third unit introduces Learning Paradigms and advanced techniques in the context of DCV. In the fourth unit, we dive into applications of DCV and discuss how to perform various computer vision applications. Finally, the fifth unit discusses image quality and ethical concerns for DCV applications.

Course outcomes (COs):

On completion of this course, the students will have the ability to:		Bloom's Level
CO-1	**Understand** basic concepts needed for Deep Computer Vision	2
CO-2	**Understand** the recent architectures, techniques, and learning paradigms in Deep Computer Vision	2
CO-3	**Apply** Deep Computer Vision for real-world applications.	3
CO-4	**Analyze** the Deep Vision model for quality, security and ethics	4

Course Topics	Lecture Hours	
UNIT – I Introduction to Deep Computer Vision	**7**	**CO1**
1.1 Deep Neural Networks- Loss functions, Regularization, Training	3	
1.2 Convolution, Transpose Convolution, Convolutional Neural Network	2	
1.3 Image classification and Object Detection using CNN	2	

UNIT – II Architectures	**8**	**CO2**
2.1 Encoder-decoder network	2	
2.2 Siamese network	2	
2.3 Graph Convolutional Networks	2	
2.4 Vision Transformers	2	
UNIT – III Learning paradigms and advanced techniques	**10**	**CO2**
3.1 Unsupervised Learning - Variational autoencoder and Generative adversarial networks	4	
3.2 Self-Supervised Learning - Exemplar Task-Based Learning and Contrastive Learning	2	
3.3 Transfer learning, Zero-Shot, One-Shot, and Few-Shot Learning	4	
UNIT-IV Applications	**10**	**CO3**
4.1 Image Restoration (Denoising, Inpainting, and Dehazing)	2	
4.2 Image Segmentation and Image Synthesis	2	
4.3 Neural style transfer and Semantic style transfer	2	
4.4 Image Retrieval using CNN	2	
4.5 Vision and Language (CLIP: Connecting text and images)	2	
UNIT-V Quality, Security and Ethics	**5**	**CO4**
5.1 Image quality assessment	2	
5.2 Attacks and Defense on Image Classification	2	
5.3 Deep Computer Vision and ethics	1	

Evaluation Method		
Item	**Weightage (%)**	**CO Mapping**
Assignments	10	CO1, CO2, CO3, CO4
Quizzes	10	CO1, CO2, CO3, CO4
Project	15	CO1, CO2, CO3
Midterm	25	CO1, CO2
End-Term	40	CO1, CO2, CO3, CO4

Text Book:

1. Elgendy, Mohamed. Deep learning for vision systems. Simon and Schuster, 2020.
2. Understanding Deep Learning Book by Simon J.D. Prince, 2023.

Other Books:

1. Dive into Deep Learning: Book by Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola.
2. Deep Learning. Book by Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press.
3. Graph Representation Learning. Book by William L. Hamilton.
4. Davies, E. Roy, and Matthew Turk, eds. Advanced methods and deep learning in computer vision. Academic Press, 2021.

Similar Courses:

1. NPTEL course on Deep Learning for Computer Vision By Prof. Vineeth N Balasubramanian
2. CS231n: Deep Learning for Computer Vision Stanford Course
3. CS294-158-SP20 Deep Unsupervised Learning, UC Berkeley, Spring 2020
4. EECS 498.008 / 598.008 Deep Learning for Computer Vision University of MICHIGAN

*Please note, as per the existing institute's attendance policy the student should have a minimum of 75% attendance. Students who fail to attend a minimum of 75% lectures will be debarred from the End Term/Final/Comprehensive examination.