INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

DEEP LEARNING PARADIGMS FOR COMPUTER VISION								
VI Semester: CSE (AI&ML)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ACAD38	**Elective**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisites: Python Programming / Applied Artificial Intelligence								

I. COURSE OVERVIEW:
This course is study of computing systems that can process, understand, or communicate in human language. The primary focus of the course will be on understanding various NLP tasks and algorithms for effectively solving these problems, and methods for evaluating their performance. This course is intended as a theoretical and methodological introduction to the most widely used and effective current techniques, strategies and toolkits for natural language processing, with a primary focus on those available in the Python programming language.

II. COURSE OBJECTIVES:
The students will try to learn:

I. The basic ideas, principles and motion analysis techniques of Computer Vision.
II. The motion analysis Techniques in Computer Vision.
III. The principles of deep learning and apply them to build effective architectures.
IV. The various deep learning models for Computer Vision.

III. COURSE OUTCOMES:
At the end of the course students should be able to:

CO1 Implement fundamental image processing techniques required for computer vision.
CO2 Employee the motion analysis techniques for solving real life problem.
CO3 Apply the deep learning architectures to various problems.
CO4 Develop applications of computer vision using deep learning techniques.
CO5 Implement various deep learning models to apply for real-time problems.
CO6 Understand the methods of solving real life problems with respect to computer Vision using Deep Learning techniques.

IV. COURSE CONTENT:

MODULE – I: BASICS OF COMPUTER VISION (09)
Introduction-Image Formation-Image Representation-Linear Filtering-Image in frequency domain Image Sampling-Edge Detection-Feature detection - SIFT and its variants- Image Segmentation Feature matching.

MODULE – II: MOTION ANALYSIS (09)
Background Subtraction and Modeling-Optical Flow- KLT- Spatio-Temporal Analysis-Dynamic Stereo-Motion parameter estimation

MODULE – III: DEEP LEARNING ARCHITECTURES (10)
CNN Architectures – Convolution – Pooling Layers – Back propagation in CNN-Transfer Learning -RNN, LSTM, GRU,

Encoder/Decoder Architectures – Autoencoders –Variational Autoencoders – Adversarial Generative Networks – Self Attention Mechanism.

MODULE – IV: DEEP LEARNING MODELS FOR COMPUTER VISION (09)
Object Classification-VGGNET, RESNET, ALEXNET, DENSENET, EFFICIENT NET, MOBILENET, INCEPTION V3, Object Detection-R-CNN, F-RCN, SSD, Retinanet, YOLO, CornerNet, Image Segmentation- U-Net, SegNet, Mask-RCNN, Attention Models-Transformers.

MODULE – V: APPLICATIONS AND RECENT TRENDS (10)
Applications- Image Editing, Inpainting, Superresolution, 3D Object Generation, Security, Surveillance-Object Tracking-Automatic Image Captioning. Recent Trends- Zero-shot, One shot, Few-shot Learning-Self-supervised Learning and Reinforcement Learning in Vision.

V. TEXTBOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, 2016.
2. Richard Szeliski, Computer Vision: Algorithms and Applications, 2010.
3. Simon Prince, Computer Vision: Models, Learning, and Inference, 2012.
4. Andrew Glassner, Deep Learning: A Visual Approach, No Starch Press, 2021.

VI. REFERENCE BOOKS:

1. Mahamoud Hassaballah, Deep Learning in Computer Vision Principles and Applications, CRC Press, 2021.
2. Seth Weidman, Deep Learning from Scratch, Building with Python, Oreilly, 2019.
3. Yoshua Bengio, Learning Deep Architectures for AI, 2009.
4. Michael Nielsen, Neural Networks and Deep Learning, 2016.
5. David Forsyth, Jean Ponce, Computer Vision: A Modern Approach, 2002.
6. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.

VII. WEB REFERENCES

1. Swayam NPTEL: Deep Learning for Computer Vision - Deep Learning for Computer Vision - Course.
2. Swayam NPTEL: Deep Learning for Computer Vision - Deep Learning for Computer Vision - Course.
3. IBM: Deep Learning - What Is Deep Learning? | IBM
4. GeeksforGeeks: Introduction to Deep Learning - Introduction to Deep Learning - GeeksforGeeks.

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. PowerPoint presentation
11. E-Learning Readiness Videos (ELRV)