

**Course Details:**

<b>Course Name:</b>	<b>Advanced Deep Learning</b>	<b>Course Code:</b>			ECSEL
<b>Department:</b>	<b>Computer Science Engineering</b>	<b>Type:</b>			<b>Core</b>
<b>L-T-P Structure</b>	<b>3-0-2</b>	<b>Credits</b>	<b>4</b>	<b>Pre-requisite:</b>	<b>Machine Learning and Deep Learning</b>
<b>Course Objectives</b>	This course covers the advanced concepts in Artificial Intelligence and Deep Learning. It helps the students to learn and practice a variety of advanced Supervised, Unsupervised and Reinforcement Deep Learning approaches.				
<b>Course Outcome</b>	At the end of this course, the students will be able to: <ol style="list-style-type: none"> <li>1. Learn about and practice a variety of advanced Supervised, Unsupervised and Reinforcement Deep Learning approaches</li> <li>2. Design current state-of-the-art Supervised, Unsupervised and Reinforcement Deep Learning approaches for real-life problems.</li> <li>3. Develop AI systems and applications using Supervised, Unsupervised and Reinforcement Deep Learning approaches</li> </ol>				
<b>Course Contents:</b>	<b>Topics</b>				<b>No. of Hours</b>
1	<b>Deep Unsupervised Learning:</b> Sparse Coding, Auto-encoder, Stacked Autoencoders, Deep Autoencoders				3
2	<b>Types of AE:</b> Denoising Autoencoder, Sparse Autoencoders, Undercomplete Autoencoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Autoencoders				3
3	<b>Autoencoder Applications:</b> Data compression, retrieval, classification, document clustering, sentiment analysis				3
4	<b>Generative Modelling - Part 1:</b> Monte Carlo Methods, Markov Chain Monte Carlo Methods, Gibbs Sampling				3
5	<b>Generative Modelling – Part 2:</b> Graphical Models, Markov Chains, Hopfield Networks				3
6	<b>Generative Modelling – Part 3:</b> Boltzmann Machines, Restricted Boltzmann Machines, Deep Belief Networks, Deep Boltzmann Machines				3
7	<b>Deep Generative Learning:</b> Variational Auto-encoders, Drawbacks of VAE, Generative Adversarial Networks				3
8	<b>Generative Adversarial Networks (GANs):</b> Discriminative and Generative Networks, Tips and Tricks in Training GANs, Variants of GANs				3
9	<b>GANs Applications:</b> Image generation, font generation, anime face/celebrity face generation, video generation				3
10	<b>Reinforcement Learning:</b> Markov decision Process, Value based RL, Policy base RL, Model based RL, Q-Learning, Bellman Equation				3

11	<b>Deep Reinforcement Learning:</b> Deep Q Networks (DQN), Exploration vs Exploitation, Value Iteration vs Policy Iteration, Policy Gradients,	3
12	<b>Reinforcement Learning Applications:</b> Robotics, gaming, Ad Targeting, recommendation system, decision making	3
13	<b>Model optimization for Deployment:</b> Pruning, sparse decomposition, quantization and binarization, Transferred or Compact Convolutional Filters	3
14	<b>Recent Trends in Deep Learning:</b> Attention mechanism, Neural Networks with External Memory, Competitive Learning	3
<b>Lab Work</b>	Aims: To focus on gathering, pre-processing tabular, visual, textual and audio data for building advanced deep learning models using standard Python libraries. To train, improve, and deploy advanced deep learning models in different devices. To analyse performance of different deep learning models using speed, accuracy, size trade-offs.	
<b>Text Book:</b>	<ol style="list-style-type: none"> <li>1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, <a href="http://www.deeplearningbook.org">http://www.deeplearningbook.org</a>, 2016.</li> <li>2. Charu C. Aggarwal, Neural Networks and Deep Learning, Springer International Publishing AG, part of Springer Nature 2018</li> </ol>	
<b>References:</b>	<ol style="list-style-type: none"> <li>1. Francois Chollet, Deep Learning with Python, Manning Publications Company, 2017</li> <li>2. Aurélien Géron, Hands-on Machine Learning with Scikit-Learn and TensorFlow, O'Reilly Media, 2017</li> <li>3. Michael Nielsen, Neural Networks and Deep Learning, <a href="http://neuralnetworksanddeeplearning.com/">http://neuralnetworksanddeeplearning.com/</a></li> </ol>	