Course Code	PCS21G01J	Course Name	DEEP LEARNING FOR DATA SCIENCE	Course Category	G	Generic Elective Course	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Science		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to,
CLR-1 :	*Develop knowledge of Neural Network*
CLR-2 :	*Understand and analyze deep learning*
CLR-3 :	*Perform Optimization Techniques*
CLR-4 :	*Implement Deep Learning models*
CLR-5 :	*Get Familiar with Keras library*
CLR-6 :	*Implement Deep Q-Learning*

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO 1	PSO 2	PSO 3
CLO-1 :	*Build a Perceptron model*	2	85	80	H	H	H	H	H	H	-								
CLO-2 :	*Build Neural Network model using BP algorithm*	3	85	80	L	H	H	H	H	H	-								
CLO-3 :	*Using Pytorch to build a prediction model*	3	85	80	L	H	H	H	H	H	-								
CLO-4 :	*Fine Tuning the Deep Learning models for performance optimization*	3	85	80	L	H	H	H	H	H	-								
CLO-5 :	*Build, Compile, Test, and evaluate model in Keras*	3	85	80	L	H	H	H	H	H	-								
CLO-6 :	*Work with Generative Adversarial Networks*	3	85	80	L	H	H	H	H	H	-								

Duration (hour)		15	15	15	15	15
S-1	SLO-1	*Introduction to Neural Network*	*Fine Tuning NN models ANN Processing Components*	*Fine Tuning NN Models What is Fine Tuning?*	*Keras and DL Overview of TFMA*	*Interactive Applications of DL*
	SLO-2	*Fundamentals*	*Learning and Training in ANN*	*Regularization*	*Practical Consideration for DL*	*Machine Vision – CNN*
S-2	SLO-1	*Biological NN Vs ANN*	*Cluster analysis in ANN*	*What is Vector Quantization?*	*DL parameters*	*Pooling Layers*
	SLO-2	*ANN Architecture*	*NN Building blocks*	*The Encoder-Decoder Model*	*Data Loading and Preprocessing*	*Lenet-5 in Keras*
S-3	SLO-1	*Computational Models in NN Neurons Interconnection*	*Perceptron to Deep NN Model and Hyper parameters*	*The Generalized Lloyd Algorithm Relation between SOM and noisy encoder-decoder*	*Data Preprocessing with Keras Keras Layers*	*Alexnet and vggnet in keras Natural Language processing*
	SLO-2	*Threshold Functions Activation functions & ANN*	*Classification with NN Deep Learning Frameworks*	*Voronoi Tesselation LVQ Introduction*	*Training Models with fit() Monitoring Performance Metrics*	*Creating word embeddings with word2vec Natural Language Classification with familiar networks*
S 4-5	SLO-1	*Laboratory 1: Implement a Feed Forward Neural Network with Back propagation training algorithm for realizing XOR problem*	*Laboratory 4: Build a NN model using PyTorch*	*Laboratory 7: Implement LVQ Network for Pattern Classification*	*Laboratory 10: Build a model for Credit Card Fraudulence Detection*	*Laboratory 13: Build a CNN model for Image Classification*
	SLO-2					
S-6	SLO-1	*Implementing Neural Networks Building Neural Networks Models*	*NN Categorization*	*The LVQ Algortihm*	*Checkpointing*	*Generative Adversarial Networks*

Duration (hour)		15	15	15	15	15
	SLO-2	*Use case of ANN*	*NN Computational Model*	*The LVQ2 Algorithm*	*Debugging the model with eager execution*	*Essential GAN Theory*
S-7	SLO-1	*Perceptrons*	*NN Building Components*	*Hebbian Learning*	*Speed Up process with multiple GPUs*	*The Discriminator Network*
	SLO-2	*Single Layer Perceptron Model*	*Evolutionary Algorithm & Gradient Descent*	*Hebbian Learning Rule*	*Multiple GPU and distributed trainings*	*The Generator Network*
S-8	SLO-1	*Least Mean Square Algorithm*	*Object Image Classification*	*Competitive Learning*	*Transfer Learning*	*The Adversarial Network*
		Learning Curves	*Learning rates and Optimization*	*Optimizing NN*	*Image classification*	*GAN Training*
	SLO-2	*Learning Rates*	*Optimizing Speed*	*Debugging NN*	*Keras Metrics*	*Reinforcement Learning*
		Perceptron	*Dense Network Tuning using Hyper parameters*	*Learning rate optimization*	*Jupyter notebooks*	*Reinforcement Learning Process steps*
S 9-10	SLO-1	*Laboratory 2: Implement a Perceptron in Python*	*Laboratory 5: Implement ANN Training in Python for MNIST Digit Classification problem*	*Laboratory 8: Using Keras, perform rate adaption schedule.*	*Laboratory 11: Work on a text classification problem with Keras API*	*Laboratory 14: Design and build a Game environment*
	SLO-2					
S-11	SLO-1	*Multilayer Perceptron*	*Linear Model with Estimators*	*Optimizing Networks*	*Dataset for NN*	*Deep Reinforcement Learning Applications*
	SLO-2	*The XOR Problem*	*NN for Predictions*	*Rate adaption schedule*	*Exploring the Dataset*	*Deep RL Use cases*
S-12	SLO-1	*Back Propagation Algorithm, Heuristics for improving BP algorithm*	*Optimization approaches for prediction, NN algorithms*	*Scaling, Scaling methods*	*Preparing the dataset, Visualizing the dataset*	*Deep-Q Learning Introduction, The DQN Agent*
	SLO-2	*Radial Basis Function Networks, Interpolation*	*Data preparation for NN, ANN Training in python*	*Batch Normalization, Mini Batch Normalization*	*Compiling the model, Training the NN*	*Q-Learning, Deep Q Learning*
S-13	SLO-1	*Regularization*	*Training Samples*	*Internal Covariate Shift*	*Testing the NN*	*Steps in Deep Q Learning*
	SLO-2	*Learning Strategies*	*Overfitting and Underfitting*	*Implement Gradient learning*	*Evaluate the model*	*Experience Replay*
S 14-15	SLO-1	*Laboratory 3: Implement a Feed Forward Neural Network with Back propagation training algorithm for realizing Straight line e.g. y = 2x + 3*	*Laboratory 6: Perform Hyper parameter tuning in the ANN model implemented in Lab 5*	*Laboratory 9: Implement Batch Normalization and gauge its performance*	*Laboratory 12: Build a DL model for diabetes classification problem*	*Laboratory 15:Build and Train the Deep Q Neural Network*
	SLO-2					

Learning Resources	1. Deep Learning with Python,By Francois Chollet, December 2017 2. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence,By Jon Krohn, Grant Beyleveld and Aglaé Bassens, September 2019	3. Hugo Larochelle's Video Lectures on Deep Learning 4. Introduction to Deep Learning by Sandro Skansi, Springer, 2018 5. Deep Learning withTensorFlow 2 and Keras - Second Edition,By Antonio Gulli, Amita Kapoor and Sujit Pal, December 2019

Learning Assessment

Bloom's Level of Thinking		Continous Learning Assessment(50% Weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4# (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
	Understand										
Level 2	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
	Analyze										
Level 3	Evaluate	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Create										
	Total	100 %		100 %		100 %		100 %		100%	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
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