LECTURE PLAN

Institute/Department	UNIVERSITY INSTITUTE OF ENGINEERING (UIE)	**Program**	**Bachelor of Engineering (Computer Science and Engineering) (Hons.) (with specialization in Artificial Intelligence and Machine Learning) (In association with IBM) (Lateral Entry)(CS220)**
Master Subject Coordinator Name:	Amit Kukker	**Master Subject Coordinator E-Code**:	**E16298**
Course Name	Deep Learning	**Course Code**	**21CSH-432**

Lecture	Tutorial	Practical	Self Study	Credit	Subject Type
3	0	2	0	4.0	T

Course Type	Course Category	Mode of Assessment	Mode of Delivery
Major Elective	Graded (GR)	Hybrid	Hybrid (HYB)

Mission of the Department	M1: To provide relevant, rigorous and contemporary curriculum and aligned assessment system to ensure effective learning outcomes for engineering technologies. M2: To provide platform for industry engagement aimed at providing hands-on training on advanced technological and business skills to our students. M3: To provide opportunities for collaborative, interdisciplinary and cutting-edge research aimed at developing solutions to real life problems M4: To imbibe quest for innovation, continuous learning and zeal to pursue excellence through hard work and problem-solving approach M5: To foster skills of leadership, management, communication, team spirit and strong professional ethics in all academic and societal endeavours of our students
Vision of the Department	To be recognized as a centre of excellence for Computer Science & Engineering education and research, through effective teaching practices, hands-on training on cutting edge computing technologies and excellence in innovation, for creating globally aware competent professionals with strong work ethics whom would be proficient in implementing modern technology solutions and shall have entrepreneurial zeal to solve problems of organizations and society at large.

Program Educational Objectives(PEOs)	
PEO1	To be able to explore areas of research, technology application & innovation and make a positive impact in different types of institutional settings such as corporate entities, government bodies, NGOs, inter-government organizations, & start-ups.
PEO2	To be able to design, and implement technology and computing solutions to organizational problems, effectively deploy knowledge of engineering principles, demonstrate critical thinking skills & make the intellectual connections between quantitative and qualitative tools, theories, and context to solve the organizational problems
PEO3	To be able to work with, lead & engage big and small teams comprising diverse people in terms of gender, nationality, region, language, culture & beliefs. To understand stated and unstated differences of views, beliefs & customs in diverse & interdisciplinary team settings
PEO4	To be able to continuously learn and update one's knowledge, engage in lifelong learning habits and acquire latest knowledge to perform in current work settings
PEO5	To continuously strive for justice, ethics, equality, honesty, and integrity both in personal and professional pursuits. Able to understand and conduct in a way that is responsible and respectful.

Program Specific OutComes(PSOs)	
PSO1	1. The graduate student shall be able to analyse and make valuable contributions in the design, development, and production of computer science and related engineering applications in the areas of Artificial intelligence and Machine learning.
PSO2	2. The graduate student shall be able to use the latest software tools and technologies related to Artificial intelligence and Machine learning and ability to practice as an engineer/researcher in the evolving field of AI and ML and its allied application domains by employing project
PSO3	3. The graduate student shall be able to analyse and exhibit proficiency in Artificial Intelligence and Data Analytics for providing solutions to real-world problems in Industry and Research establishments.

Program OutComes(POs)	
PO1	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal, and environmental considerations.
PO4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
PO5	Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context to technological change.

Text Books					
Sr No	Title of the Book	Author Name	Volume/Edition	Publish Hours	Years
1	Deep Learning	Goodfellow, I., Bengio,Y., and Courville, A	-	MIT Press	2016
2	., Pattern Recognition and Machine Learning	Bishop, C., M	-	Springer	2006

Reference Books					
Sr No	Title of the Book	Author Name	Volume/Edition	Publish Hours	Years
1	Artificial Neural Networks	Yegnanarayana, B.	-	PHI Learning Pvt. Ltd	2009

Course OutCome	
SrNo	OutCome
CO1	Understand neural network, its working and parameters, and various optimization methods for neural networks.
CO2	Differentiate between the major types of neural network architectures and its use case for different problems (classification/recognition) by these architectures.
CO3	Understand different deep neural network model architectures and its parameters tuning.
CO4	Design sequence model using different neural network architectures for new data problems based on their requirements and problem characteristics and analyse their performance.
CO5	Describe latest research being conducted in the field and open problems that are yet to be solved.

Lecture Plan Preview-Theory

Unit No	LectureNo	ChapterName	Topic	Text/ Reference Books	Pedagogical Tool**	Mapped with CO Numer (s)
1	1	Basics of Artificial Neural Network	Computational models of neurons	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO1
1	2	Basics of Artificial Neural Network	Structure of neural networks	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO1
1	3	Basics of Artificial Neural Network	Functional units of ANN for pattern recognition tasks	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO2
1	4	Basics of Artificial Neural Network	Pattern classification using perceptron	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO2
1	5	Basics of Artificial Neural Network	Multilayer feed forward neural networks (MLFFNNs)	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO2
1	6	Basics of Artificial Neural Network	Backpropagation learning	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO2
1	7	Basics of Artificial Neural Network	Empirical risk minimization, Regularization	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO1
1	8	Basics of Artificial Neural Network	Difficulty of training DNNs	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO1
1	9	Basics of Artificial Neural Network	Greedy layer wise training	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO1
1	10	Basics of Artificial Neural Network	Greedy layer wise training	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO1
1	11	Basics of Artificial Neural Network	Optimization for training DNNs	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO1
1	12	Basics of Artificial Neural Network	Optimization for training DNNs	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO1
1	13	Basics of Artificial Neural Network	Newer optimization methods for neural networks (AdaGrad, RMSProp, Adam)	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO1
1	14	Basics of Artificial Neural Network	Newer optimization methods for neural networks (AdaGrad, RMSProp, Adam)	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO1
1	15	Basics of Artificial Neural Network	Newer optimization methods for neural networks (AdaGrad, RMSProp, Adam)	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO1
2	16	Second Order Methods	Second order methods for training	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
2	17	Second Order Methods	Second order methods for training	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
2	18	Second Order Methods	Regularization methods (dropout, drop connect, batch normalization)	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
2	19	Second Order Methods	Regularization methods (dropout, drop connect, batch normalization)	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3

2	20	Second Order Methods	Regularization methods (dropout, drop connect, batch normalization)	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
2	21	Second Order Methods	Introduction to CNNs - convolution, pooling, Deep CNNs	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
2	22	Second Order Methods	Introduction to CNNs - convolution, pooling, Deep CNNs	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
2	23	Second Order Methods	Introduction to CNNs - convolution, pooling, Deep CNNs	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
2	24	Second Order Methods	Different deep CNN architectures - LeNet, AlexNet, VGG	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
2	25	Second Order Methods	Different deep CNN architectures - LeNet, AlexNet, VGG	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
2	26	Second Order Methods	Different deep CNN architectures - LeNet, AlexNet, VGG	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
2	27	Second Order Methods	Training a CNNs: weights initialization, batch normalization, hyper parameter optimization	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
2	28	Second Order Methods	Training a CNNs: weights initialization, batch normalization, hyper parameter optimization	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
2	29	Second Order Methods	Training a CNNs: weights initialization, batch normalization, hyper parameter optimization	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
2	30	Second Order Methods	Understanding and visualizing CNNs	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO3
3	31	Sequence modeling	Sequence modeling using RNNs	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO4
3	32	Sequence modeling	Sequence modeling using RNNs	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO5
3	33	Sequence modeling	Backpropagation through time	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO4
3	34	Sequence modeling	Backpropagation through time	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO5
3	35	Sequence modeling	Long Short Term Memory (LSTM), Bidirectional LSTMs	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO4
3	36	Sequence modeling	Long Short Term Memory (LSTM), Bidirectional LSTMs	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO5
3	37	Sequence modeling	Bidirectional RNNs, Gated RNN Architecture	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO4
3	38	Sequence modeling	Bidirectional RNNs, Gated RNN Architecture	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO5
3	39	Sequence modeling	Autoencoders (standard, denoising, contractive, etc), Variational Autoencoders	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO4
3	40	Sequence modeling	Autoencoders (standard, denoising, contractive, etc), Variational Autoencoders	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO4

3	41	Sequence modeling	Autoencoders (standard, denoising, contractive, etc), Variational Autoencoders	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO5
3	42	Sequence modeling	Autoencoders (standard, denoising, contractive, etc), Variational Autoencoders	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO5
3	43	Sequence modeling	Adversarial Generative Networks	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO4
3	44	Sequence modeling	Adversarial Generative Networks	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO4
3	45	Sequence modeling	Adversarial Generative Networks	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	PPT	CO5

Lecture Plan Preview-Practical

Unit No	ExperimentNo	Experiment Name	Text/ Reference Books	Pedagogical Tool**	Mapped with CO Numer(s)
1	1	Implementing Multilayer feed forward neural networ	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	Simulation	CO1,CO2
1	2	Implementing DNN	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	Simulation	CO1,CO2
1	3	Greedy Layerwise training of DNN	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	Simulation	CO1,CO2
2	4	AdaGrad optimization	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	Simulation	CO3
2	5	Implementing CNN	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	Simulation	CO3
2	6	Implementing Deep CNN	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	Simulation	CO3
2	7	Sequence Modelling using RNN	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	Simulation	CO3
3	8	Implementing LSTM	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	Simulation	CO4,CO5
3	9	Implementing Autoencoder	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	Simulation	CO4,CO5
3	10	Implementing Adversarial Generative Network	,T-., Pattern Recognition and Mac,T-Deep Learning,R-Artificial Neural Networks	Simulation	CO4,CO5

Assessment Model

Sr No	Assessment Name	Exam Name	Max Marks
1	Hybrid Course All	Practical Evaluations	40
2	Hybrid Course All	End Term Hybrid Theory	60
3	Hybrid Course All	Attendance Marks	2
4	Hybrid Course All	Surprise Test	12
5	Hybrid Course All	Practical MST	10
6	Hybrid Course All	Practical Worksheet/Projects 1	30
7	Hybrid Course All	Practical Worksheet/Projects 2	30

8	Hybrid Course All	Practical Worksheet/Projects 3	30
9	Hybrid Course All	Practical Worksheet/Projects 4	30
10	Hybrid Course All	Practical Worksheet/Projects 5	30
11	Hybrid Course All	Practical Worksheet/Projects 6	30
12	Hybrid Course All	Practical Worksheet/Projects 7	30
13	Hybrid Course All	Practical Worksheet/Projects 8	30
14	Hybrid Course All	Practical Worksheet/Projects 9	30
15	Hybrid Course All	Practical Worksheet/Projects 10	30
16	Hybrid Course All	Quiz	4
17	Hybrid Course All	Assignment/PBL	10
18	Hybrid Course All	MST-1 Hybrid	20
19	Hybrid Course All	MST-2 Hybrid	20