CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **BACHELOR OF TECHNOLOGY (Electronics and Communication)**

Semester: **VIII**

Course Code: **202060805**

Course Title: **Deep Neural Networks & Applications**

Course Group: Professional Elective Course

Course Objectives: In this course students will be given an exposure to the details of neural networks as well as deep learning architectures and to develop end-to-end models for complex systems. Students will learn to implement, train and debug their own neural networks. This is a project oriented practical course in which every student has to develop a complete working model to solve some real-world problem.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50/18	50/17	25/9	25/9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Learning with Neural Networks:** Problems, designing a learning system, Issues with machine learning, supervised versus Unsupervised learning, Basic architecture of Neural Networks, training a neural network with back propagation, Practical issues in neural networks training, Machine learning using shallow neural networks: Neural architectures for binary classification models, neural architectures for multiclass models.	8
2	**Deep Neural Network (DNNs):** Concept of Deep Learning, Deep Neural Networks (DNNs), Difficulty of training DNNs, Greedy layer wise training, Optimization for training DNNs, Newer optimization methods for neural networks (AdaGrad, RMSProp, Adam), Second order methods for training, Regularization methods (dropout, drop connect, batch normalization), Deep Learning with Tensor flow and Keras.	8
3	**Convolution neural networks (CNNs):** Introduction, Basic structure of Convolutional Networks, pooling, Deep CNNs, Different deep CNN architectures – LeNet, AlexNet, VGG, PlacesNet, Training a CNNs: weights initialization, batch normalization, hyperparameter optimization, Understanding and visualizing CNNs.	8

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4	**Recurrent neural networks (RNNs):** Sequence modeling using RNNs, Back propagation through time, Long Short Term Memory (LSTM), Bidirectional LSTMs, Bidirectional RNNs, Gated RNN Architecture.	**8**
5	**Generative models:** Restrictive Boltzmann Machines (RBMs), Stacking RBMs, Belief nets, Learning sigmoid belief nets, Deep belief nets.	**8**
6	**Applications:** Applications in vision, speech and Natural Language Processing, etc.	**5**
		45

List of Practicals / Tutorials:

1	Introduction to MATLAB / Python Tool for Neural Network Applications: Neural Network (NN) Toolbox, NN Simulink Demos
2	MATLAB simulation: Artificial Neural Network (ANN) implementation.
3	MATLAB simulation: NN Tool Artificial Neural Network (ANN) implementation.
4	MATLAB simulation: Various structure of NN algorithms implementation
5	Perform classification using AlexNet architecture.
6	Develop an algorithm using LeNet 5 for binary classification.
7	Develop algorithm for Recurrent Neural Network (RNN).
8	Implementation of LSTM architecture.
9	Design of a deep learning algorithm for multi label classification.
10	Case Study: Convolutional Neural Networks for Visual Recognition.
11	Case Study: Deep Learning for Natural Language Processing.

Reference Books:

1	Ian Goodfellow, Yoshua Bengio and Aaron Courville, **Deep learning**, MIT Press.
2	Charu C. Agrawal, **Neural Networks and Deep Learning**, Springer.
3	B. Yegnanarayana, **Artificial Neural Networks**, Prentice- Hall of India, 1999
4	C.M. Bishop, **Pattern Recognition and Machine Learning**, Springer, 2006
5	S. Haykin, **Neural Networks and Learning Machines**, Prentice Hall of India, 2010

Supplementary learning Material:	
1	https://towardsdatascience.com/an-introduction-to-deep-learning-af63448c122c
2	NPTEL and Coursera Video Lectures

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

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Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
10	**20**	**25**	**20**	**15**	**10**	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand the concept of Artificial Neural Networks for binary and multiclass classifications.	**20**
CO-2	Learn about various deep learning architectures.	**20**
CO-3	Study deep CNN architecture, convolution and recurrent neural network.	**30**
CO-4	Understand Advanced deep learning techniques and applications.	**30**

Curriculum Revision:	
Version:	**2.0**
Drafted on (Month-Year):	June -2022
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025

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