CENTRAL UNIVERSITY OF PUNJAB BATHINDA

SYLLABUS

Post Graduate Certificate Course in Deep Neural Networks

Session – 2025 Onwards

Department of Computer Science & Technology
Central University of Punjab, VPO-Ghudda, Bathinda, Punjab, India- 151401

Proposed Course Curriculum
Certificate Course in Deep Neural Networks

Course Description

Deep neural networks are an emerging area and is effecting the research in mostly all disciplines. Thus there is a strong need to train our students from various departments in the area of neural networks and deep learning. The course is designed for Second year PG students and PhD research Scholars. The course will be based on case studies from various disciplines with hands on training.

The course duration will be of 6 months.

Programme Objectives

Deep neural networks are used in most fields from Education, Law to Medical Science, Defense and other critical areas. The objective of this certificate course is to introduce the students from various disciplines to the area of Deep Neural Networks. The certificate course will help the students from various disciplines to:

PEO1: Understand the concept of neural networks and its evolution to deep neural networks
PEO2: Discuss major technology trends driving Deep Learning
PEO3: Be able to build, train and apply deep neural networks to their area specific problems
PEO4: Recognize the key parameters in a neural network's architecture that effect the results
Desirable: Basic programming skill
Eligibility: Any UG Program in Science or Humanities
Duration: 06 months
Number of Seats: 30

Course Structure of the Programme

The certificate course comprises of two papers with project work:

S.No	Course Name	Type	Hours	Credits
1.	Artificial Neural Networks	Theory	4	4
		Practical	4	2
2.	Deep Neural Networks	Theory	4	4
		Practical	4	2
3.	Capstone Project	Practical	16	8
TOTAL				**20**

Course Code:
Course Title: Artificial Neural Networks
Total Hours: 60

L	T	P	Cr
4	0	2	4

Course Objective:
The course Artificial Neural Networks aims to provide PG Diploma students with a foundational understanding of neural network models and their applications. It covers the structure of neural networks, learning algorithms, and different architectures such as feedforward and recurrent networks. Students will gain hands-on experience in designing, training, and applying neural networks to real-world problems like classification and prediction. The course also introduces relevant tools and software, preparing students to implement intelligent systems effectively.

Course Learning Outcomes:
After completion of course, students would be able to:
CLO1: Describe Artificial Intelligence and Machine Learning
CLO2: Explain the architecture and characteristics of Artificial Neural Networks
CLO3: Discuss the different types of neural network training algorithms
CLO4: Build simple neural network models using open source tools

Units/Hours	Contents	Mapping with Course Learning Outcome
I **10 Hours**	Introduction to Artificial Intelligence and Machine learning and their role in emerging areas.	**CLO1**
II **12 Hours**	Fundamentals of Artificial Neural Networks (ANN): Definition, Introduction to the ANN Architecture, Characteristics of neural networks, Example uses of ANN	**CLO2**
III **18 Hours**	Neural Networks Training Algorithms: Supervised and Unsupervised Training Algorithms, Learning using Hebbian, competitive and Boltzmann method, Types of Activation Functions.	**CLO3**
IV **20 Hours**	Building a neural network from scratch using either MatLab, Python. Introduction to open source libraries for machine learning like Tensor flow.	**CLO4**

Suggested Readings

1. Neil Wilkins, Artificial Intelligence: An Essential Beginner's Guide to AI, Machine Learning, Robotics, The Internet of Things, Neural Networks, Deep Learning, Reinforcement Learning and Our Future, Bravex Publications (20 July 2019)
2. Herbert Jones, Neural Networks: An Essential Beginners Guide to Artificial Neural Networks and their Role in Machine Learning and Artificial Intelligence
3. Stuart Russell and Peter Norvig, Artificial Intelligence – A Modern Approach, (3rd Edition)
4. Chandra S.S.V, Artificial Intelligence and Machine Learning, Prentice Hall India Learning Private Limited; 1st edition (1 January 2014)
5. Denis Rothman, Artificial Intelligence By Example, Packt Publishing; 1st edition (31 May 2018)

Course Code:
Course Title: Deep Neural Networks
Total Hours: 60

L	T	P	Cr
4	0	2	4

Course Objective:
To provide students with a strong foundation in deep neural network architectures, training algorithms, and transfer learning techniques, enabling them to design, implement, and fine-tune deep learning models for real-world applications.

Course Learning Outcomes:
After completion of course, students would be able to:
CLO1: Discuss the Deep Neural Network Models and their types
CLO2: Apply various Deep Neural Network Training algorithms
CLO3: Describe Transfer Learning and its types
CLO4: Design Deep Neural Network model as minor project and Identify and fine tune the Deep Neural Network parameters

Units/Hours	Contents	Mapping with Course Learning Outcome
I 20 Hours	Deep Neural Networks, Types of Deep Neural Network Models (RNN, CNN, LSTM, Deep Belief Network, semantic Hashing). Uses, merits and demerits of various models. Training deep neural network: Training process of deep neural networks, Challenges in training the deep learning models and frontier areas of research. .	**CLO1**
II 15 Hours	Overview of Transfer Learning: Inductive, unsupervised and Transductive	**CLO2**
III 15 Hours	Building deep neural network-based project	**CLO3**
IV 10 Hours	Tuning Deep Learning Models, Trends in Deep Learning, Deep Neural Networks Case Studies	**CLO4**

Suggested Reading

1. Seth Weidman, Deep Learning from Scratch: Building with Python from First Principles, O`Reilley.
2. David Julian, Deep Learning with PyTorch Quick Start Guide: Learn to train and deploy neural network models in Python, Packt Publishing Limited (24 December 2018)
3. Yuxi (Hayden) Liu, Hands-On Deep Learning Architectures with Python: Create deep neural networks to solve computational problems using TensorFlow and Keras, Packt Publishing Limited (30 April 2019).
4. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer; 1st ed. 2018 edition (13 September 2018)

Course Code:
Course Title: Capstone Lab
Total Hours: 16

L	T	P	Cr
0	0	16	8

Course Objectives:
The objective of this lab is to help a team of students develop and execute an innovative project idea under the direction of the Capstone course Incharge.

Learning Outcome:
After the completion of the course the students will be able to
CLO1: Complete the four phases of project development: requirements analysis, design, implementation, and documentation.

Timeline Work of Seminar:

Month	Module-1	Module-2	Module-3
Work to be Done	Submit area and Objectives to be achieved	Weekly report to faculty Incharge.	• 3rd week submit report • 4th week Presentation

Evaluation Criteria:

Evaluation Parameter	Marks	Evaluated By
Area & Objectives		**Evaluation Committee**
Reports and Implementation		
Presentation and Viva-voce		
Total		