# COURSE PLAN

## 21CSE558T DEEP NEURAL NETWORK ARCHITECTURES

### AUGUST-DECEMBER 2025

## Revision History:

| Date | Version | Modification done | Modified by | Reviewed by | Authorized by |
| --- | --- | --- | --- | --- | --- |
| 15-08-2025 | 1.0 | Initial Release | Prof. Ramesh Babu | Dr. [HOD Name] |  |
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## 1.0 General Details

**Course Code:** 21CSE558T  
**Course Title:** Deep Neural Network Architectures  
**Semester:** VII  
**Course Time:** AUGUST – DEC 2025  
**Slot:** [To be assigned]

| Day | Batch 1 |  | Batch 2 |  |
| --- | --- | --- | --- | --- |
|  | Hour | Timing | Hour | Timing |
| Day order 1 | - | - | - | - |
| Day order 2 | - | - | - | - |
| Day order 3 | 1,2 | 8:00am - 9:40am | - | - |
| Day order 4 | 10 | 04:00-04:50 | - | - |
| Day order 5 | 3 | 9:45-10:35 | - | - |

**Location:** University Building, Tech Park, [Room Number]

## 2.0 Reference Books

1. Chollet F. “Deep learning with Python.” 2nd Edition, Manning Publications, ISBN: 978-1617296864, 2021
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, ISBN: 978-0262035613, 2017
3. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, ISBN: 978-0262018029, 2012
4. Brownlee J. “Deep learning with Python: develop deep learning models on Theano and TensorFlow using Keras.” 2016
5. Weidman S. “Deep learning from scratch: Building with python from first principles.” O’Reilly Media, ISBN: 978-1492041405, 2019
6. Gulli A, Kapoor A. “TensorFlow 1.x Deep Learning Cookbook.” Packt Publishing Ltd, ISBN: 978-1786462169, 2017

## 3.0 Prerequisites

* Basic knowledge of Python programming
* Understanding of linear algebra and calculus
* Familiarity with machine learning concepts (recommended)
* Access to computing resources with GPU support (preferred)

## 4.0 Instructional Objectives

1. **Understand the fundamental concepts and basic tools of deep neural networks** including biological motivation, perceptron models, and TensorFlow framework implementation.
2. **Recognize and appreciate the functionalities of various layers in deep neural networks** with emphasis on activation functions, optimization algorithms, and regularization techniques.
3. **Explore the application of deep neural networks in image processing** including feature extraction, classification, and computer vision applications using OpenCV.
4. **Comprehend convolutional neural networks and its layer-wise functionality** including convolution operations, pooling layers, and CNN architectures.
5. **Get familiar with transfer learning techniques** including pre-trained models, fine-tuning, and object detection frameworks.
6. **Apply knowledge of deep learning best practices** to real-world scenarios including model optimization, evaluation metrics, and deployment considerations.
7. **Implement hands-on projects using industry-standard frameworks** including TensorFlow, Keras, and OpenCV for practical deep learning applications.

## 5.0 Overall Assessment Plan

| S.No | Component | Type | Marks |
| --- | --- | --- | --- |
| 1 | Formative Assessment I | Quiz | 5 |
| 2 | Formative Assessment II | Written Test | 15 |
| 3 | Formative Assessment III | Written Test | 15 |
| 4 | Formative Assessment IV | Assessment of Tutorials | 15 |
| 5 | Life Long Learning I | Technical Paper/Project | 10 |
| **Total Marks** |  |  | **60** |

## 6.0 Tentative Test Schedule

| S.NO. | Tentative date | Test | Marks | Portion | Duration |
| --- | --- | --- | --- | --- | --- |
| 1 | 29.08.2025 | FT-I | 5 | Module 1 (Partially) | 50 min |
| 2 | 19.09.2025 | FT-II | 15 | Modules 1 & 2 (Complete) | 100 minutes |
| 3 | 31.10.2025 | FT-III | 15 | Modules 3 & 4 (Complete) | 100 minutes |

## 7.0 Detailed Test Plan

| Test | Tentative Date | Type | Marks | Mode |
| --- | --- | --- | --- | --- |
| FT-I | 29.8.2025 | Quiz | 22 multiple choice questions and 3 fill in the blanks (25 marks to be converted to 5 marks) | Physical Exam |
| FT-II | 19.9.2025 | Written Exam | MCQ-10 X 1=10 marksPart A: 4 x 5 =20 marksPart B: 2 x 10=20 marks | Physical mode |
| FT-III | 31.10.2025 | Written Exam | MCQ-10 X 1=10 marksPart A: 4 x 5 =20 marksPart B: 2 x 10=20 marks | Physical mode |
| FT-IV | Continuous Assessment | Demo & QA | Each week Assignment-5 marksAverage=15 marks | Physical mode |

## 8.0 Lifelong Learning

### 8.1 Higher order thinking Skills through Co teaching

| Test | Tentative date of Evaluation | Total Marks | Split-up |
| --- | --- | --- | --- |
| Technical Paper/Project | End of Module 3 | 10 | Submission -5 marksPresentation and implementation – 5 marks |

## 9.0 Detailed Session Plan

| Unit/Module No. | Topic Name | No. of Hours | Method of delivery | Assignment(s)/Activities |
| --- | --- | --- | --- | --- |
| **MODULE 1: INTRODUCTION TO DEEP LEARNING** |  |  |  |  |
| 1 | Fundamentals of Deep Learning Architecture | 1 | Lecture | In-class discussion, Quiz |
| 1 | Motivation: Biological Neurons | 1 | Lecture | Case study review |
| 1 | Perceptron Model and AND-OR Models | 1 | Lecture | Hands-on: Perceptron implementation |
| 1 | Multilayer Perceptron and XOR Problem | 1 | Lecture | Assignment: XOR solution |
| 1 | Basics of TensorFlow Framework | 1 | Lecture + Lab | **T1: Getting Familiar with TensorFlow Environment** |
| 1 | Data Structures in TensorFlow | 1 | Lecture + Lab | **T2: Working with Tensors** |
| 1 | Need and Use of Activation Functions | 1 | Lecture | Activity: Compare activation functions |
| 1 | Types of Activation Functions | 1 | Lecture + Lab | **T3: Building Programs to Perform Basic Operations in Tensors** |
| 1 | Layers in Neural Networks and Mathematical Models | 1 | Lecture | Assignment: Neural network design |
| **MODULE 2: OPTIMIZATION AND REGULARIZATION** |  |  |  |  |
| 2 | Gradient Descent Algorithms | 1 | Lecture | Mathematical derivation exercise |
| 2 | Stochastic and Mini-Batch Gradient Descent | 1 | Lecture + Lab | **T4: Building basic neural network in Python** |
| 2 | Unit Saturation: Vanishing and Exploding Gradients | 1 | Lecture | Case analysis |
| 2 | Underfitting and Overfitting Problems | 1 | Lecture | Activity: Model comparison |
| 2 | Hyperparameter Tuning and Learning Rate | 1 | Lecture + Lab | **T5: Building neural network using Keras** |
| 2 | Regularization Techniques: LASSO, Ridge, Dropouts | 1 | Lecture | Assignment: Regularization comparison |
| 2 | Early Stopping and Cross-Validation | 1 | Lecture | Hands-on: Model validation |
| 2 | Normalization: Batch, Group, Instance | 1 | Lecture + Lab | **T6: Building programs to optimize neural network using gradient descent** |
| 2 | Advanced Optimization Algorithms | 1 | Lecture | Assignment: Optimizer comparison |
| **MODULE 3: IMAGE PROCESSING AND DEEP NEURAL NETWORKS** |  |  |  |  |
| 3 | Fundamentals of Image Processing | 1 | Lecture | Group discussion |
| 3 | Image Enhancement and Noise Removal | 1 | Lecture + Lab | **T7: Building Programs on Image Processing Using OpenCV** |
| 3 | Edge Detection Techniques | 1 | Lecture | Hands-on: Edge detection demo |
| 3 | Image Segmentation Methods | 1 | Lecture + Lab | **T8: Building Programs to Perform Image Segmentation Using OpenCV** |
| 3 | ROI Segmentation and Morphological Processing | 1 | Lecture | Assignment: Morphological operations |
| 3 | Feature Extraction: Shape, Colour, Texture | 1 | Lecture + Lab | **T9: Building Programs to Extract Features from Image Using OpenCV** |
| 3 | Unstructured Image Data Analysis | 1 | Lecture | Activity: Feature analysis |
| 3 | Image Classification from Extracted Features | 1 | Lecture | Case study: Classification pipeline |
| 3 | Computer Vision Applications | 1 | Lecture | Assignment: CV application survey |
| **MODULE 4: CONVOLUTIONAL NEURAL NETWORKS AND TRANSFER LEARNING** |  |  |  |  |
| 4 | Biological Motivation for CNNs | 1 | Lecture | Discussion: Visual cortex analogy |
| 4 | 1D, 2D, and 3D Convolution Operations | 1 | Lecture | Mathematical demonstration |
| 4 | CNN Architecture: Convolution Layers | 1 | Lecture + Lab | **T10: Building Programs to Perform Classification Using CNN In Keras** |
| 4 | Pooling Layers and Types of Pooling | 1 | Lecture | Hands-on: Pooling operations |
| 4 | Fully Connected Layers in CNNs | 1 | Lecture | Activity: Architecture design |
| 4 | Regularization in CNNs and Dropout | 1 | Lecture + Lab | **T11: Building Programs to Perform Multiclass Classification with Data Augmentation** |
| 4 | Stride Convolutions and Padding | 1 | Lecture | Assignment: Parameter calculation |
| 4 | Introduction to Transfer Learning and ImageNet | 1 | Lecture | Case study: ImageNet competition |
| 4 | Pre-trained Architectures: AlexNet, VGG, ResNet | 1 | Lecture + Lab | **T12: Building Programme to Develop A LSTM Model** |
| **MODULE 5: OBJECT LOCALIZATION AND DETECTION MODELS** |  |  |  |  |
| 5 | Object Localization vs Detection | 1 | Lecture | Conceptual comparison |
| 5 | Single Shot Approaches: YOLO Architecture | 1 | Lecture | Algorithm walkthrough |
| 5 | Single Shot Detection (SSD) Framework | 1 | Lecture + Lab | **T13: Building programs to implement prediction using pre-trained model** |
| 5 | Two Stage Approaches: R-CNN Family | 1 | Lecture | Historical development |
| 5 | Fast R-CNN and Faster R-CNN | 1 | Lecture | Architecture comparison |
| 5 | Region Proposal Networks (RPN) | 1 | Lecture + Lab | **T14: Building programs to implement transfer learning with fine tuning** |
| 5 | Intersection over Union (IoU) | 1 | Lecture | Mathematical calculation |
| 5 | Mean Average Precision (mAP) | 1 | Lecture | Evaluation metrics |
| 5 | Non-Maximal Suppression (NMS) | 1 | Lecture + Lab | **T15: Building programs to implement object detection using R-CNN** |

## 10.0 Overall Execution Plan

| # | Activity | Execution |
| --- | --- | --- |
| 1 | Attainment Level - Setting up of target | The target is 2.5 for all Course Outcomes |
| 2 | Lecture handling – Theory | The lecture will be handled through PPT/Jupyter Notebooks/Interactive Coding Sessions |
| 3 | Tutorial handling | Google Colab, TensorFlow/Keras environment, OpenCV demonstrations |
| 4 | Question Paper Scrutiny | The FT questions are to be taken with respect to Bloom’s Taxonomy based on Course Learning Assessment (CLA), Performance Indicators (PIs), COs and POs. The same will be validated and verified by audit professor. |
| 5 | Conduct of Test | FT-1 (5 marks)FT-II (15 marks)FT-III (15 marks)FT-IV (15 marks)LLT-1 (10 marks) |
| 6 | Mark Entry | The marks will be entered in academia after the FT components evaluation |
| 7 | Course File Preparation | The course file will be prepared simultaneously from the very first phase of commencement of course based on the SOC & Dept. checklist |
| 8 | COPO mapping | The COPO mapping will be done for every CLA Component and for the end semester result as well. |
| 9 | Co Teaching | Co Teaching has to be organized for students and the same will be tested based on Technical Papers/Projects and HOTS which will be considered for LLT Component. |
| 10 | Presentation on real world applications | Presentation on their technical paper/project will be conducted for course students to showcase their skills in deep learning applications |
| 11 | Conduct of meeting with Course Audit Professor | Before and after the commencement of every test meeting will be conducted with audit professor to discuss the progress of course |
| 12 | Feedback collection | The feedback will be collected from students (mid sem and end sem) |
| 13 | Technical Environment Setup | Ensure all students have access to Google Colab, TensorFlow 2.x, Keras, OpenCV, and necessary Python libraries |
| 14 | Industry Integration | Guest lectures from industry experts, case studies from real-world applications, internship opportunities discussion |
| 15 | Research Integration | Encourage students to explore latest research papers, implement state-of-the-art models, contribute to open-source projects |

**Prepared by:** Prof.Ramesh Babu, [Designation/Department]  
**Verified by:** Dr. [HOD Name], Professor & Head  
**Date:** 15-08-2025