# Prasad V. Potluri Siddhartha Institute of Technology:: Vijayawada.
# Department of Computer Science and Engineering

**I/II M.Tech. (CSE) (Second Semester)**

**17CSCS2T5C** **DEEP LEARNING** **Credits: 4**

**Elective - III**

**Lecture: 4 Periods/week** **Internal Assessment: 40 Marks**

**Semester end examination: 60 Marks**

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## Course Description

This course provides an introduction to deep learning methods. These are modern methods in artificial intelligence (AI) and Machine Learning Paradigms, which are incorporated into most of the top-performing algorithms in several fields of research. In this course, the main focus is on the machine learning paradigms through statistical learning techniques, where rules are learned from examples, rather than being hard-coded. The core concepts of deep learning will cover basic understanding of deep learning strategies, probability and statistical measures, performance measures, fundamentals of Deep learning feed forward and recurrent neural networks, convolution neural networks and Optimization techniques.

## Course Outcomes:

At the end of the course, students should be able to:

**CO1:** Formalize tasks in terms of computational Complexity via Deep Learning architectures.

**CO2:** Design deep learning models via Statistical approaches to solve data-rich tasks

**CO3:** Build datasets, tune and train deep learning models with advanced deep learning libraries

**CO4:** Understand the inner mechanisms of Deep learning Neural techniques during training

**CO5:** Analyze the performance of Optimization techniques on tasks of interest

### Unit-1

**Introduction:** How do we train Deep Architectures, Intermediate Representations: Sharing Features and Abstractions Across Tasks, Desiderata for Learning AI, Computational Complexity, Local vs Non-Local Generalization

**Unit-2**

**Probability and Information Theory**: Why Probability, Random Variables, Probability Distributions, Conditional Probability, Independence and Conditional Independence, Expectation, Variance and Covariance, Information Theory, Common Probability Distributions.

**Unit-3**

**Neural Networks for Deep Architectures:** Learning Algorithms, Generalization, Capacity, Overfitting and Under fitting, Generalization Error, Estimators, Bias and variance, Maximum Likelihood Estimation. Learning Mechanisms: Supervised Vs Unsupervised Learning, **Feedforward Deep learning Neural Networks**: Introduction, Formalizing and Generalizing Neural Networks, Multi-Layer Neural Networks, The Challenge of Training Deep Neural Networks, Unsupervised Learning for Deep Architectures, Deep Generative Architectures, Convolutional Neural Networks, Auto-Encoders.

**Unit-4**

**Optimization for Training Deep Models** : **Optimization for Model Training**: Empirical Risk minimization, generalization, Data parallelism. **Challenges in Optimization**: Local Minima, III- Conditions, Plateaus, Saddle Points and Other flat regions. **Optimization Algorithms**: Gradient Descent, Stochastic Gradient Descent, Momentum.

**Text Books:**

1. Learning Deep Architectures for AI", Foundations and Trends® in Machine Learning, Yoshua Bengio, 2009, Now Publishers
2. Deep Learning , Yoshua Bengio Ian J. Goodfellow Aaron Courville, MIT Press, 2015

**Reference Books:**

1. Deep Learning in Python Prerequisites The LazyProgrammer (http://lazyprogrammer.me).
2. Deep Learning and Neural Networks, Jeff Heaton, Heaton Research, Inc. , 2015
Statistical Language Learning, Charniack, Eugene,MIT Press, 1993.