

1. Course Number and Course Title

COE 49412 – Neural Networks and Deep Learning

2. Credit Hours

3-0-3

3. Prerequisites and/or Co-Requisites:

Prerequisites: CMP 220 (Programming II), MTH 221 (Linear Algebra)

4. Name and Contact Information of Instructor:

Dr. Imran Zualkernan

5. Course Description (Catalog Description):

Covers tensors, neural network modelling, gradient descent optimization and loss functions, feature engineering, and evaluation of neural networks. Focusses on various types of neural networks including feedforward networks, auto-encoders, convolutional neural networks, recurrent neural networks. Discusses topics in generative deep learning.

6. Textbook and other Supplemental Material:

Textbook:

François Chollet, Deep Learning with Python, November 2017, Manning Press.

Other supplemental material:

Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, 2016, The MIT Press.

Aurélien Géron, Hands-On Machine Learning with Scikit-Learn and TensorFlow Concepts, Tools, and Techniques to Build Intelligent Systems, 2017, O'Reilly Media.

7. Learning Outcomes:

Upon completion of the course, students will be able to:

1. Describe and build feedforward neural networks
2. Demonstrate an understanding of issues in feature modelling and overfitting
3. Describe and apply neural network evaluation techniques
4. Design, build and analyze auto-encoders
5. Design, build and analyze convolution neural networks
6. Design, build and analyze recurrent neural networks
7. Apply generative deep learning techniques to create synthetic data

8. Teaching and Learning Methodologies:

Methods include lectures; problem and project-based learning methods (homework, simulation-based projects) and class discussions.

9. Course Topics and Schedule:

Topic	Week #
Introduction and history of neural networks	1

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Review of linear algebra	1
Bootcamp in Python	2
Introduction to Keras	3
Feedforward neural networks	4,5
Feature engineering and autoencoders	6
Evaluation of neural network models	7,8
Convolution neural networks and applications	9,10
Recurrent neural networks and applications	11,12
Generative deep learning and applications	13,14
Revision	15
Final Exam	16