



# Course Book

<b>Course Description</b>	<p>This course provides a foundational understanding of Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DL). It begins by exploring the basic concepts of AI and the distinctions between AI and ML. Students will learn the different types of machine learning—supervised, unsupervised, and reinforcement learning—along with commonly used algorithms within each category. The course then delves into deep learning, introducing key concepts such as neural networks, activation functions, layers, and learning processes. A detailed examination of forward propagation and backpropagation is provided, enabling students to understand how deep neural networks learn from data. This course lays the groundwork for further study or practical work in AI and deep learning.</p>
<b>Course objectives</b>	<p>By the end of this course, students will be able to:</p> <ul style="list-style-type: none"><li>Define and distinguish between Artificial Intelligence (AI) and Machine Learning (ML).</li><li>Describe the main types of machine learning: supervised, unsupervised, and reinforcement learning.</li><li>Identify and explain common machine learning algorithms such as linear regression, decision trees, k-means clustering, and Q-learning.</li><li>Explain the concept of deep learning and how it differs from traditional machine learning.</li><li>Understand the architecture of deep neural networks including layers, nodes, weights, and activation functions.</li><li>Describe the process of forward propagation in a neural network.</li><li>Explain how backpropagation is used to train deep learning models, including the role of gradients and loss functions.</li><li>Apply conceptual knowledge to analyze the training process of a basic neural network.</li></ul>







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### Week 3-5: Machine Learning Algorithms

- Supervised learning algorithms:
  - Linear regression
  - Logistic regression
  - Decision trees
  - Support Vector Machines (SVM)
- Unsupervised learning algorithms:
  - K-means clustering
  - Principal Component Analysis (PCA)
- Reinforcement learning basics:
  - Markov Decision Processes (MDP)
  - Q-learning

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### Week 6: Introduction to Deep Learning

- What is deep learning?
- Differences between deep learning and classical ML
- Applications of deep learning (e.g., image recognition, NLP)

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### Week 7: Neural Networks – Architecture and Concepts

- Biological inspiration and artificial neurons
- Neural network architecture:
  - Input, hidden, and output layers
  - Weights, biases, and activation functions (ReLU, sigmoid, tanh)

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## Week 8: Forward Propagation

- Biological inspiration and artificial neurons
  - Neural network architecture:
    - Input, hidden, and output layers
    - Weights, biases, and activation functions (ReLU, sigmoid, tanh)
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## Week 9-10: loss Function and Optimization

- Purpose of a loss/cost function (MSE, Cross-Entropy)
  - Introduction to optimization techniques:
    - Gradient descent
    - Learning rate and its impact on convergence
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## Week 11: Backpropagation Algorithm

- The chain rule and gradient calculation
- Backpropagation steps for updating weights
- Importance of differentiable activation functions

## Week 12-14: Forward Propagation

Structure and flow of a feedforward neural network

Role of input, hidden, and output layers

Function of weights and biases in each layer

Purpose of activation functions in introducing non-linearity

Step-by-step data propagation through each layer

Generation of the final output (prediction)

Understanding how the network "makes decisions" based on input

Importance of proper data formatting and normalization





## External supporting Link:

## External Evaluator

I confirm that the syllabus given the attached course book is sufficient and covers the required areas needed for the students.









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