ISM UNIVERSITY OF MANAGEMENT AND ECONOMICS

APPROVED BY
THE STUDY COMMISSION
Minutes No. 02-12-2026-15
as of 27th August 2026

Artificial Intelligence and Machine Learning

Course code	*IT102*
Compulsory in the programmes	*Economics and Data Analytics*
Level of studies	*Undergraduate*
Number of credits	*6 ECTS (48 contact hours + 2 consultation hours, 106 individual work hours)*
Course coordinator (title and name)	*Dr. Simonas Čepėnas*
Prerequisites	*Statistical Data Analysis, Mathematical Analysis, Finite Mathematics, Mathematical Methods in Economics, Computer Programming, Data Mining for Business Intelligence*
Language of instruction	*English*

THE AIM OF THE COURSE:

This course provides a technical introduction to cutting-edge topics in artificial intelligence and deep learning, with a particular emphasis on large language models. Students will study the foundations of neural networks, optimization, representation learning, and transformer architectures before applying these concepts to the design, training, and evaluation of their own LLMs. The course combines theoretical understanding with hands-on implementation in Python and PyTorch, covering topics such as natural language processing, model scaling, fine-tuning, and real-world AI applications. Students will use GitHub for version control, collaboration, experiment tracking, and project documentation.

Prerequisites: linear algebra, calculus, probability, and programming experience in Python.

MAPPING OF COURSE-LEVEL LEARNING OUTCOMES (OBJECTIVES) WITH DEGREE LEVEL LEARNING OBJECTIVES (See Annex), ASSESSMENT AND TEACHING METHODS

Course level learning outcomes (objectives)	**Degree level learning objectives (Number of LO)**	**Assessment methods**	**Teaching methods**
CLO1. Understand the key components of neural networks and be able to implement simple linear regression and classification neural networks in PyTorch.	ELO1.1 ELO3.1	Final exam, Mid-term exam, group project	Lectures, seminars, independent work
CLO2. Grasp the basic principles of neural network training, including forward/backward passes, automatic differentiation, and the most common optimization algorithms.	ELO1.1 ELO4.2	Final exam, Mid-term exam, group project	Lectures, seminars, independent work
CLO3. Comprehend the distinction between simple neural networks and deep neural networks. Be capable of explaining the motivation behind different specialized layers and activation functions.	ELO4.1 ELO4.2 ELO4.3	Final exam, Mid-term exam, group project	Lectures, seminars, independent work
CLO4. Grasp the principles of the convolution operation and convolutional layers. Be able to implement a simple convolutional neural network in PyTorch.	ELO1.1 ELO3.2	Final exam, Mid-term exam, group project	Lectures, seminars, independent work

CLO5. Understand the curse of dimensionality and be proficient in performing various data augmentation and processing techniques.	ELO1.2 ELO3.2	Final exam, Mid-term exam, group project	Lectures, seminars, independent work
CLO6. Recognize how sequential data differs from tabular data. Develop an intuition for how recurrent neural networks and transformers process sequential data. Be able to discuss the advantages and disadvantages of both approaches.	ELO1.1 ELO1.2 ELO4.2	Final exam, Mid-term exam, group project	Lectures, seminars, independent work
CLO7. Develop a general understanding of generative AI methods, with a focus on diffusion-based approaches. Comprehend the basic principles of diffusion and be able to explain it in general terms.	ELO1.1 ELO1.2	Final exam, Mid-term exam, group project	Lectures, seminars, independent work

ACADEMIC HONESTY AND INTEGRITY

The ISM University of Management and Economics Code of Ethics, including cheating and plagiarism, is fully applicable and will be strictly enforced in the course. Academic dishonesty and cheating can and will lead to a report to the ISM Committee of Ethics. With regard to remote learning, ISM reminds students that they are expected to adhere to and maintain the same academic honesty and integrity that they would in a classroom setting.

COURSE OUTLINE

Week	Topic	In-class hours	Readings
1.	The history and foundations of machine learning	4	Zhang et al (2023), Ch 1.
2.	Single-layer networks	4	Zhang et al (2023), Ch. 3-4.
3.	Deep neural networks	4	(Zhang et al (2023), Ch 5.
4.	How do machines learn? Gradient descent and backpropagation	4	(Zhang et al (2023), Ch 12.
5.	Convolutional neural networks	4	Zhang et al (2023), Ch 7-8.
6.	Recurrent neural networks	4	Zhang et al (2023), Ch 9.
7.	*Midterm exam*	4	
8.	Transformers: the basis for modern deep learning	4	(Zhang et al (2023), Ch 11.
9.	Transformers: contemporary design choices	4	(Zhang et al (2023), Ch 11.
10.	Graph neural networks	4	To be provided during the lectures
11.	Generative adversarial networks	4	Zhang et al (2023), Ch 20.
12.	Representation learning and autoencoders	4	To be provided during the lectures

		Total: 48 hours	
	CONSULTATIONS	2	
	FINAL EXAM	2	

FINAL GRADE COMPOSITION

Type of assignment	**%**
Group Components 40%	
Group project	40%
Individual Components, 60%	
Seminar Participation	10%
Mid-term exam	25%
Final exam	25%
Total:	**100**

DESCRIPTION AND GRADING CRITERIA OF EACH ASSIGNMENT

Group project. In the group project, students will have to prepare a report detailing the analysis they have performed. Details on the group project will be provided later in the course. Broadly, students can expect to build and train deep learning models, evaluate them, deploy them, and report the performance of this model. Makes up 40% of the final grade.

Seminar Participation. Students will be assigned to perform various tasks to be completed with Python/PyTorch during seminars. The grade will be a combination of course attendance and active participation/task completion during seminars. Makes up 10% of the final grade.

Mid-term exam. The mid-term exam will be held during the midterm exam session. It counts towards 25% of the final grade. The midterm will be based on topics 1-6. The midterm will consist of theoretical questions, practical and coding problems.

Final exam. The final exam counts towards 25% of the final grade. The final exam includes multiple-choice questions and open questions. It tests conceptual, analytical, and numerical skills. The exam will be primarily based on topics 7-11; it might include questions from the previous chapters as well. The final examination will take place during the final examination session.

RETAKE POLICY

In case of a negative final grade, students can sit for a retake exam. Such an exam will cover all course material. The weight of the retake is 50%. The grades from other activities are not subject to a retake but their evaluation (if positive) will count towards the final grade with the retake exam.

ADDITIONAL REMARKS

The syllabus is subject to changes. Specific chapters from the books are TBA. Additional readings will be available online on the course website.

COMPLIANCE WITH ISM ARTIFICIAL INTELLIGENCE POLICY

All course participants must comply with the ISM University of Management and Economics Artificial Intelligence Policy published on the e-learning platform.

The use of AI tools is limited to grammar checks, proofreading and solving issues with code for data analysis unless instructed otherwise. All AI usage must be acknowledged. Failure to do so will result in a grade of 0 for a given task.

REQUIRED READINGS

Zhang, A., Lipton, Z. C., Li, M., & Smola, A. J. (2023). *Dive into deep learning*. Cambridge University Press.

ADDITIONAL READINGS

Christopher M. Bishop and Hugh Bishop, Springer Cham (2023). *Deep Learning: Foundations and Concepts*.

Other readings will be provided in the class.

APPROVED BY
THE STUDY COMMISSION
Minutes No. 02-12-2026-15
as of 27th August 2026

ANNEX

DEGREE LEVEL LEARNING OBJECTIVES

Learning objectives for the Bachelor of Business Management
Programmes:
International Business and Communication,
Business Management and Marketing,
Finance,
Industrial Technology Management,
Entrepreneurship and Innovation

Learning Goals	Learning Objectives
Students will be critical thinkers	BLO1.1. Students will be able to understand core concepts and methods in the business disciplines
	BLO1.2. Students will be able to conduct a contextual analysis to identify a problem associated with their discipline, to generate managerial options and propose viable solutions
Students will be socially responsible in their related discipline	BLO2.1. Students will be knowledgeable about ethics and social responsibility
Students will be technology agile	BLO3.1. Students will demonstrate proficiency in common business software packages
	BLO3.2. Students will be able to make decisions using appropriate IT tools
Students will be effective communicators	BLO4.1. Students will be able to communicate reasonably in different settings according to target audience tasks and situations
	BLO4.2. Students will be able to convey their ideas effectively through an oral presentation
	BLO4.3. Students will be able to convey their ideas effectively in a written paper

Learning objectives for the Bachelor of Social Science
Programmes:
Economics and Data Analytics,
Economics and Politics

Learning Goals	Learning Objectives
Students will be critical thinkers	ELO1.1. Students will be able to understand core concepts and methods in the key economics disciplines
	ELO1.2. Students will be able to identify underlying assumptions and logical consistency of causal statements
Students will have skills to employ economic thought for the common good	ELO2.1.Students will have a keen sense of ethical criteria for practical problem-solving
Students will be technology agile	ELO3.1. Students will demonstrate proficiency in common business software packages
	ELO3.2. Students will be able to make decisions using appropriate IT tools
Students will be effective communicators	ELO4.1.Students will be able to communicate reasonably in different settings according to target audience tasks and situations
	ELO4.2.Students will be able to convey their ideas effectively through an oral presentation
	ELO4.3. Students will be able to convey their ideas effectively in a written paper