Formal LOGIC

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| Course code | *FUN121* |
| Compulsory in programs | *Economics and Politics, Economics and Data Analytics, Finance,* |
| Stage of study | *Undergraduate* |
| ECTS | *3: 12 hours of lectures, 12 hours of practices, 57 hrs. of self-study* |
| Coordinating lecturer | *Doc. dr. Jonas Dagys* |
| Prerequisites | *–* |
| Language of instruction | *English* |

AIM OF THE COURSE

This introductory logic course is focused on the basic issues in logic, such as the distinction between factual and logical truths, the conditions of the formal analysis of thought, elementary logical relations (contradiction and entailment), the issues of validity of inferential knowledge, formal and informal requirements for arguments and proofs, and the most widely used methods of formal proofs. The student will become familiar with the theory of categorical syllogism and propositional calculus. In addition to that classroom exercises are devoted to the practice of formalization – translating the expressions of natural language into the formal language, formal analysis of validity of arguments and consistency of propositions. The main methods applied during the course are as follows: Venn diagramms, truth tables, and natural deduction proof methods (including conditional and indirect proofs). This course aims to introduce students to the theoretical basics of logic, main methods of logical analysis and their applications.

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

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| Course level learning objectives (CLO) | Degree level learning objectives (Number of LO) | Study methods | Evaluation methods |
| CLO1. To understand theoretical basics of logic and main methods of logical analysis | ELO 1.1, ELO 1.2, ELO 2.1, ELO 4.1, ELO 4.2, ELO 4.3, BLO 2.1, BLO 4.1, BLO 4.2, BLO 4.3 | Homework, final exam | Lecture, discussion, self-studies |
| CLO2. Be able to recognize formal and informal fallacies of reasoning and proofs | ELO 1.1, ELO 1.2, ELO 2.1, ELO 4.1, ELO 4.2, ELO 4.3, BLO 2.1, BLO 4.1, BLO 4.2, BLO 4.3 | Homework, final exam | Lecture, discussion, self-studies |
| CLO3. Be able to determine if the statements (assumptions of an inference and premises of a proof) are consistent | ELO 1.1, ELO 1.2, ELO 2.1, ELO 4.1, ELO 4.2, ELO 4.3, BLO 2.1, BLO 4.1, BLO 4.2, BLO 4.3 | Homework, final exam | Lecture, discussion, self-studies |
| CLO4. Be able to think in a structured and consistent way | ELO 1.1, ELO 1.2, ELO 2.1, ELO 4.1, ELO 4.2, ELO 4.3, BLO 2.1, BLO 4.1, BLO 4.2, BLO 4.3 | Homework, final exam | Lecture, discussion, self-studies |
| CLO5. To perceive importance of the logical inference, be able to correct informal fallacies in argumentation | ELO 1.1, ELO 1.2, ELO 2.1, ELO 4.1, ELO 4.2, ELO 4.3, BLO 2.1, BLO 4.1, BLO 4.2, BLO 4.3 | Homework, final exam | Lecture, discussion, self-studies |

**ACADEMIC HONESTY AND INTEGRITY**

The teaching and testing methods are chosen taking into account the purpose of the minimization of cheating opportunities. The ISM regulations on academic ethics are fully applied in the course.

**COURSE OUTLINE**

Topics

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| **NO.** | **TOPIC** | **CONTACT HOURS** | | **Readings**  (No. according to the list below): |
| **Lectures** | **Seminars** |
| 1. | The object of logic. Arguments and their logical structure. Enthymeme. Proofs and arguments. Types of arguments: deductive and inductive. Factual and logical truths.  Formal logic. The notion of logical form. Logical operator. Method of formalization. Fundamental logical relations. Theory of sets. Set-theoretic relationships. Types of definitions and basic rules of a definition. | 2 | 2 | **1:** 1-62.  **2:** 1-20. |
| 2. | Categorical statements. Types of categorical statements, their structure, distribution of terms. Square of opposition. Immediate inferences from categorical statements: obversion, conversion, contraposition.  Simple categorical syllogisms, their structure (moods and figures). Rules of categorical syllogism. | 2 | 2 | **1:** 197-222, 223-228, 269-274.  **2:** 225-232. |
| 3. | Venn diagrams for testing validity of categorical syllogisms.  Propositional (sentential) logic: simple and compound propositions. Truth-functional propositional connectives: negation, conjunction, disjunction, material conditional and biconditional. Types of truth-functional compounds. | 2 | 2 | **1:** 229-268, 277-309.  **2:** 393-397, 21-50. |
| 4. | Propositional logic. Formalizing sentences of natural language in propositional logic.  Properties and types of deductive argument. Validity and soundness. Analysing deductive arguments in propositional logic. Truth table method for testing validity. Short truth table method for proving invalidity. | 2 | 2 | **1:** 277-295, 310-343.  **2:** 51-112. |
| 5. | Basic laws of natural deduction. Rules of inference. Simple validity proofs by derivation.  Rules of replacement. More complex validity proofs by natural deduction using inference rules and replacement rules. | 2 | 2 | **1:** 345-391.  **2:** 113-174. |
| 6. | Proving inconsistency of statements by natural deduction. Further methods of validity proofs: Conditional proof and indirect proof.  Informal criteria of rational argumentation and reasoning. Main types of informal fallacies. | 2 | 2 | **1:** 392-418, 147-196.  **2:** 175-200. |
|  | **Total:** | **12** | **12** |  |

**Individual work and assessment**

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| **Type of assessment** | **Weight, %** |
| Homework I | 8 |
| Homework II | 8 |
| Homework III | 8 |
| Homework IV | 8 |
| Homework V | 8 |
| Final exam | 60 |
| Total: | 100 |

**DESCRIPTION AND GRADING CRITERIA OF EACH ASSIGNMENT**

**1. Homework.** Specific homework tasks are based on the lecture materials and are to be provided during the lectures. Homework is to be collected and discussed each week during the seminars. Late submissions are accepted no later than before the final exam.

**2. Final exam.** It is held during the exam session and covers the material of the entire course, its duration is 90 min. Exam consists of three (3) multiple-choice theory questions and twelve (12) practical tasks. Students are allowed to use the set of formulas (prepared and provided by the lecturer).

**3. Retake.** In case of a failing final grade (less than 5) student can be allowed to have a retake. Retake lasts 90 min. and covers all the material of the course. Students are allowed to use the set of formulas (prepared and provided by the lecturer). All previous marks, except of homework, are annulled; the weight of the retake is 60%. Additional homework will not be accepted.

Precision of composite evaluations is left intact (up to 2 decimal places) until the end of semester and only the final evaluation will be subject to rounding.

**RETAKE POLICY**

In case of a failing final grade, students are allowed a retake exam. It will cover all course material. The weight of a retake is 60%. Homework grades are not annulled and cannot be substituted by the retake.

Main textbooks:

1. Frances Howard-Snyder, Daniel Howard-Snyder, Ryan Wasserman (2012)-*The Power of Logic (5th Edition)* –McGraw-Hill.
2. Patrick Hurley (2015). Concise introduction to Logic (12th Edition) – Cengage Learning.

**Additional readings:**

1. Virginia Klenk (2008) *Understanding Symbolic Logic (5th Edition) –* Pearson, Prentice Hall.
2. Copi, I.M., Cohen, C., McMahon, K. (2010) Introduction to Logic. New Jersey: Prentice Hall.
3. Warburton N. (2000). *Thinking from A to Z*,Routledge.
4. Toulmin S, Rieke R., Janik A. (1997). *An Introduction to Reasoning*, Prentice Hall.
5. Bowell T.& Kemp G. (2005). *Critical Thinking*. Routledge.

**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*

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| **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*

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| **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 |