1 (Fundamentals of Logic)

- **Course name:** Fundamentals of Logic)
- **Course number:** BS-

1.1 Course description

This course is an introduction to formal symbolic logic. Philosopher John Locke once wrote that "logic is the anatomy of thought." This course will teach students to analyse and evaluate arguments using the formal techniques of modern symbolic logic.

This course sets students upon a path of finely honed logical skills essential for life in the modern world. This course is thus specifically designed to improve writing, thinking and oral presentation skills that are applicable to all areas of academic study and relevant to working life.

1.1.1 Class Times, Venue and Other Important Information

- Teaching Begins: week of Sept 1
- Teaching Ends: 15 weeks after that, week of Dec 8
- Final Exams run: Department of Education will schedule final exams closer to the exam date, the exams are scheduled in weeks 16 and 17 of the semester

Classes will be held online via zoom (Please check your Moodle for relevant links to join the event) every Tuesdays and Weds. On Tuesdays between 17:40 and 19:10 we will do the plenary lecture. Labs will be carried out on Weds. There will be 6 lab sessions two conducted by me, two conducted by Hamna Haslam and two more conducted by Timur Fayzrakhmanov. Please check to which group you belong to for the lab sessions ahead of the first lecture. Thank you

During both lectures and lab sessions, students will be required to actively discuss with the professor/instructor the mandatory readings (papers, slides, or handouts, more on which below) for the week. The lecture will be carried out interactively, sometimes via kahoots. The goal of the kahoot is to summarise the lecture's contents so as to maximise the students' understanding of the topic discussed. Hence, it is compulsory for students to read

ahead of each lecture the relevant material for the week, which you will find online on moodle. For this reason, it is crucial that you check your moodle regularly.

During the lab sessions students will work with their instructors in small groups of 6-7 people max, which will have to be formed with the students attending the same lab. Typically, they will be provided open questions or exercises, which they will be required to solve collectively. Answers to the weekly exercises (reports) as carried out during lab sessions under the supervision of instructors will have to be submitted to the relevant instructor each week by a deadline mutually agreed (e.g. Fridays 23:55).The contribution of each individual student within the group should be crystal clear. Failure to submit all reports to the relevant instructor for the lab sessions will incur in a penalty on your final mark, which will be proportional to the number of reports missing.

1.1.2 Learning outcomes

By the end of the course you should be able to:

1. understand what is an argument
2. construct and reconstruct arguments
3. understand what is categorical logic
4. know how to use the square of opposition and Venn diagrams
5. understand what is propositional logic
6. know how to calculate truth values
7. remember the formal structures of some arguments
8. evaluate arguments critically
9. know the difference between deduction, induction, and abduction
10. understand the difference between validity, soundness, and cogency
11. recognize and avoid logical mistakes and fallacies in arguments
12. understand the basics of predicate logic

1.1.3 Textbooks

- Holyoak, K. J., Morrison, R. G. (Eds.). (2005). The Cambridge handbook of thinking and reasoning (Vol. 137). Cambridge, UK: Cambridge University Press.

- Hurley, P. J. (2014). A Concise Introduction to Logic. Wadsworth Pub Co

- Tindale, C. W. (2007). Fallacies and argument appraisal. Cambridge, UK: Cambridge University Press

- Priest, G. (2017). Logic: A very short introduction. Oxford, UK: Oxford University Press.

Electronic copies of these books are available on Moodle for download. Students must read and carefully study the mandatory readings (mostly weekly slides, handouts or relevant papers) ahead of each lecture. The materials for the course will be uploaded by the Professor on Moodle in due time. Please note: The lectures will be highly interactive and the students will be interrogated on the readings during the lectures, sometimes via kahoots (this approach is known as flipped learning).

1.1.4 Course Sections

The course is organized in 15 weeks with every weeks 2 academics hours of lectures, 2 academic hours of labs, and 2 academic hours of tutorials. The main sections of the course and approximate hour distribution between them is as follows

1.1.5 Section 1

Topics covered in this section:

- Claims and Statements
- Premises and Conclusion

Section	Section Title	Teaching Hours
1	Basic Concepts	12
2	Fundamentals of Logic	30
3	Types of Inferences	30
4	Synthesis	18

Table 1: Course Sections

- Conditionals
- Arguments and Extended Arguments
- Argument Reconstruction
- Difference between Logic and Rhetoric
- Logical Validity
- Soundness

What forms of evaluation were used to test students' performance in this section?

1**Form**	**Yes/No**
Development of individual parts of software product code	0
Homework and group projects	1
Midterm evaluation	1
Testing (written or computer based)	0
Reports	1
Essays	0
Oral polls	1
Discussions	1

Typical questions for ongoing performance evaluation within this section

1. Explaining the difference between a valid and an invalid argument.
2. Explaining the difference between Rhetoric and Logic
3. Explaining the steps involved in argument reconstruction

4. What is a logical inference and under which conditions is valid?
5. What is the difference between an argument and a statement?
6. What is a sound argument?

Typical questions for seminar classes (labs) within this section

1. Assessing the logical validity of an argument
2. Individuating Premises and Conclusion in a sophisticated argument
3. Diagramming an extended argument
4. Assessing the soundness of an argument

Test questions for final assessment in this section

1. Solving exercises on logical validity and soundness.
2. Reconstructing a sophisticated argument
3. Spotting truth preserving inferences
4. Spotting invalid inferences

1.1.6 Section 2

Topics covered in this section:

- Quantity and Quality
- Distribution
- Venn Diagrams
- Spare of Opposition
- Syntax
- Semantics
- Evaluation and Satisfaction
- Truth Tables for Propositions

- Truth Tables for Arguments
- Symbols
- Quantifiers
- Translation
- Rules of Inferences

What forms of evaluation were used to test students' performance in this section?

1**Form**	**Yes/No**
Development of individual parts of software product code	0
Homework and group projects	1
Midterm evaluation	1
Testing (written or computer based)	0
Reports	0
Essays	0
Oral polls	1
Discussions	1

Typical questions for ongoing performance evaluation within this section

1. Solve Truth Tables
2. Use Truth Tables to analyse arguments
3. Use Venn Diagrams to represent categorical propositions
4. Use the Square of Opposition to infer the truth value of a proposition
5. Use Quantifiers to assess inferences

Typical questions for seminar classes (labs) within this section

1. Exercises to understand the importance of Categorical Logic for Arguments' Assessment
2. Exercises to understand the potential implications of Propositional Logic for Computer Science

3. Exercises to get a glimpse of the importance of Predicate Logic in Science (e.g. Mathematics)

4. Exercises to understand the relation between connectors and truth tables.

Test questions for final assessment in this section

1. What is the difference between Categorical and Propositional Logic?

2. How does Predicate Logic differ from Categorical and Propositional Logic?

3. Why is Predicate Logic so important?

4. What are Truth-Functions and why do we use them?

5. What are Conversion, Obversion and Contraposition and what's their function in the Square of Opposition?

1.1.7 Section 3

Topics covered in this section:

- Cogency
- Inductive Reasoning vs Deductive Reasoning
- Inductive Inferences
- Generalisations
- Causal Inferences and Predictions
- The Problem of Induction
- Abduction
- The Epistemological Status of Deductive, Inductive, and Abductive Inferences

1**Form**	**Yes/No**
Development of individual parts of software product code	0
Homework and group projects	1
Midterm evaluation	0
Testing (written or computer based)	0
Reports	1
Essays	0
Oral polls	0
Discussions	1

What forms of evaluation were used to test students' performance in this section?

Typical questions for ongoing performance evaluation within this section

1. Recognising Inductive Inferences
2. Distinguishing between a Deductive and an Inductive Argument
3. Explaining the difference between soundness and cogency
4. Explaining the role and function of Abductive Logic

Typical questions for seminar classes (labs) within this section

1. Problematising around the different responses to the problem of Induction
2. Understanding the difference between an epistemic externalist and epistemic internalist
3. Understanding the difference between an epistemic internalist and a pragmatist
4. Critically reflecting on the role of Induction in Science

Test questions for final assessment in this section

1. Understanding the difference between Induction, Deduction, and Abduction
2. Being able to explain why Abduction is reducible to Induction

3. Comprehending the role of Deduction in Science

4. Understanding the role of Causal Inferences and Predictions in Logic and Science

1.1.8 Section 4

Topics covered in this section:

- Summary of the Topics covered in the course
- Role of Logic in Argumentation
- Role of Logic in Science
- Role of Logic in Daily Life
- Awareness of the logical structure of thinking
- Knowledge of the formal mechanisms of Symbolic Logic

What forms of evaluation were used to test students' performance in this section?

1**Form**	**Yes/No**
Development of individual parts of software product code	0
Homework and group projects	1
Midterm evaluation	0
Testing (written or computer based)	0
Reports	1
Essays	0
Oral polls	1
Discussions	1

Typical questions for ongoing performance evaluation within this section

1. Applying the concepts learned in the third section of the course to specific case studies in the history of science (e.g. discovery of Uranus and the discovery of the Electron)

2. Reflecting on whether science really uses Induction that much at all

3. Using the concepts learned in the second section of the course to better understand categorical (syllogistic) arguments
4. Understanding the potential applications of Propositional Logic in Artificial Intelligence

Typical questions for seminar classes (labs) within this section

1. What is Categorical Logic used for?
2. What are the four types of categorical propositions?
3. Evaluate syllogisms
4. What is Propositional Logic used for?
5. Translate logically different statements
6. What is Predicate Logic used for?

Test questions for final assessment in this section

1. Can Logic help in argumentative debates? If so, how?
2. Are Religion and Logic irreconcilable?
3. Do you think Logic is a form of Art?
4. Is there a Logic in Scientific Discoveries?
5. What is the role of Logic (if any) in society and in the modern world?

1.1.9 Office Hours

TBA in my office (***) or by appointment. Alternatively, I am always available via email (farinamirko@gmail.com or m.farina@innopolis.ru)

1.1.10 Changes to the Syllabus

This syllabus may be changed at any point in the semester following students' feedback. Changes will be announced in class. It is your responsibility to stay up to date with announcements if you miss a class.

1.1.11 Assessment

- Mid-term Exam: 30% (week 8, in class; between Oct 5 – Oct 9)
- Group Presentation 30%
- Final Exam (Oral): 40%

1.1.12 Grades

Table 2: Course grading range.

Grade	**Default Range**
A. Excellent	90-100
B. Good	75-89
C. Satisfactory	60-74
D. Poor	0-59

1.1.13 Homework and Exercises in Class

There are no graded exercises. However, all exercises in class are mandatory. In addition, there is a website connected to one of the textbooks we will use full of self-study exercises and answers and explanations organized in segments that go with each chapter of the book. This website is important and should be visited at least weekly. Simply go to: www.mheducation.asia/olc/introcriticalandcreat then 'student edition', then 'interactive exercises'. Please use this resource as homework. Another important source you should consult for your homework is: https://rkirsling.github.io/modallogic/

As mentioned above, we will also be doing exercises together in class, during our laboratories. These exercises we will be doing in class together are not taken from the above-mentioned links but will be provided to students on a weekly basis by the professor. During seminars students will work in small groups (6-7 people max.) with their instructor and will be required to submit their works as a group to the instructor at the end of each seminar by a deadline mutually agreed (Students' participation in the seminar is therefore monitored). Answers for the exercises carried out in class during the tutorials and seminars will be posted by the professor each week on Moodle.

1.1.14 Marks

- Mid-Term Exam (30% of final grade)

This exam will consist of quizzes and various exercises (such as open theoretical questions, multiple choices, and true/false questions). The Mid-Term will be held in class on week 8. The exam will last 75 minutes.

- Final Exam - Oral (40% of final grade)

The final exam will consist of an oral interrogation conducted by the Professor.Students will be questioned in deep on the content of the course and will be assessed for being able to present with accuracy what was presented, for showing their own ability to reflect on it, and apply the presented concepts in a variety of situations.

- Video Presentations (30% of final grade)

Video Presentations are to be done in groups defined by the instructor at his discretion, with a max duration of 5 minutes (300 seconds). Groups from 4 to 7 students should be proposed to the instructor by week 2 of the course; the instructor will then review them and finalize them by week 4. Notice, that even this is a group work, the contribution of each member of the group should be crystal clear and any attempt of skipping this component of the exam will trigger a D in the course. Video presentations can be done on logical fallacies, materials for self-study and preparation will be posted on Moodle by the Professor.

1.1.15 Class Participation

Attendance is mandatory. Although participation is not graded active engagements during lectures and tutorials/labs is a requirement to pass the course. [Cell phones and tablets are banned in class. It is also prohibited to use Telegram/Whats up and other social media on the PC during class].

1.1.16 Attendance policy

If you are unable to attend class for a very important reason such as illness or family emergency, please discuss it with me or with your instructor as soon as possible (e.g. email me the morning of the lecture and I will excuse you). If you need to leave a class early or arrive late, again you should tell me in advance.

1.1.17 Late Submission Policy

Late submissions must be granted by the Professor, hence the student must discuss this possibility with the Professor well ahead of the submission deadline. NOTE: Late submissions are only granted under exceptional circumstances (e.g. illness) and students are expected to submit their assignments on time. Late submissions (within 48hs of the deadline) carry a 50% deduction on the mark. Submissions submitted after 48hs of the deadline, unless previously granted by Professor, won't be accepted.

1.1.18 Provisional Schedule of Topics

- **Week 1** (August 31-Sept 6)
  - Basic Concepts: claims, statements, premises, conclusion, arguments, extended arguments
  Mandatory Task: read and study (before the lecture) handout and slides for Week 1.

- **Week 2** (Sept 7- Sept 13)
  -Deductive Reasoning: validity, truth, soundness, deductive arguments, assessing deductive arguments
  Mandatory Task: read and study (before the lecture) handout and slides for Week 2.

- **Week 3** (Sept 14 - Sept 20)
  - Categorical Logic: the components of categorical propositions
  Mandatory Task: read ch.4 of Hurley, P. J. (2014). A Concise Introduction to Logic. Wadsworth Pub Co

- **Week 4** (Sept 21 – Sept 27)
  -Categorical Logic: quantity, quality, distribution
  Mandatory Task: read ch.4 of Hurley, P. J. (2014). A Concise Introduction to Logic. Wadsworth Pub Co

- **Week 5** (Sept 28 – Oct 4)
  - Categorical Logic: Venn diagrams and Square of Opposition
  Mandatory Task: read ch.4 of Hurley, P. J. (2014). A Concise Introduction to Logic. Wadsworth Pub Co

- **Week 6** (Oct 5 – Oct 11)
  - Propositional Logic: symbols, translation and truth functions
  Mandatory Task: read ch.6 of Hurley, P. J. (2014). A Concise Introduction to Logic. Wadsworth Pub Co

- **Week 7** (Oct 12 - Oct 18)
  -Propositional Logic: truth tables for propositions
  Mandatory Task: read ch.6 of Hurley, P. J. (2014). A Concise Introduction to Logic. Wadsworth Pub Co

- **Week 8** (Oct 19 – Oct 25)
  -Mid-Term:
  Mandatory Task: we will rehearse contents and do exercises together

- **Week 9** (Oct 26 – Nov 1)
  -Propositional Logic: truth tables for arguments
  Mandatory Task: read ch.6 of Hurley, P. J. (2014). A Concise Introduction to Logic. Wadsworth Pub Co

- **Week 10** (Nov 2 – Nov 8)
  - Predicate Logic: predicate, quantifiers, translation
  Mandatory Task: read ch.8 of Hurley, P. J. (2014). A Concise Introduction to Logic. Wadsworth Pub Co

- **Week 11** (Nov 9 – Nov 15)
  - Predicate Logic: rules of Inference: UG, UI, EG, EI
  Mandatory Task: read ch.8 of Hurley, P. J. (2014). A Concise Introduction to Logic. Wadsworth Pub Co

- **Week 12** (Nov 16 – Nov 22)
  - Inductive Reasoning: validity, cogency, inductive arguments, assessing inductive arguments, inductive inferences
  Mandatory Task: read and study (before the lecture) handout and slides for Week 12.

- **Week 13** (Nov 23 – Nov 29)
  - Abduction and the Problem of Induction
  Mandatory Task: read and study (before the lecture) handout and slides for Week 13

- **Week 14** (Nov 30 – Dec 6)
  - Review, Video Presentations
  Mandatory Task: Incremental videos preparation

- **Week 15** (Nov 23 – Nov 27)
  - Review, Video Presentations
  Mandatory Task: Incremental videos preparation