

# The Hebrew University of Jerusalem

Syllabus

## MATHEMATICAL LOGIC (2) - 80424

Last update 10-10-2024

<u>HU Credits:</u> 3

Degree/Cycle: 1st degree (Bachelor)

Responsible Department: Mathematics

<u>Academic year:</u> 0

Semester: 2nd Semester

<u>Teaching Languages:</u> Hebrew

<u>Campus:</u> E. Safra

<u>Course/Module Coordinator:</u> Prof. Itay Kaplan

Coordinator Email: yair.hayut@math.huji.ac.il

Coordinator Office Hours: By appointment

Teaching Staff:

Prof. Itay Kaplan

Course/Module description:

In the beginning of the 20th century mathematicians tried to find a complete system of axioms for the whole of mathematics and in particular for number theory.

Godel showed that these efforts cannot succeed: Godel's incompleteness theorem says that in any reasonable system of axioms there is always a true statement which cannot be proved.

In the course we will review the incompleteness theorems and relevant parts of recursion theory. We will also learn about Peano Arithmetic.

In addition the course includes an introduction to model theory.

## Course/Module aims:

1) Prove Godel's incompleteness theorems.

2) learning the axioms of PA.

*3)* Understanding recursive functions.

# Learning outcomes - On successful completion of this module, students should be able to:

1) Formulate and prove Godel's first and second incompleteness theorems. 2) Answer claims asserting implications of said theorems to the universe beyond their precise mathematical meaning.

3) Prove some basic facts about models of PA.

4) Understand the connection to recursive functions and computability.

#### Attendance requirements(%):

0

Teaching arrangement and method of instruction: Lecture+exercise

## Course/Module Content:

This is a list of some of the subjects that will be covered in the course: Godel's incompleteness theorems on Peano arithmetic. Tarski's undefinability of truth theorem. Recursion theory: recursive function, the recursion theorem, RE sets. Model theory: ultraproducts, compactness, Lowenheim-Skolem theorems. Models of Peano Arithmetic. We may learn more/other subjects. <u>Required Reading:</u> none

<u>Additional Reading Material:</u> R. Smullyan, Godel's Incompleteness Theorems

R. Kaye, Models of Peano Arithmetic

- J.L. Bell and M. Machover, A Course in Mathematical Logic
- J.R. Shoenfield, Mathematical Logic
- H. Enderton, A Mathematical Introduction to Logic

Grading Scheme:

Essay / Project / Final Assignment / Home Exam / Referat 50 % Submission assignments during the semester: Exercises / Essays / Audits / Reports / Forum / Simulation / others 50 %

Additional information:

50% of the grade will be based on students presenting solutions to exercises during the semester and a final assignment.

Lecture recordings will be available after each class.