

COURSE OUTLINE OF "MODEL THEORY"

(1) GENERAL

SCHOOL	School of Science, NKUA / School of Applied Mathematical and Physical Sciences, NTUA / Research Center for Greek Philosophy, Academy of Athens		
ACADEMIC UNIT	History and Philosophy of Science, NKUA		
LEVEL OF STUDIES	Graduate		
COURSE CODE	L6	SEMESTER	1 st or 3 rd , depending on specialization
COURSE TITLE	Model Theory		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>	WEEKLY TEACHING HOURS	CREDITS	
Lectures	3	10	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE <i>General background, special background, specialized general knowledge, skills development</i>	General Background		
PREREQUISITE COURSES:	—		
LANGUAGE OF INSTRUCTION and EXAMINATION:	English		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)	https://eclass.uoa.gr/courses/PHS633/ (under construction)		

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

The aim of this course is to teach students how various kinds of mathematical objects, such as groups, rings, linear orders etc. are studied using formal predicate languages. Students will see how properties of such objects are deduced, as well as several applications of fundamental results, such as the compactness theorem. The course will also deal extensively with special classes of structures (saturated, universal etc.).

Upon successful completion of the course, students will have the ability to

- Apply the Löwenheim-Skolem upward and downward theorems.
- Recognize first-order mathematical statements in a given language.
- Give rigorous axiomatizations of natural mathematical theories.
- Understand and apply techniques of ultraproducts.

- Recognize saturated, universal, prime and atomic models of a first-order theory.
- Apply Ehrenfeucht-Fraïssé techniques.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below) at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
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Others...
.....

Upon successful completion of the course, students will acquire the following general abilities:

- Production of novel scientific ideas.
- Development of critical thinking.
- Development of free, productive and inductive thinking.
- Team work.

(3) SYLLABUS

1. Examples of first-order theories and models.
2. Elimination of quantifiers.
3. Completeness and compactness.
4. Omitting types and interpolation.
5. Countable models of complete theories.
6. Elementary extensions and elementary chains.
7. Applications of elementary chains.
8. Skolem functions and indiscernibles.
9. Examples.
10. Ultraproducts and applications, I.
11. Ultraproducts and applications, II.
12. Saturated models and applications, I.
13. Saturated models and applications, II.

(4) TEACHING AND LEARNING METHODS - EVALUATION

DELIVERY <i>Face to face, Distance learning etc.</i>	Face to face
	Use of e-class
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	

TEACHING METHODS	Activity	Semester workload
<p>The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity etc.</p> <p>The student's study hours for each learning activity are given as well the hours of non-directed study according to the principles of the ECTS.</p>	Lectures	39 hours
	Non-directed study	211 hours
<p>STUDENT PERFORMANCE EVALUATION</p> <p>Description of the evaluation procedure</p> <p>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other.</p> <p>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</p>	<p>Written final examination (weight 70%) and homework assignments (weight 30%). The language of evaluation is English.</p> <p>The main criteria of assessment are the degree to which students understand technical methods involved in a question and the degree to which they are in a position to solve exercises. The criteria of assessment are explained to the students at the beginning of the semester.</p>	
		Total for this course

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. C. C. Chang and H. Jerome Keisler. *Model Theory*, Dover Publications, 3rd edition, 2012.
2. K. Trent & M. Ziegler. *A Course in Model Theory*, Lecture Notes in Logic, Series Number 40, Cambridge University Press, 2012.
3. D. Marker. *Model Theory: An Introduction*, Graduate Texts in Mathematics, Vol. 217, Springer, 2002.

- Related academic journals:

Journal of Symbolic Logic, Archive for Mathematical Logic, Annals of Pure and Applied Logic, Mathematical Logic Quarterly, Journal of Mathematical Logic.