COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF PHYSICS		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**105**	**SEMESTER**	**8**
COURSE TITLE	COSMOLOGY		

INDEPENDENT TEACHING ACTIVITIES *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*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background, specialised general knowledge, skills development
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=1531

(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 objective of this course is to present to the students the basic principles of the science of Cosmology, one of the fastest developing sciences today, but also to teach them how to construct different cosmological models and how to compare them with the observational data. More analytically, after the end of this course, the student will be able to:

1. Recall the basic principles and assumptions of Cosmology, as these were formulated after centuries of theoretical studies and observations.
2. Relate the spacetime structure with the distribution of matter and energy in the universe through the Einstein's equations.
3. Construct and solve simple cosmological models in the presence of one or two ingredients of the universe.
4. Be familiar with the most recent observational data and use them to assess a specific cosmological model.
5. Explain basic quantities and describe physical processes that took place during the

evolution of the universe up to its present form.

6. Identify the weak points of each cosmological model and improvise ways to modify them in order to improve the model.

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
……
Others…
…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Decision-making
Working independently
Criticism and self-criticism
Production of free, creative and inductive thinking

(3) SYLLABUS

Cosmological observational data: Hubble expansion, microwave background radiation, largescale structures, dark matter, abundances of light elements. Big-bang theory: basic assumptions (homogeneity, isotropy, general relativity, perfect fluid), Robertson-Walker metric, horizons, red shift, luminosity distance, Friedman equations, age of the universe (Hubble expansion, background radiation, nucleosynthesis). Problems of the big-bang theory: the cosmological constant, flatness and horizon problems, dark matter, baryogenesis, primordial perturbations. Inflating universe: solution of basic problems. Evolution of primordial perturbations: structure formation in the universe.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of the course web page on http://ecourse.uoi.gr to post notes and exercise sheets Use of electronic mail to communicate with the students
TEACHING METHODS *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.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	see table below

Activity	***Semester workload***
Lectures	32
Students' Presentations	20
Homeworks	35
Independent Study	35
Exams	3

	Course total	***125***
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *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* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Oral presentations by the students during the semester on untaught material Problem solving (every second week) and submission for assessment End-of-semester written exams during which the students are asked to solve problems related to the material taught at the course	

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. "Cosmology", P. Kanti, University of Ioannina Publications, 2008.
2. "Particle Physics. An introduction to the basic structure of matter", C. Vayonakis, NTUA Publications, 2013.
3. "An Introduction to General Relativity: Spacetime and Geometry", S. Carroll, Addison Wesley, 2004.
4. "Gravity: An Introduction to Einstein's General Relativity", J. Hartle, Addison Wesley, 2003.
5. "Introducing Einstein's Relativity", R. D' Inverno, Oxford University Press, 2003.