COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**10EK102**	**SEMESTER**	**7**
COURSE TITLE	**Space and Solar Physics**		

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**
Lectures (theory and exercises)	4	6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised Knowledge
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes, in the English language for Erasmus students
COURSE WEBSITE (URL)	https://eclass.uoa.gr/courses/PHYS212/

(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 course covers the basic knowledge of the physics of the Sun and of space plasma, planetary magnetism, the physical processes linking the Sun to the planetary magnetospheres, and the geospace phenomena resulting from the variable coupling of the solar wind with the Earth's magnetosphere.
Upon successful completion of the course the student should be able to:
- Define what a plasma is and describe the basic properties and dynamics of some important plasma populations in the solar system.
- Understand the basic physical properties of the Sun.
- Describe the key elements of the Sun-Earth interaction and of the geospace particle and electromagnetic environment.
- Recognise the effects of distinct solar and interplanetary disturbances on magnetospheric dynamics.
- Explain the basic concepts and principles of charged particle motion and wave-particle interaction
- Calculate various key physical parameters of space particles and fields using the appropriate mathematical formulas.
- Differentiate between distinct collective processes of energy conversion, involved in the transfer of magnetic energy of the Sun and kinetic energy of the solar wind to kinetic energy of geospace plasma.
- Combine relevant formulas to solve complex problems involving wave-particle interactions.
- Evaluate the results of problem solutions in the framework of the theoretical predictions.

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…
…….

The course aims at the following general competences

Analysis and synthesis of data and information
Decision-making
Working independently
Analytical and synthetic thinking
Critical thinking
Taking initiative/responsibility
New Technology skills
Learning word/excel/ppt/ origin/spss
Communication skills
Information management
Meeting Deadlines and Keeping Schedules
Flexibility / Adaptability
Problem solving

(3) SYLLABUS

- Plasma properties, space plasma, charged particle motion in electric and magnetic fields, adiabatic invariants of motion.
- Basic properties of the Sun, solar interior: Core, radiation zone, convection zone, solar magnetic field, solar corona.
- Active Sun: Sunspots, flares, coronal mass ejections, solar wind high-speed streams, corotating interaction regions, solar energetic particles, solar cycle, cosmic rays.
- Planetary magnetism, Earth magnetosphere: geomagnetic field, topology, plasma populations, sources and losses of plasma, open and closed magnetosphere models,
- Dynamic phenomena in geospace: magnetospheric substorms, aurora, geomagnetic storms.
- Energetic particles in geospace: ring current, Van Allen radiation belts, acceleration and loss mechanisms.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Yes
Electronic communication with the students using ICT (Information and Communications Technology), Computer-aided lectures, use e-class platform, OneDrive, Kahoot! platform.</td></tr>
<tr><td>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</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures/Exercises</td><td>52</td></tr>
<tr><td>Individual Study / Analysis of bibliography</td><td>55</td></tr>
<tr><td>Homework</td><td>40</td></tr>
<tr><td>Final exam</td><td>3</td></tr>
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<tr><td></td><td></td></tr>
<tr><td>Course Total</td><td>150</td></tr>
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<tr><td>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.</td><td>Student performance evaluation is carried out through an examination in Greek or English (60% of the grade) and home assignments during the semester (40% of the grade), including:
1. Short-answer questions
2. Open-ended questions,
3. Problem solving

Yes. They are announced during the early lectures and are available in the folder “Documents” of the course on the e-class platform.</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Space Physics (in Greek) – Ioannis A. Daglis, Christos Katsavrias, Nikolaos Sergis, Georgia Marinou, Kallipos, 2023, https://www.kallipos.gr/el/
- Physics of the Sun and of Space (in Greek) – C. Alyssandrakis, A. Nindos, S. Patsourakos, https://repository.kallipos.gr/handle/11419/5516
- Space Physics - An introduction to plasmas and particles in the heliosphere and magnetospheres: May-Britt Kallenrode, Springer, 2001, ISBN 978-3-662-04443-8
- Space Physics: An Introduction – Christopher T. Russell, Janet G. Luhmann, Robert J. Strangeway (eds.), Cambridge University Press, 2016, ISBN: 978-1107098824
- Paths of the Sun (in Greek) – P. Preka-Papadima, M. Danezis, D. Kariolaki, ISBN: 978-960-531-243-5

- Related academic journals:

- Annales Geophysicae
- Frontiers in Astronomy and Space Science
- Geophysical Research Letters
- Journal of Geophysical Research: Space Physics
- Scientific Reports
- Space Science Reviews