COURSE OUTLINE

(1) GENERAL

SCHOOL			
ACADEMIC UNIT			
LEVEL OF STUDIES			
COURSE CODE		SEMESTER	
COURSE TITLE	From the Big Bang to Great Powers: Science and Geopolitics		

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
	3	
Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	Specialized general knowledge
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.unipi.gr/courses/DES396/

(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

- *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*

Upon successful completion of this course, students will be able to:

- Apply conceptual and metaphorical analogies between Cosmology and International Relations (IR) to generate novel insights into the structure and dynamics of the international system, and demonstrate awareness of the epistemological, cultural, and strategic implications.
- Analyze historical and contemporary case studies—such as the Manhattan Project, the Apollo Program, and CERN—to evaluate how scientific innovation and geopolitical power interact.
- Interpret strategic and policy documents (from NATO, China, the United States, etc.) to assess how states frame scientific and technological capability as elements of national and international strategy.
- Synthesize interdisciplinary perspectives from physics, philosophy, and political science to articulate informed views on science diplomacy and global governance.

Guest lectures from experts in physics and international policy (e.g., CERN) will support these outcomes by exposing students to real-world applications of course themes.

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	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

The course develops a range of general competences relevant to interdisciplinary and internationally oriented higher education. Through case studies such as the Manhattan Project, the nuclear era, the space race, and contemporary frontiers like quantum computing and artificial intelligence, students will:

- Adapt to new intellectual contexts by applying cosmological and philosophical perspectives to questions of international strategy and governance as well as emerging frontiers like quantum computing and artificial intelligence.
- Search for, analyze, and synthesize complex data and policy sources using digital and research technologies.
- Collaborate in an interdisciplinary and international environment, integrating insights from physics, philosophy, and political science.
- Exercise independent and critical judgment in assessing the ethical, security, and societal implications of scientific progress.
- Generate original ideas that link scientific capability to power structures, diplomacy, and global cooperation.
- Demonstrate social and ethical awareness, including sensitivity to cultural, environmental, and technological challenges.
- Cultivate creative and inductive thinking, using metaphor and analogy to approach global problems from innovative perspectives.

Overall, the course aims to foster reflective, globally minded graduates capable of navigating the intersections of science, technology, epistemology, philosophy, and international affairs.

(3) SYLLABUS

This course explores the profound interconnections between scientific discovery, technological innovation, and global power dynamics. Beginning with the birth of the universe and the foundations of cosmology, the course examines how advances in physics, engineering, and computation have shaped modern geopolitics, military strategy, and international relations.

The contents of the course may be outlined in two pillars as follows:

1. What is cosmology? How science works

    The Universe, the Big Bang, the expansion of the Universe, redshift, Hubble's Law & Hubble Constant, the observable Universe, Cosmic Microwave Background (CMB), the Cosmological Principle, gravity, black holes, dark matter and dark energy, geometry of the Universe, multiverses, the Anthropic Principle, the end of the Solar System, the end of the Universe, philosophical implications and worldview formation

2. Case studies and strategic technologies

- The Manhattan Project
- Hiroshima, Nagasaki, and the nuclear taboo
- Space race during the Cold War: US vs USSR
- History of the European Space Program
- CERN diplomacy and safety of scientific research
- China’s moon ambitions
- Private enterprise in space (SpaceX, Blue Origin, Amazon Kuiper)
- Satellites: GPS and relativity theory
- Nuclear physics
- Quantum computing
- Artificial intelligence

(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>The course makes extensive use of Information and Communications Technology.

Class notes are authored and shared via Google Docs, allowing students to access and download them in multiple formats—such as EPUB for mobile reading or PDF for computer use and printing.

The collaborative platform also enables students to comment directly on the notes, fostering interactive learning and continuous communication between instructor and participants.</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>Lecture attendance</td><td>3 hours per week</td></tr>
<tr><td>Active participation through commentary or polls</td><td>30 minutes per week (during lectures)</td></tr>
<tr><td>Guided analysis of readings and videos</td><td>30 minutes per week</td></tr>
<tr><td>Independent study</td><td>One hour per week</td></tr>
<tr><td>TOTAL</td><td>5 hours per week</td></tr>
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Teaching is primarily conducted through lectures supported by rich visual material and illustrated class notes, which are authored and shared via Google Docs for flexible student access in multiple formats (EPUB, PDF, etc.). Students are encouraged to comment directly on the notes, promoting dialogue and collaborative learning beyond class hours.

Lectures are designed as lively presentations combining theoretical exposition with colorful images, multimedia examples, and short YouTube videos that connect cosmological ideas with geopolitical and strategic realities.

To enhance engagement and deepen understanding, the course incorporates the following:

• Interactive pauses, where students reflect on key questions or analogies (e.g. balance of power as gravitational</td></tr>
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	equilibrium). • Quick polls or show-of-hands questions to gauge perspectives or understanding. • Metaphor-building exercises, where students create their own cosmology–IR analogies (e.g. "What would the UN look like as a solar system?"). • Short assigned readings (e.g., excerpts from Carl Sagan or Hans Morgenthau) discussed in class to link scientific and political reasoning. The course workload follows ECTS principles, consisting of lecture attendance, guided analysis of readings and videos, active participation through digital commentary or polls, and independent study or essay writing.
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.*	All examinations in this course will be open book and open notes, encouraging critical thinking and the integration of course materials rather than memorization. The grading scheme is as follows: • Midterm Exam 1 (Cosmology): 15% of the final grade • Midterm Exam 2 (Case Studies): 15% of the final grade • Final Exam: 70% of the final grade.

(5) ATTACHED BIBLIOGRAPHY

Course textbook

Doboš, B. (2019). *Geopolitics of the outer space: A European perspective*. Springer.

Suggested reading

Bennet, J. (2008). *Beyond UFOS: The search for extraterrestrial life and its astonishing implications for our future*. Princeton University Press.

Coles, P. (2001). *Cosmology: A very short introduction*. Oxford University Press.

Green, J., & Mack, K. (2024). *Crash Course Pods: The Universe* [Audio podcast]. Spotify. https://open.spotify.com/show/5sdOcHY6d4Q6slJ7PCu5Oc

Kraus, L. M. (2012). *A universe from nothing*. Free Press.

Mack, K. (2020). *The end of everything (Astrophysically speaking)*. Scribner.

Tyson, N. d. (2017). *Astrophysics for people in a hurry*. W. W. Norton & Company.

Wald, R. M. (1992). *The theory of the Big Bang and black holes* (2nd ed.). The University of Chicago Press.