#### **1. OVERVIEW**

FACULTY	FACULTY OF HUMANITIES AND SOCIAL SCIENCES						
SECTION	DEPARTMENT OF PRIMARY EDUCATION						
LEVEL OF STUDY	UNDERGRADUATE						
COURSE TITLE							
Basic Concepts in the Natural Sciences							
COURSE CODE	ФЕ0201	SEMESTER	1				
HOURS per WEEK	4	ECTS	6				
COURSE CATEGORY	Compulsory	COURSE TYPE	General background, General Knowledge				
LANGUAGE OF INSTRUCTION AND EXAMINATIONS	Modern Greek	PREREQUISITES					
OFFERED TO ERASMUS	YES	ECLASS PAGE	https://eclass.uth.gr/courses/PRE_U_113/				

# 2. LEARNING OUTCOMES

# **Learning Outcomes**

Upon successful completion of the course, students are expected to:

Specify the position of physical and biological science within the map of contemporary knowledge.

Understand significant aspects of the biological subject matter and reproduce foundational knowledge necessary for future teaching of the science of biology.

Be familiar with student misconceptions in basic concepts of biology.

Reason in order to answer biological questions.

Compare and evaluate explanations of physical phenomena in common discourse with explanations in Physics.

Compare explanations of phenomena provided by Physics with explanations provided by Biology.

Compose explanations consistent with the practices of Physics in the areas of Geometric Optics, Heat, Mechanics, the Structure of Matter, and Changes of State.

Compose explanations consistent with the Theory of Evolution in the realm of life phenomena.

Calculate the proper dimensions for models that represent entities of the microcosm.

Recognize alternative/intuitive ways of thinking about natural phenomena in their own thinking and in the thinking of their fellow students.

Describe similarities and differences between the science of physics and the science of biology

General competences
Autonomous work
Teamwork
Respect for diversity and multiculturalism
Respect for natural environment
Critical and self-critical thinking
Argumentation, Reflection

#### 3. CONTENT

Ontology of the sciences and map of scientific knowledge.

The chemistry of life.

On the nature of scientific explanations.

Definition of biological evolution and student misconceptions.

Structure and function of large biological molecules: Carbohydrates, Lipids, Nucleic acids, Proteins.

What is life: Functional definition and student misconceptions.

Basic biological processes: Nutrition, Growth, Movement, Response to stimuli, Excretion and Reproduction.

Photosynthesis, Respiration and student misconceptions.

What is life: Structural definition and student misconceptions.

Tour of the cell: cell size, prokaryotic and eukaryotic cells, cell organelles.

Viruses. Resistance of microbes to antibiotics.

Neo-Darwinian theory of evolution.

Explanations in Physics and Explanations in Everyday life.

Differences in argumentation in Physics and in Everyday life.

Scales. Calculations of dimensions of physical entities in models while maintaining proportions.

Geometric Optics. The ray model. Prediction of shadows. Plane mirrors. The role of the lens in the eye.

Thermal phenomena. Distinction between heat and temperature.

Heat transfer by conduction, radiation, convection, evaporation/condensation. The microscopic model for heat and temperature. Heat capacity. Greenhouse effect.

Structure of Matter. Particulate structure of matter. Distinction between atoms-molecules. Distinction between physicalchemical processes.

Evaporation/Condensation with emphasis on water. Connection with heat flow.

Mechanics. Kinematics.

# 4. TEACHING AND LEARNING METHODS - ASSESSMENT

TEACHING MODE	In person						
USE OF ICT	Teaching and learning: e-class/ youtue/ phet/ WISE Berkeley/ pbworks/ google forms/ MsTeams (possible) Communication: Webmail / eClass						
COMPULSORY ATTENDANCE	NO MAXIMUM NUMBER OF ABSENCES:						
TEACHING ORGANIZATION	Activity			Semester Workload (hours)			
	Lectures			26			
	Tutorial			26			
	Literature study & analysis			45			
	Essay writing			20			
	Study			32			
	Examination			2			
	Course total			151			
EVALUATION	Туре		Format	Weighting			
	Final written exam		Multiple Choice Questions	1.1	75%		
			Open-Ended Questions				
	Intermediate written		Multiple Choice Questions		25%		
	examination (mid-term) Short Answer Questions		Short Answer Questions	2.2			
	Open-Ended Questions						
	Description of other evaluation method / Evaluation criteria:						
	Students receive individual bonus points by creating videos of experiments they have						
	conducted, building a pinhole camera, and writing a short fairy tale on a topic from the						
	course. They also submit 2 or 3 assignments.						

# 5. RECOMMENDED BIBLIOGRAPHY

Core textbooks (available through the *Eudoxus* service)

Campbell N., Reece J., Urry L., Cain M., Wasserman S., Minorsky P., Jackson R. (2013). ΒΙΟΛΟΓΙΑ (Τόμος Ι). Πανεπιστημιακές εκδόσεις Κρήτης.

Hewitt, P. (2004). Βασικές έννοιες της Φυσικής. Ηράκλειο: ΙΤΕ,-Πανεπιστημιακές Εκδόσεις Κρήτης.

Holton G., Brush S. ( επιστ. επιμ. Σκορδούλης Κ.) (2018) Εισαγωγή στις έννοιες και τις θεωρίες της φυσικής επιστήμης. Αθήνα: Gutenberg.

Κολιόπουλος Δ., Μέλη Κ. (2022) Η διδασκαλία της ενέργειας. UNIVERSITY STUDIO PRESS

Κουμαράς Π. (2015). Μονοπάτια της σκέψης στον κόσμο της Φυσικής. Αθήνα: Gutenberg.

Other books / Notes

Mayr, E. (2002). Αυτή είναι η Βιολογία. Εκδόσεις κάτοπτρο.

Πατηνιώτης Μ, (2013) Στοιχεία Φυσικής Φιλοσοφίας, Εκδόσεις Gutenberg

# Scientific journals

New Scientist (https://www.newscientist.com/)

Scientific American ( https://www.scientificamerican.com/ )

Scientific articles

Ioannidis, J. P. (2005). Why most published research findings are false. PLoS medicine. 2(8), e124.

Other

https://tinyurl.com/dfwrra97

https://gr.euronews.com/tag/science

https://scicom.gr/members-lab/