ISEL
INSTITUTO SUPERIOR DE ENGENHARIA DE LISBOA

DEC
ÁREA DEPARTAMENTAL DE ENGENHARIA CIVIL

Course file

Study cycle	BACHELOR IN CIVIL ENGINEERING		
Course	General Physics	Mandatory	☒
		Optional	☐
Course scientific area	CIVIL ENGINEERING	Category	B

Course category: B - Basic; C - Core Engineering; E - Specialization; P - Complementary.

Year: 1st	Semester: 2nd		ECTS: 5,5		Total: 149
Contact time	T: 22,5	TP: 22,5	PL: 22,5	S:	OT:

T - Lectures; TP - Theory and practice; PL - Lab Work; S - Seminar; OT - Tutorial Guidance.

Course Director	**Title**	**Position**
Pedro M. F. Carvalho da Silva	Doutor	Professor Adjunto

Learning objectives (knowledge, skills and competences to be developed by students)

(max. 1000 characters)

The Physics fulfill the gap between essential topics of scientific/technical knowledge and engineering. In this course students are motivated to acquire knowledge and to structure a critical analysis, which sustained by principles, laws and physical/mathematical models allow them to solve real-world challenges. The student should also include the assumptions underlying a particular theory or formalism and its limitations. Finally, develop the ability to approach and solve problems applied to Civil engineering, based on rigorous formulation of the same.

Students will build on the basic concepts of rigid body mechanics, fluid dynamics and physical properties of materials (electrical and thermal), thus providing the basis for specialty disciplines in Civil Engineering, particularly in the areas of hydraulics, structures and Materials.

Syllabus

(max. 1000 characters)

1. Systems of units and the similarity theory - Systems of units, Dimensional analysis, similarity theory

2 . Dynamic - Vectors, laws of motion, Newton's Laws, Work and Energy, Potential Energy and Conservation of Energy, Linear momentum and collisions, rotation of rigid body, rolling motion, angular momentum and torque.

3. Fluid Mechanics - Pressure, Archimedes' Principle, Fluid dynamics, equation of continuity, Bernoulli's equation, Flow and Flux, Divergence and Stokes theorems.

4. Thermal properties of materials - Mechanisms of heat transfer, mixed modes of transfer, Solar and Atmospheric Radiation Applications to thermal insulation, heating and cooling of buildings .

5. Electrical properties of materials - electrical charges, Coulomb's Law and Gauss, conductors, semiconductors and insulators, electrical conductivity and resistivity, mobility of electric charge, electric current, direct current electrical circuits.

Demonstration of the consistency between the syllabus and the course objectives

(max. 1000 characters)

Dimensional characterization and vector physical quantities. Design of physical models to small scales and its application to the Civil Eng.

Mechanics of Rigid Body: predict the effects of forces applied to rigid body systems, their physical constraints in real problems and develop the ability to construct a mathematical model that constitutes a good approximation of reality.

Students should familiarize themselves with the fundamental principles of fluid mechanics and understand the concepts of flow, flux, mass balance, etc...

Physical properties (electrical and thermal) materials: understand and characterize processes of transfer of electrical charges on different types of materials and electrical circuits. Acquire skills in solving problems of calorimetry and thermal expansion of solids. Clearly distinguish the processes of heat transfer, conduction, convection and radiation.

Teaching methodology (evaluation included)

(max. 1000 characters)

The functioning of the course is divided between theoretical, TP lessons and experimental classes. During the lectures are presented and demonstrated the theoretical concepts of physics and illustrated its applicability. During the TP lessons is encouraged the discussion and applicability of theoretical concepts to solve problems, including the discussion and resolution of proposed exercises. In conducting laboratory experiments application of the subjects covered, the emphasis is on measurement methodology and treatment of acquired data, but it is also a powerful tool in understanding concepts.

It is made available to the students the opportunity to carry out continuous assessment and/or summative assessment. The final grade result from the average of the mid-term tests (8 the minimum score value and

the final average equal to or higher than 10). If the student opts for a summative assessment, the final grade is independent of any result obtained in the continuous assessment.

Demonstration of the consistency between teaching methodology and the course learning objectives

(max. 3000 characters)

Lectures are intended to provide students with the necessary tools for describing and predicting events and / or sequences of events. Their discussion and examples aimed at understanding the assumptions underlying a particular theory or formalism and what their limitations. In this context, laboratory classes play a key role. The training in the rigorous formulation and problem solving is acquired in practical classes. Among the proposed problems, some include simple engineering devices, which tend to arouse more interest in students, and exemplify the relevance of physics in engineering.

Main Bibliography

(max. 1000 characters)

Marsden, J.E., Tromba, A.J., 1996. Vector Calculus. Freeman and Company, NY, USA.

Panofsky and Philips - Classical Electricity and Magnetism, Addison-Wiley.

Sadiku, M.N.O., 2000. Elements of electromagnetism. Oxford University Press, NY, USA.

Serway, R.A., Beichner, R.J., 2000. Physics – For Scientists and Engineers with Modern Physics. Saunders College Publishing.

Course booklet available on Moodle