APPLIED PHYSICS IN ARCHITECTURE 2

Bachelor in Architectural Studies BAS SEP-2023 APA2-AS.2.S.A

Area Architecture and Design

Number of sessions: 15

Academic year: 23-24

Degree course: SECOND

Number of credits: 3.0

Semester: 2º

Category: BASIC

Language: English

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Professor Luis Echevarría is a Civil Engineer who studied at the University of La Coruña where he graduated in 2010 with a final mark of "Matrícula de Honor". He is now following his studies in order to obtain a doctorate in Civil Engineer.

He teaches Applied Mathematics in Architecture 1 since 2015 and Applied Physics in Architecture 1 since 2018

Echevarría began working in 2010 as a Civil Engineer at the Eduardo Torroja Institute of Construction Science, a public institution under the Spanish National Research Council, where he works as a researcher in the fields of structures and materials used in construction and structural pathology.

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SUBJECT DESCRIPTION

The objective of Applied Physics in Architecture II is to provide the student tools for understanding the physical principles that are involved in building installations. The subject aims to show the student the physics fundamentals necessary to design building installations, to evaluate building energy loads and to design according to acoustic considerations.

The way to introduce the student in the subject is through an intuitive vision before approaching the essential mathematical algorithms. The lessons, in which the theoretical content is presented, are complemented with practical individual work, which is intended to give the student some attitudinal skills that will be of great use to take on, with security, a professional career.

The formal learning is complemented with practices, media tools, case discussions and individual workshops, trying to provide the student with the knowledge and attitude to face a professional career.

Therefore, the objective of the course is not limited to prepare the student for further courses matters. It is also organized to encourage students to follow the concepts, suggesting them how study must be undertaken and how to find information and face the workshops.

LEARNING OBJECTIVES

Per Ministerial Decree EDU/2075/2010, 29 of July; and the official accreditation request for the Bachelor in Architectural Studies, July 2015.

BASIC AND GENERAL OBJECTIVES:

- CB1: Students have demonstrated knowledge and an understanding of a given area of study, building upon the foundation of secondary education, supported by advanced texts, and including aspects that engage the latest advances in their area of study.
- CB2: Students know how to apply their knowledge professionally to their work or vocation and possess the competencies that are often demonstrated through elaboration and defense of arguments and the resolution of problems within their area of study.
- CB3: Students can gather and interpret relevant facts (usually within their area of study) in order to make judgments that include reflection on relevant social, scientific, and ethical topics.
- CB4: Students can transmit information, ideas, problems, and solutions to both specialized and non-specialized audiences.
- CB5: Students have developed the necessary learning skills to continue their studies with a highdegree of autonomy.
- CG4: An understanding of the fundamental issues in design, construction, and engineering as related to building projects, as well as the techniques used to address these issues.
- CG5: Knowledge of the issues related to building physics, technologies, and programmatic uses, in order to create buildings that provide internal comfort and protection from the elements.

SPECIFIC COMPETENCIES:

- CE8: Adequate knowledge of the principles of thermodynamics, acoustics, and optics, as applied to architecture and urbanism.
- CE9: Adequate knowledge of the principles of fluid mechanics, hydraulics, electricity, and electromagnetism, as applied to architecture and urbanism.

TRANSVERSE COMPETENCIES OF THE UNIVERSITY:

- CT4: Use disciplinary knowledge to analyze and evaluate current situations.

  In this course, we will emphasize the fundamentals of architectural vocabulary, and an introduction to the key movements, contexts, and elements in the discipline of architecture. We will therefore place special emphasis on the specific competencies CE7, CE8 and CE9, as described above.

TEACHING METHODOLOGY

The approach of this subject aims to start with a real case, to deal with its physics particularities and to learn how to use the proper mathematical tools to meet their resolution.

The subject is focused on the physics and mathematical principles on which installations are based. Traditional methodology consists on explaining the mathematical and physical principles at early stages so students are soon capable of solving problems of ideal situations, most of them separated from the reality.

The learning will be supported by a varied range of problems and practical examples to illustrate the concepts. The resolution of exercises and problems will help the student to illustrate the physical and mathematical principles on which the theory is based.

Based on the competences described above, the Professor will rely for his class sessions on a combination of the below course formats:

- Lectures, to explain the theory of new concepts
- Development of practical exercises for the correct understanding of the subject

Based on the competences described above, students will dedicate their individual study hours to:

- Individual study
- Preparation of assignments

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	30.67 %	23.0 hours
Discussions	10.67 %	8.0 hours
Exercises in class, Asynchronous sessions, Field Work	38.67 %	29.0 hours
Group work	0.0 %	0.0 hours
Individual studying	20.0 %	15.0 hours
TOTAL	100.0 %	75.0 hours

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Presentation of the subject

Description of the subject contents, objectives, methodology and evaluation criteria.

SESSION 2 (LIVE IN-PERSON)

Structure of the matter and waves

States of matter aggregation. Molecules. Atoms. Subatomic particles.

Simple Harmonic Motion: period, frequency, displacement, speed, acceleration

SESSION 3 (LIVE IN-PERSON)

Introduction to thermodynamics

Conservation of energy. Energy balance. Ideal gas.1st Law of Thermodynamics. Conduction. Thermal insulating.

SESSION 4 (LIVE IN-PERSON)

Radiation

Emission and absorption of a material. Stefan Boltzmann's law. Black and grey bodys.

SESSION 5 (LIVE IN-PERSON)

Gas and convection.

Energy transfer. Mass transfer. Flow causes. Boundary layer. Heat transmission combined.

SESSION 6 (LIVE IN-PERSON)

Thermal Confort. Humidity

Absolute and relative humidity. Capillarity. Condensation and dew point.

SESSION 7 (LIVE IN-PERSON)

Psychometrics.

Psychometric chart. Exercises

SESSION 8 (LIVE IN-PERSON)

Fluids

Fluids: Composition. Average pressure. Hydrostatic pressure. Pascal's principle. Archimedes' principle

SESSION 9 (LIVE IN-PERSON)

Fluids inside a building

Fluids flow or discharge. Viscosity. Bernoulli's equation. Reynolds number. Equation of continuity

SESSION 10 (LIVE IN-PERSON)

Sound

Sound speed and pressure. Intensity. Sound power.

SESSION 11 (LIVE IN-PERSON)

Acoustics

Paths of sound. Absorbents. Techniques of absorption

SESSION 12 (LIVE IN-PERSON)

Electricity

Basic concepts: Intensity, tension, resistance, energy, Ohm's law.

Current. DC and AC

SESSION 13 (LIVE IN-PERSON)

Electricity inside a building

Battery. Electrical work. Electrical power. Power loss in a resistor. Thermal energy generated in a resistor.

SESSION 14 (LIVE IN-PERSON)

Ilumination

Nature and behaviour of light.

Sun paths, light intensity, seasonal influence.

Behaviour of the light through different materials

SESSION 15 (LIVE IN-PERSON)

Final Examination

All matters of the subject

EVALUATION CRITERIA

GENERAL CONSIDERATIONS

Students will be evaluated continuously over the course of the semester, taking into account attendance and student commitment and participation in class, as well as the completion of written assignments.

EVALUATION CRITERIA AND WEIGHTING

In accordance with the spirit of the EEES, the assessment will be continuous. The teacher will evaluate certain aspects set down in the table below and their corresponding weight in order to grade the student.

criteria	percentage	Learning Objectives	Comments
Final Exam	60 %		
Intermediate Tests	25 %		
Class Participation	15 %		

RE-SIT / RE-TAKE POLICY

Students have access to a total of four enrollments, in two consecutive academic years.

Students must attend at least 80% of all class sessions. Students who do not meet this minimum percentage automatically fail both first and second enrollments, and pass directly to the third enrollment.

Students that have failed the subject in first enrollment pass to the second enrollment, except those who do not meet the minimum attendance percentage, and that therefore pass directly to the third enrollment.

Ordinary Examination (1st exam session):

For all students who fulfill the university's attendance requirements (which is a minimum of a 80%), and has submitted the final assessment, the final grade will be the obtained by weighting the average of the aspects related above. If the obtained qualification is not equal or superior to 5.0, the student will have to do the extraordinary examination. Students with a percentage of class attendance inferior to 80% or that hasn't submitted the final assignment will be assessed directly on the 3rd and 4th exam sessions.

Extraordinary Examination (2nd exam session):

Students can attend the extraordinary examination only if the individual work has been submitted. The final grade will be the maximum of the retake exam or the weighting of the exam and the class participation and individual work. The maximum grade that a student may achieve in second enrollment is an 8.

Ordinary and Extraordinary Examinations (3rd and 4th exam sessions):

For those students that do not pass the module there are two more consecutive sessions. In the 3rd and 4th exam sessions the evaluation system will consist on the same criteria, taking into account the fact that they might not be able to attend regularly the sessions. However, all the cases will be acorded individually at the beginning of the course.

BIBLIOGRAPHY

Recommended

- Eugene Hecht. *Schaum's Outline of College Physics, Twelfth Edition.* McGraw Hill. ISBN 1259587398 (Digital)

- Hugh D YoungRoger A FreedmanT R SandinA Lewis Ford. *Sears and Zemansky's university physics.* ISBN 0201603292 (Printed)

- Yehuda Salu. *Physics for Architects.* Infinity Publishing. ISBN 0741419297 (Digital)

OTHER INFORMATION

Each student will need a calculator.

Calculators are not provided at the test, and you can't share a calculator. Bring Your Own Calculator

If you have a calculator with characters that are one inch or higher, or if your calculator has a raised display that might be visible to other test-takers, you will be seated at the discretion of the teacher.

Only battery-operated, handheld equipment can be used for testing. No power cords are allowed.

No graphical calculator nor programable calculators are allowed.

You will be dismissed and your scores canceled if you use your calculator to share information during the test, or to remove test questions or answers from the test room.

BEHAVIOR RULES

Please, check the University's Code of Conduct here. The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy here. The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code here. The Program Director may provide further indications.