Course guides
230902 - F - Physics

Last modified: 29/04/2020

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 748 - FIS - Department of Physics.

Degree: BACHELOR'S DEGREE IN ELECTRONIC ENGINEERING AND TELECOMMUNICATION (Syllabus 2018). (Compulsory subject).

Academic year: 2020 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Vicente Gomis

Others: Vicente Gomis
José Eduardo García

PRIOR SKILLS

Mathematical skills: vector algebra/ derivation and integration
Physical skills: fundamentals of Newtonian kinematics and dynamics

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE1. (ENG) GREELEC: Capacitat per a la resolució dels problemes matemàtics que poguin plantejar-se a l'enginyeria. Aptitut per aplicar els coneixements sobre àlgebra lineal, geometria, geometria diferencial, càlcul diferencial i integral, equacions diferencial i en derivades parcials, mètodes numèrics, algorítmica numèrica, estadística i optimització. (Mòdul de formació bàsica).

Generical:
CG3. (ENG) GREELEC: Coneixmetn de matèries bàsiques i tecnològíes que el capacitin per a l'aprenentatge de nous mètodes i tecnologies, així com que el dotin d'una gran versatilitat per adaptar-se a noves situacions.

Transversal:
CT6. (ENG) GREELEC:APRENENTATGE AUTÒNOM: Detectar deficiències en el propi coneixement i superarles mitjançant la reflexió crítica i l'elecció de la millor actuació per ampliar coneixements.

Basic:
CB1. (ENG) GREELEC: Que els estudiants hagin demostrat tenir i comprendre coneixements en una àrea d'estudi que neix de la base de l'educació secundària general, i que sol trobar un nivell que, si bé es recolza en llibres de text avançats, inlou també alguns aspectes que impliquin coneixements procedents de la vanguardia del seu camp d'estudi.

TEACHING METHODOLOGY

Lecturers provided by the profesor will be complemented by much more participatives solving class sesions. Specific problems will be proposed to promote autonomous and cooperative work. In parallel, the posibility of individual or small groups colective consulting sesions will be presented to the students.

LEARNING OBJECTIVES OF THE SUBJECT

It must be boring to be God, and have nothing to discover. (Stephen Hawking)
Paradoxically, General physics is often presented as a rules set to be learned and correctly applied. Completely different conception is involved here where theoretical formulations are presented as tools to be used in the predictive and scientific observation and discarded if they are not useful for such purposes. Simultaneously, approaching to subjects involved in physical electronics will be performed. Initially, a classical point of view is introduced thought a review of a single particle physics which basics concepts will be applied in a many particle system scenario. Introduction of statistics in a many particle system problem will able us the definition of macroscopic averaged variables thus leading us to thermodynamics. Finally, unsolved problems will be analysed introducing modern physics of great importance in electronic engineering,

STUDY LOAD

Type	Hours	Percentage
Hours large group	65,0	43.33
Self study	85,0	56.67

Total learning time: 150 h

CONTENTS

SINGLE PARTICLE PHYSICS

Description:
Review of one dimensional Newton’s laws expanding them to 2D and 3D. Correcting of misunderstood concepts. Invariants. Angular speed and kinetic moment. Work and particle energy.

Specific objectives:
A. SINGLE PARTICLE PHYSICS
1. Conservation of the particle translational momentum
1.1. Single particle kinetics
1.1.1. 1D Kinetics
1.1.2 Intrinsic coordinates
1.1.3. Changing coordinate system
1.2. Newton’s laws and conservation of lineal momentum
2. Conservation of kinetic momentum
2.1. Polar coordinates
2.2. Kinetic momentum definition and properties.
2.3. Force momentum and conservation rules
2.4. Rotational kinetic energy: Inertia momentum
3. Energy conservation rules
3.1. Work and kinetic energy
3.2. Work of conservative forces: potential energy
3.3. Mechanical energy and its conservation
3.4. Equilibrium of conservative forces.

Related activities:
ATENEA platform support on learning.
• Lecturing notes
• Resolution of proposed exercises
• Additional information about singular subjects of special interest.

Cross-disciplinary:
• Meetings and lectures attending possibility as docent tasks.
• Participation in activities of other disciplines where Basic concepts on Physics are required.

Full-or-part-time: 62h
Theory classes: 27h
Self study : 35h

PHYSICS OF A MULTIPLE PARTICLE SYSTEM

Description:
Application of the conservativity theorems introduced above in a many particle system by using the Centre of Mass. Discrete and continuus modelization: density definitions. Rigid solid basics.

Specific objectives:
B. PHYSICS OF A MULTIPLE PARTICLE SYSTEM
1. Conservation theorems of lineal momentum.
1.1. Centre of Mass (CM) definition
1.2. CM translational momentum and its conservation
1.3. CM reference system
1.3. Discrete and continuous mass: density and Centre of Mass
2. Conservation theorems of kinetic momentum:
2.1. Kinetic momentum of the Centre of Mass
2.2. Inertia momentum: Steinner theorem
2.3. Rotational Newton's laws: Rigid Solid
2.4. Rotational energy
3. Energy conservation
3.1. System and CM energy; Conservation theorems

Full-or-part-time: 26h
Theory classes: 11h
Self study : 15h

PHYSICS OF A MANY PARTICLE SYSTEM

Description:
Definition of macroscopic variables from microscopio modelization. Thermodynamic postulates. Heat conduction problem. What does kT mean?.

Specific objectives:
C. PHYSICS OF A MANY PARTICLE SYSTEM
1. Root square mean speed
2. Macroscopic V.S. microscopic: Kinetic Theory
3. Thermodynamic state variables in a macroscopic system: Thermodynamic 0 law
4. Thermodynamic postulates: 1st law
5. Heat conduction
6. Thermodynamic postulates: 2on law
7. Basics on Statistical mechanics. Velocity and energy distributions.

Full-or-part-time: 36h
Theory classes: 16h
Self study : 20h

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INTRODUCCTIÓN INTO MODERN PHYSICS

Description:
Basic wave properties. Differences between waves and particles. Checking the ideas and contradictions of old physics: Introduction into modern physics

Specific objectives:
D. INTRODUCCTIÓN INTO MODERN PHYSICS
1. Particles and waves: wave fundamental characteristics
1.1. Wave propagation
1.2. Wave classification
1.3. Introduction to wave equation: transverse and longitudinal waves (rope waves and sound waves)
1.4. Energy transport: characteristic impedance
1.5. Media interface
1.6. Superposition: The interference
1.7. Wave diffraction
2. Unsolved classical physics problems
2.1. Michelson-Morley experiment
2.2 Black body radiation: Planck quantum hypothesis
2.3. Photoelectric effect: the photon
2.4. Compton effect: the photon as a single particle
3. Quantum mechanics postulates:
3.1. Particle-wave duality
3.2. Stationary waves and energy quantization
3.3. Heisenberg uncertainty principle
3.4 Wave function: The quantum states
3.5. Basics on energy band model

Full-or-part-time: 26h
Theory classes: 15h
Self study : 11h

GRADING SYSTEM

On-going assessment achieved from partial tests
Global assessment form a final test
The final assessment will be determined from the final test . If the on-going assessment provides positive elements to be taken into acount, the final assessment will be obtained from a combiantion of 40% partial tests and 60% of final test.

BIBLIOGRAPHY

Basic:

- Tipler, P.A.; Mosca, G. Física para la ciencia y la tecnología [on line]. 6a ed. Barcelona: Reverté, 2010 [Consultation: 14/05/2020]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6536. ISBN 9788429144284.