Complements to Aerospace Engineering

Academic Year: (2020 / 2021) **Review date: 08-07-2020**

Department assigned to the subject:

Coordinating teacher: DOMINGUEZ VAZQUEZ, ADRIAN

Type: Electives ECTS Credits : 6.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

This course requires a solid basis on calculus, linear algebra, and general physics.

OBJECTIVES

Basic competences

CB6 To possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context

CB7 Students must know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study

CB8 Students must be able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments

CB9 Students must know how to communicate their conclusions and the knowledge and ultimate reasons that sustain them to specialized and non-specialized audiences in a clear and unambiguous way

CB10 Students must have the learning skills allowing them to continue studying in a way that will be largely self-directed or autonomous.

General competences

CG1 Ability to formulate, critically check, and defend hypotheses, as well as design experimental tests for their validation.

CG2 Ability to make value judgments and prioritize in making conflicting decisions using systemic thinking.

CG4 Ability to work in multidisciplinary teams in a cooperative way to complete work tasks

CG5 Ability to handle the English, technical and colloquial language.

DESCRIPTION OF CONTENTS: PROGRAMME

Mechanics:

1. Vectors, vector bases, reference frames, coordinates. Vector differentiation in a moving reference frame
2. Point particle kinematics and dynamics
3. Central force problems
4. Oscillations
5. Geometry of masses
6. Rigid body kinematics and dynamics
7. Torque-free motion of a rigid body
8. Constraints and reactions
9. Kinematics and dynamics of material systems

Fluid mechanics and thermal engineering:

1. Continuum postulate. Control mass and volume.
2. Thermodynamic state, properties, processes
3. Conservation of Mass, Momentum and Energy
4. First Law: heat and work, stored energy, internal energy, the energy equation for a control volume, enthalpy, specific heats
5. Second law: entropy and irreversibility.
6. Thermodynamic cycles
7. 1D flow model and Nozzles
8. Heat transfer mechanisms. Conduction, convection and radiation

Solid mechanics and structural engineering
1. Introduction to solid mechanics and linear structures. Types of structures (beam, plate, ...).
2. Deformation and stress in a material. Elasticity: Young modulus.
4. Loads: compression/tension, shear, torsion, bending, thermal...
5. Resistance: ultimate stresses. Safety factors in a structure
6. Introduction to structural dynamics. Vibration modes, fundamental frequency, harmonics.

LEARNING ACTIVITIES AND METHODOLOGY

Theory sessions in master classes
Problem sessions in reduced groups
Personal and group work

ASSESSMENT SYSTEM

End-of-term exam (60%)
Continuous evaluation (40%)

In order to pass the subject, two requirements need to be met:

1) to have a MINIMUM mark of 4.0/10 in the end-of-term exam;
2) to have a minimum overall mark of 5.0/10 (weighing 60% the end-of-term exam mark and 40% the mark of the continuous evaluation).

For the extraordinary evaluation, the grade will be the best grade of the two:
1) Grade of the extraordinary exam
2) Grade of the extraordinary exam (60%) plus continuous evaluation grade (40%).
It is still necessary to reach a MINIMUM of 4/10 in the exam and 5/10 in the global grade to pass the course.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- J. H. Ginsberg Engineering Dynamics, Cambridge University Press, 2007

- Lubliner, Jacob, Papadopoulos, Panayiotis Introduction to Solid Mechanics, Springer, 2017

- M.J. Moran Introduction to thermal systems engineering, thermodynamics, fluid mechanics, and heat transfer, Wiley, 2003

- M.J. Zucrow, J.D. Hoffman Gas Dynamics (vol I and II), Wiley, 1977

ADDITIONAL BIBLIOGRAPHY

- W.E. Wiesel Spaceflight Dynamics, Aphelion press, 2010