Calculus IV

Academic Year: (2022 / 2023) **Review date: 08-07-2020**

Department assigned to the subject: Mathematics Department

Coordinating teacher: PESTANA GALVAN, DOMINGO DE GUZMAN

Type: Electives ECTS Credits : 3.0

Year : 4 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Calculus I, Calculus II, Calculus III and Linear Algebra

OBJECTIVES

By the end of this content area, students will be able to have:
1.- The knowledge and understanding of the mathematical principles of the systems of differential equations and difference equations -and also of its applications to the study of dynamical systems- underlying the energy engineering.
2.- The ability to apply their knowledge and understanding to identify, formulate and solve mathematical problems of systems of differential equations and difference equations.
3.- The ability to choose and apply relevant analytical and modelling methods using systems of differential equations, difference equations or its applications to dynamical systems.
4.- The ability to select and use appropriate tools and methods to solve mathematical problems in terms of systems of differential equations and difference equations.
5.- The ability to combine theory and practice to solve mathematical problems of systems of differential equations or difference equations, and to apply it to the study of dynamical systems.
6.- Understanding of the applicable methods and techniques applicable to systems of differential equations or difference equations, and their limitations.

DESCRIPTION OF CONTENTS: PROGRAMME

Chapter 1. Linear systems of differential equations (3 weeks)
a. Matrix calculus.
b. Linear systems with constant coefficients.
c. Non homogeneous systems. Variations of constants method.

Chapter 2. Dinamical systems. Stability (3 weeks)
a. Autonomous systems.
b. Phase diagram.
c. Stability.

Chapter 3. Nonlinear autonomous systems. (4 weeks)
a. Nonlinear models. Population dynamics.
b. Trajectories and phase diagrams.
c. Local and global aspects of phase diagrams.
d. Linearization. Stability.
e. Conservative systems.

Chapter 4. Linear difference equations. (2 weeks)
a. Initial value problems and general solution.
b. Linear models.
c. Non homogeneous equations.

Chapter 5. Nonlinear difference equations. Bifurcation and chaos. (2 weeks)
a. Recurrent sequences. Spiderweb diagram.
b. Parametric equations. Bifurcation and chaos.

LEARNING ACTIVITIES AND METHODOLOGY

The docent methodology will include:
- Master classes, where the knowledge that the students must acquire will be presented. To make easier the development of the class, the students will have written notes and also will have the basic texts of reference that will facilitate their subsequent work.
- Resolution of exercises by the student that will serve as self-evaluation and to acquire the necessary skills.
- Small groups classes, in which problems proposed to the students are discussed and developed.
- Tutorials.
- Partial Evaluations.
- Final Evaluation.

ASSESSMENT SYSTEM

Teaching is 50% taught in the synchronous and interactive online modality using Blackboard Collaborate, The other 50% Is face to face. The evaluation system will consist of:

1. Solving proposed exercises.
2. Control exams.
3. Final exam.

The weight of the control exams and the final exam in the final grade will be 50% for each one of them.

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

BASIC BIBLIOGRAPHY

- J. Polking, A. Bogges, D. Arnold Differential equations, Pearson-Prentice Hall, 2006
- P. Blanchard, R.L. Devaney, G.R. Hall Differential Equations, Brooks Cole, 2011

ADDITIONAL BIBLIOGRAPHY

- C. Fernández Pérez, F.J. Vázquez Hernández, J.M. Vegas Montaner Ecuaciones diferenciales y en diferencias. Sistemas dinámicos, Thomson, 2003
- C.H. Edwards Jr, D.E. Penney Elementary differential equations, Pearson-Prentice Hall, 2008
- G.F. Simmons, S.G. Krantz Differential Equations: Theory, Technique, and Practice, McGraw-Hill Higher Education, 2006
- R.K. Nagle, E.B. Saff, A.D. Snider Fundamentals of Differential Equations, Pearson, 2011