Calculus IV

Academic Year: (2019 / 2020)	**Review date: 09-05-2019**

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
The student will learn the basic topics of dynamical systems and difference equations:

1. Solving first order linear systems of differential equations.
2. Discussing stability of linear and nonlinear autonomous systems.
3. Solving linear homogeneous and non homogeneous differential equations.
4. Discussing spiderweb diagrams of recurrent equations.
5. Studying bifurcation and chaos in parametric difference equations.

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.

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

% 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