Advanced Mathematics

Academic Year: (2019 / 2020) **Review date: 17-05-2019**

Department assigned to the subject: Department of Mathematics

Coordinating teacher: MOSCOSO CASTRO, MIGUEL ANGEL

Type: Basic Core ECTS Credits : 6.0

Year : 2 Semester : 1

Branch of knowledge: Engineering and Architecture

STUDENTS ARE EXPECTED TO HAVE COMPLETED

Calculus I, Calculus II and Linear Algebra

COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

The student should be familiar with important techniques in complex variable functions. Specifically, he/she should understand and be able to work with the following basic concepts:

1. Elementary functions of one complex variable
2. Integration in the complex plane
3. Power series developments
4. Applications of the residue theorem

The course is complemented with some basic topics in ordinary differential equations:

1. Solution of first order differential equations.
2. Solution of higher order linear differential equations.
3. Use of Laplace transform to solve linear equations and systems with constant coefficients.

DESCRIPTION OF CONTENTS: PROGRAMME

1. FUNCTIONS OF ONE COMPLEX VARIABLE:
1.1. Complex numbers.
1.1.1. Operations with complex numbers.
1.1.2. Absolute value and argument.
1.2. Holomorphic functions.
1.2.1. Limits and continuity.
1.2.2. Complex derivative.
1.2.3. Cauchy-Riemann equations.
1.2.4. Harmonic functions.
1.3. Analytic functions.
1.3.1. Power series.
1.3.2. Elementary functions.
1.4. Complex integration.
1.4.1. Cauchy's theorem and applications.
1.4.2. Laurent series.
1.4.3. Calculus of residues.
1.4.4. The residue theorem and applications.
1.4.5. Computation of real integrals.

2. ORDINARY DIFFERENTIAL EQUATIONS:
2.1. Initial and boundary value problems.
2.2. Existence and uniqueness.
2.3. Elementary solution methods.
2.3.1. Separable differential equations.
2.3.2. Homogeneous differential equations.
2.3.3. Exact differential equations.
2.3.4. Integrating factor.
2.3.5. Linear differential equations.
2.3.6. Bernoulli equations.
2.3.7. Reduction of order.
2.4. Linear equations and systems.

2.4.1. Characteristic polynomial.
2.4.2. Laplace Transform and applications.

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 the basic texts with precise references that will facilitate their subsequent work.
- Resolution of exercises by the student that will serve as a self-evaluation and to acquire the necessary skills.
- Problem classes, in which proposed problems are discussed and developed.
- Mid term exams.
- Final exam.
- Tutorials.

ASSESSMENT SYSTEM

The evaluation will be based in the following criteria:

- Mid term exams (40%).
- Final exam (60%).

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

BASIC BIBLIOGRAPHY

- LEVINSON, N. and REDHEFFER, R. M., Complex Variables, Holden-Day, 1970
- PESTANA, D., RODRÍGUEZ, J.M. and MARCELLÁN, F Curso práctico de variable compleja y teoría de transformadas, Editorial Pearson, Madrid, 2014
- SIMMONS, G.F and S.G. KRANTZ Differential Equations: Theory, Technique, McGraw-Hill, 2007

ADDITIONAL BIBLIOGRAPHY

- CHURCHILL, R.V. and BROWN, J.W. Variable Compleja y Aplicaciones, Ed. McGraw-Hill, N.Y., 1992
- EDWARDS, C. H. Jr., PENNEY, D. E. Elementary Differential Equations with Applications, Prentice Hall , 1988
- NAGLE, R.K., SAFF, E.B. and SNIDER, A.D. Fundamentals of Differential Equations, Addison-Wesley, 1995
- SPIEGEL, M.R. Schaum's Outlines: Complex Variables , McGraw-Hill, 1964