Math Extension

Academic Year: (2019 / 2020) **Review date: 28-06-2019**

Department assigned to the subject: Department of Mathematics

Coordinating teacher: HERNANDO OTER, PEDRO JOSE

Type: Basic Core ECTS Credits : 6.0

Year : 2 Semester : 1

Branch of knowledge: Engineering and Architecture

STUDENTS ARE EXPECTED TO HAVE COMPLETED

Linear Algebra, Calculus I, Calculus II

COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

A. Learning objectives (PO: a)

A.1. To understand the concept of complex analyticity.
A.2. To be able o compute the Laurent or Taylor series expansions associated to a function which is analytic in part of the complex plane, and to determine the region of convergence of such series.
A.3. To acquire the basic concepts related to the elementary complex functions.
A.4. To compute definite integrals by means of the residue calculus.
A.5. To understand and solve first and second order linear homogeneous and non-homogeneous differential equations.
A.6. To solve second order equations using power series methods.
A.7. To recognisee classical PDEs describing physical processes such as diffusion, wave propagation and electrostatics.
A.8. To solve analytically, using the method of separation of variables, the heat and wave equations (in one space variable).

B. Specific skills (PO: a)

B.1. To understand the concept of complex differentiation and its practical applications.
B.2. To be able to handle functions given in terms of series.
B.3. To understand the concept of concept of complex integration and its practical applications.
B.4. To be able to solve first and second order linear homogeneous and non-homogeneous ODEs.
B.5. To be able to solve second order ODEs using power series methods.
B.5. To be able to model real-world problems using PDEs, and solve them using Fourier techniques.

C. General skills (PO: a)

C.1. To be able to think abstractly, and to use induction and deduction.
C.2. To be able to communicate in oral and written forms using appropriately mathematical language.
C.3. To be able to model a real situation using differential equation techniques.
C.4. To be able to interpret a mathematical solution of a given problem, its accuracy, and its limitations.

DESCRIPTION OF CONTENTS: PROGRAMME

1. ORDINARY DIFFERENTIAL EQUATIONS.
First order equations. Second order linear equations. Power series solutions and special functions. Fourier series solutions of ODEs. The Laplace transform: Applications to differential equations.

2. COMPLEX ANALYSIS.
Analytic functions and singularities. Laurent series. Contour integration and Cauchy's integral formula. The residue theorem and its applications.

3. PARTIAL DIFFERENTIAL EQUATIONS.
Heat, wave, and Laplace equations. Fourier's method of separation of variables.

LEARNING ACTIVITIES AND METHODOLOGY

Lecture sessions: 3 credits (PO: a).
Problem sessions: 3 credits (PO: a).

ASSESSMENT SYSTEM

We follow a continuous-assessment system plus a final exam:

- The continuous-assessment part consists in two exams with a 40% weight on the final mark (20% each). The exams will take place, approximately a week after the necessary lessons have been taught and it will be held in regular class hours, according to the current regulations.

- The final exam (contributing with weight 60% to the final mark) is compulsory, and will be held at the end of the semester. (PO: a.)

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

BASIC BIBLIOGRAPHY

- G. F. Simmons Differential equations with applications and historical notes , McGraw-Hill, 1991
- P. J. Hernando Clases de Ámpliación de Matemáticas para Ingeniería, Revisión 3.2 - 2019.
- R. Haberman Elementary applied partial differential equations : with Fourier series and boundary value problems, Prentice Hall, 1998
- R. V. Churchill Complex variables and applications, McGraw-Hill, 1992