



## Course guides

# 230909 - EDT - Differential Equations and Transforms

Last modified: 29/04/2020

**Unit in charge:** Barcelona School of Telecommunications Engineering  
**Teaching unit:** 749 - MAT - Department of Mathematics.

**Degree:** BACHELOR'S DEGREE IN ELECTRONIC ENGINEERING AND TELECOMMUNICATION (Syllabus 2018).  
(Compulsory subject).

**Academic year:** 2020    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

### LECTURER

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**Coordinating lecturer:** Jimenez Urroz, Jorge

**Others:**

### PRIOR SKILLS

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Basic Calculus, Linear Algebra

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**General:**

CG3. (ENG) GREELEC: Coneixement de matèries bàsiques i tecnològiques que el capaciten per a l'aprenentatge de nous mètodes i tecnologies, així com que el dotin d'una gran versatilitat per adaptar-se a noves situacions.

**Transversal:**

CT6. (ENG) GREELEC: APRENTATGE AUTÒNOM: Detectar deficiències en el propi coneixement i superarles mitjançant la reflexió crítica i l'elecció de la millor actuació per ampliar coneixements.

**Basic:**

CB1. (ENG) GREELEC: Que els estudiants hagin demostrat tenir i comprendre coneixements en una àrea d'estudi que neix de la base de l'educació secundària general, i que sol trobar un nivell que, si bé es recolza en llibres de text avançats, inclou també alguns aspectes que impliquin coneixements procedents de la vanguardia del seu camp d'estudi.

### TEACHING METHODOLOGY

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Expository instruction/Master class

### LEARNING OBJECTIVES OF THE SUBJECT

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The main goal of the subject is the study of the main transforms, the Fourier Series and their applications to solving ordinary differential equations and systems, and some partial differential equations (like the one-dimensional wave equation). The contents of this subject is well connected to the other subjects about linear circuits and signal processing, including as well the basic concepts about differential equations needed in other subjects related to electronics and electromagnetism.



## STUDY LOAD

Type	Hours	Percentage
Self study	85,0	56.67
Hours large group	65,0	43.33

**Total learning time:** 150 h

## CONTENTS

### Laplace Transform

**Description:**

Definition, convergence. Properties. Transforms of the basic functions. Inversion by partial fractions decomposition. Piecewise defined functions. Convolution. Dirac's delta.

**Full-or-part-time:** 12h

Theory classes: 12h

### Introduction to ordinary differential equations

**Description:**

First order ordinary differential equations. Initial value problems. Resolution examples. Homogeneous and non-homogeneous linear equations. Higher order ordinary linear differential equations and systems. Resolution by the Laplace transform. Numerical methods to solve differential equations.

**Full-or-part-time:** 12h

Theory classes: 12h

### Fourier Series

**Description:**

Euclidean spaces of functions. Orthogonal sequences. Bessel inequality. Parseval's theorem. Trigonometric and complex exponentials Fourier series. Even and odd functions. Pointwise convergence. Term-by-term differentiation. Introduction to partial differential equations.

**Full-or-part-time:** 16h

Theory classes: 16h

### Fourier Transform

**Description:**

Definition, convergence. Properties. Inversion. Transforms of the basic functions, the step function and the Dirac's delta. Asymptotic behavior. Parseval's theorem. Convolution theorems. Periodic functions.

**Full-or-part-time:** 12h

Theory classes: 12h



## z Transform

### Description:

Z transform unilateral and bilateral. Properties. Convergence region. Transforms of basic sequences. Inversion. Convolution of sequences. Applications.

**Full-or-part-time:** 13h

Theory classes: 13h

## GRADING SYSTEM

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Short partial exams (40%). Final exam (60%). The final score of the course will be the maximum between the previous and the score of the final exam.

## BIBLIOGRAPHY

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### Basic:

- Simmons, G.F; Krantz, S.G. Ecuaciones diferenciales : teoría, técnica y práctica. Mèxic: McGrawHill, 2007. ISBN 9789701061435.
- Beerends, R.J. Fourier and laplace transforms. Cambridge: Cambridge University Press, 2003. ISBN 9780521534413.
- Boyce, W.E.; DiPrima, R.C. Ecuaciones diferenciales y problemas con valores en la frontera. 5a. ed. México: Limusa, 2010. ISBN 9786070501517.