



UNIVERSITÀ DI PAVIA

Anno Accademico 2016/2017

ADVANCED MATHEMATICAL METHODS FOR ENGINEERS

Anno immatricolazione	2016/2017
Anno offerta	2016/2017
Normativa	DM270
SSD	MAT/05 (ANALISI MATEMATICA)
Dipartimento	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
Corso di studio	ELECTRONIC ENGINEERING
Curriculum	PERCORSO COMUNE
Anno di corso	1°
Periodo didattico	Primo Semestre (26/09/2016 - 13/01/2017)
Crediti	9
Ore	76 ore di attività frontale
Lingua insegnamento	ENGLISH
Tipo esame	SCRITTO E ORALE CONGIUNTI
Docente	ROCCA ELISABETTA (titolare) - 9 CFU
Prerequisiti	Differential and integral calculus, complex functions, sequence and series of functions, linear algebra, differential operators, power and Fourier series, Laplace and Fourier transforms for classical signals, linear differential equations with constant coefficients.
Obiettivi formativi	The course is an introduction to some basic elements of linear functional analysis (Hilbert spaces and distributions), variational principles, ordinary differential equations and dynamical systems, with simple applications to basic partial differential equations.
Programma e contenuti	Ordinary differential equations Basic definitions, examples and properties Existence and uniqueness, comparison Linear systems, exponential matrix, Liouville Theorem

Basic tools of functional analysis

Functional spaces, norms and Hilbert spaces

Best approximation and projection theorem, orthonormal basis

Linear operators: boundedness and continuity, symmetry, self-adjointness, eigenvalues and eigenfunctions. Sturm-Liouville Problems.

Applications to simple PDE's

Partial differential equations

Examples and modelling

Wave equations, D'Alembert formula, characteristics and boundary value problems, spherical waves, solutions in two and three dimensions

The Laplace and heat equations

Simple techniques for calculating explicit solutions; separation of variables.

Distributions

Introduction, examples and applications.

Operating on distributions: sum, products, shift, rescaling, derivatives.

Sequence and series of distributions: Fourier series.

Fourier transform, tempered distributions, convolutions

Metodi didattici

Lectures (hours/year in lecture theatre): 54

Practical class (hours/year in lecture theatre): 22

Practicals / Workshops (hours/year in lecture theatre): 0

Testi di riferimento

Ordinary Differential Equations and Systems

E.A. Coddington, An Introduction to Ordinary Differential Equations, Dover Publications, Inc., New York, 1961.

M.W. Hirsch and S. Smale, Differential Equations, Dynamical Systems, and Linear Algebra, Academic Press, New York, 1974.

V.V. Nemytskii and V.V. Stepanov, Qualitative Theory of Differential Equations, Dover Publications, Inc., New York, 1989.

W.T. Reid, Sturmian Theory for Ordinary Differential Equations, Applied Mathematics Series 31, Springer-Verlag, New York Heidelberg Berlin, 1980.

Basic Tools of Functional Analysis

B. D. Reddy, Introductory Functional Analysis, Texts in Applied Mathematics n. 27, Springer Verlag, New York, (1998).

W. Rudin, Functional Analysis, Mc Graw Hill, New York, (1973).

W. Rudin, Real and Complex Analysis, Mc Graw Hill, New York, (1966).

Distributions

E. DiBenedetto, Real Analysis, Birkhauser, Boston, (2002): Chapter VII.

F.G. Friedlander, Introduction to the theory of distributions, Cambridge University Press, Cambridge, (1998).

S. Salsa, Partial Differential Equations in Action. From Modelling to Theory, Springer-Verlag Italia, (2008): Chapter 7.

Partial Differential Equations

E. DiBenedetto, Partial Differential Equations, 2nd Edition, Birkhäuser, (2009): Chapter 6.

S. Salsa, Partial Differential Equations in Action. From Modelling to Theory, Springer-Verlag Italia, (2008): Chapter 5.

W. Strauss. Partial Differential Equations: an introduction. Wiley.

**Modalità verifica
apprendimento**

Written and oral examination

Altre informazioni

A more detailed description of the course can be found on the web page at the URL

<http://matematica.unipv.it/rocca/>

**Obiettivi Agenda 2030 per lo
sviluppo sostenibile**

[\\$Ibl legenda sviluppo sostenibile](#)