COMMUNICATION ENGINEERING AND ELECTRONIC TECHNOLOGIES

(Lecce - Università degli Studi)

Teaching MATHEMATICAL METHODS FOR ENGINEERING

GenCod A003085

Owner professor Diego PALLARA

Teaching in italian MATHEMATICAL METHODS FOR ENGINEERING

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SSD code MAT/05

Reference course COMMUNICATION ENGINEERING AND ELECTRONIC

Course type Laurea Magistrale

Credits 9.0

Teaching hours Front activity hours: 81.0

For enrolled in 2022/2023

Taught in 2022/2023

Course year 1

Language ENGLISH

Curriculum PERCORSO COMUNE

Location Lecce

Semester First Semester

Exam type Oral

Assessment Final grade

Course timetable https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION	Measure theory. (hours: 9) Functions of bounded variation (BV) and Riemann-Stieltjes Integral. (hours: 9) Theory of distributions. (hours: 8) Elements of Functional Analysis. (hours: 8) Complements on Ordinary Differential Equations. (hours: 10) Equations of Mathematical Physics. (hours: 12)
REQUIREMENTS	Prerequisites: Ordinary differential equations, multiple, line and surface integrals. Complex Analysis, linear algebra, elementary physics.
COURSE AIMS	Aims and Scope: Concepts of advanced mathematical Analysis - Problem solving for ordinary and partial differential equations arising from physics or engineering.
TEACHING METHODOLOGY	Lectures and exercises.
ASSESSMENT TYPE	Final examination: The final (written) exam consists in solving 2 exercises (8+8 points) and answering 2 theoretical questions (7+7 points) related with the topics of the course.

FULL SYLLABUS

Measure theory. (hours: 9) Positive measures. Measurable functions. Integral. Limit theorems in integration theory. Real and vector measures, total variation. Absolute continuity and singularity of measures. Image measure. Lebesgue's Measure in R^n. Product Measures and Fubini's Theorem. Parameters dependent integrals. Functions Gamma and Beta of Euler. Convolution.

Functions of bounded variation (BV) and Riemann-Stieltjes Integral. (hours: 9) Pointwise and essential variation. Monotonous functions. Features of bounded variation functions. Absolutely continuous functions. Cantor's function. Definition and existence of the integral of Riemann-Stieltjes. Integral's properties. Hausdorff's measures. Self-similar fractals.

Theory of distributions. (hours: 8) Definition and examples. Derivative of a distribution. Examples of Differential Equations in D'. Temperate distributions. Support of a Distribution, convolution. Fourier Transform in L^1, L^2, S, S'.
Elements of Functional Analysis. (ore: 8) The spaces L^1, L^2. Banach and Hilbert spaces. Scalar products and induced norms, orthonormal bases. Fourier Series in L^2. Linear, continuous, compact Operators. Spectral Theory of Compact Self-adjoint Operators.

Complements on Ordinary Differential Equations. (hours: 10) Sturm-Liouville theory for boundary value problems. Connections between boundary value problems and orthogonal developments. Differential Equations with analytical coefficients: regular case; Singular case and Frobenius theorem. Examples of Ordinary Differential Equations Solvable by Series: Equations of Bessel and Legendre.

Equations of Mathematical Physics. (hours: 12) Examples of Partial Differential Equations solved by the method of separation of variables, by series developments and Fourier transform. Boundary value problems, initial value problems, and mixed problems. Heat equation in the strip, and in the whole space. Wave equation in one, two and three dimensions. Wave equation in the half-line and in an interval. Eigenvalues of Laplacean in the square, in the disc, in the ball. Hermite polynomials.

REFERENCE TEXT BOOKS

S.Fornaro, D.Pallara, Appunti del corso di Metodi matematici per l'Ingegneria, web page of prof. Pallara.

F.Gazzola, F.Tomarelli, M.Zanotti: Analisi Complessa, Trasformate, Equazioni Differenziali, Società Editrice Esculapio, Bologna, III Ed., 2015. Eng. ver.: Analytic functions, Integral transforms, Differential equations, Esculapio, Bologna, II Ed., 2015.

E.Kreyszig: Advanced engineering mathematics, John Wiley & Sons, New York, 1993.

A.N.Tichonov, A.A.Samarskij, Equazioni della fisica matematica, MIR, Mosca, 1981.

A.N.Tichonov, A.A.Samarskij, B.M.Budak, Problemi della fisica matematica, MIR, Mosca, 1981.