UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2017/2018
BACHELOR'S DEGREE (BSC)	INGEGNERIA CIBERNETICA
SUBJECT	MATHEMATICAL ANALYSIS 2
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50283-Matematica, informatica e statistica
CODE	01241
SCIENTIFIC SECTOR(S)	MAT/05
HEAD PROFESSOR(S)	GARGANO FRANCESCO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**GARGANO FRANCESCO** Tuesday 10:00 11:00 Ex dipartimento di Metodi e modelli Matematici, primo piano

DOCENTE: Prof. FRANCESCO GARGANO

PREREQUISITES	Classical knowledge of the concepts of mathematical logic. Solution of equation, system of equation, inequalities, system of inequalities. Basic knowledge of trigonometry. Classical knowledge of the mathematical analysis of function of one real variable
LEARNING OUTCOMES	Knowledge and Understanding The student, at the end of the course, will have acquired knowledge on the mathematical and scientific principles at the base of engineering. In particular, the student will be able to solve problems of differential and integral calculus of real functions of two or more real variables and problems related to expansion in Fouries series of periodic functions. The student must know and distinguish conservative and non conservative fields and be able to determine the work done by these fields. These mathematical skills are important for the student's engineering course of study Applying knowledge and understanding The student must be able to use the differential and integral calculus of two or more real variables in order to solve mathematical problems arising also from classical mechanics. The student well be able to determine the fundamental characteristics of a field of forces and to discern whether this field is conservative or not . Finally the students will know how to calculate multiple integrals, partial derivatives and limits, and apply them in the study of a function and in the calculation of volumes. Moreover the student will be able to expand in Fouries series periodic function of one variable. Making judgements The student will develop a critical ability in determining the correct solution to the proposed problem. In particular, the student will be able to analyze the mathematical problem, contextualize it, and finding among the various methodologies, the more efficient one Communication skills The student will acquire the ability to expose in a clear and rigorous way, by using adequately the disciplinary lexicon, the outcomes of the qualitative analysis and of the solution of the problems proposed. The communication skills will be verified in the oral exam. Learning skills The knowledge acquired by the student during the course are fundamental to increase and refine student's mathematical expertise , in order to use them in concrete cases and in topics strictly related to the characterizing courses of cybernetic engineering
ASSESSMENT METHODS	The knowledge and the understanding of the student about the contents of the course will be verified through a written test and an oral discussion. In the written test the solution of four exercises is demanded. The exercises refer to all the topics of the program and are consistent to the examples and the exercises proposed during the course. In particular the test contains exercises on: Differential calculus, surface/volume integration, differential equation, Fourier series The exercises will be structured in several questions in order to determine whether the student has gained knowledge and understanding of the proposed arguments. During the oral discussion the student must be able to discuss the solution of the proposed exercises in the written test; furthermore the student must answer to proposed questions (at least one) of different levels of complexity, in order to verify the knowledge gained. The final evaluation takes into account for the "in itinere" test, the the final test, and the discussion, and it is an average of the three evaluations. Final evaluation will be scaled according to the following: 30-30 cum laude optimal knowledge of the contents of the course, optimal property of language, very good analytic abilities and competence in problem solving; 26-29 good mastery of the contents of the course, very good property of language, good competence in problem-solving ; 24-25 knowledge of base treated contents, discrete property of language, with limited ability to independently apply the competence to solve the proposed problems; 21-23

	not have full mastery of the main contents of the course but possesses knowledge, satisfactory property of language, insufficient ability to independently apply the acquired knowledge; 18-20 minimal base knowledge of the contents of the course and of the technical language, most insufficient or null ability to independently apply the acquired knowledge ; no sufficient does not possess an acceptable knowledge of the contents of the presented topics;
EDUCATIONAL OBJECTIVES	The student at the end of the course will acquire the knowledge on the main topics and methodologies on infinitesimal, differential and integral calculus for fields of more variables. In particular, the student will be able to understand the issues arising from the needing to create a rigorous language using the logical-deductive method in order to deal with mathematical problems related to the topics of the course. The students will be also able to solve problems arising from physics and from engineering cybernetics and of the information, and to contextualize them in the correct mathematical language. These objectives are in agreement with the educational objectives of the of Engineering cybernetics, which deal with the formation of an engineer with expertise useful to identify, formulate a solve problems which require an interdisciplinary approach based on the rigorous scientific-mathematical method
TEACHING METHODS	The course consists of frontal lessons and discussion in which illustrative problems are solved. The aimof the course is to provide the students the foundations for a rigorous approach to mathematical analysis of multi-variable functions and for differential problems. The students will acquire the following knowledge: - Differential calculus for multivariable functions. - Curve, and line integration. - Surface and volume integral. -Solution of differential equations, -Conservative Field. -Series of function These arguments will be introduced and analyzed in rigorous way during the frontal lessons. Through the exercises the students will acquire greater understanding of the presented topics. An "in itinere" test will be held at the end of the first part of the course, and it will contains exercises on differential calculus and differential equation. The obtained grade, expressed in thirtieths, will be considered for the final evaluation of the student.
SUGGESTED BIBLIOGRAPHY	M. Bramanti, C.D. Pagani, S. Salsa: Analisi matematica 2 Ed. Zanichelli, Bologna, 2009 M. Bramanti: Esercitazioni di Analisi Matematica 2 Ed. Esculapio, Bologna, 2012

SYLLABUS

Hrs	Frontal teaching
7	Definition and generality of the differential equation of order n. First Order Equations and resolving techniques. Cauchy's problem .Existence and uniqueness theorem of Cauchy's problem. Separate variable equations. Second Order Equations and the general solution. Theorem of existence and uniqueness for Cauchy's problem. Similarity Method for non homogeneous problem.
7	Differential calculus. Generality on the functions of more variables. Graph. Topology in Rn. Definition of limit and continuous function for more variables. Unicity of the limit. Algebra of Limits. Weirstrass Theorem. Zero theorem. Sign permanence theorem. Partial Derivatives, Derivable Functions. The gradient vector. Directional Derivatives. Definition of plan Tangent to the graph of a function of two real variables. Schwarz theorem. Hessian Matrix. Taylor's Formula to Second Order. Orders of higher order than the second: extension of the Schwarz theorem. Definition of minimum and minimum point, local and global, for more variable functions.. Definition of maximum or minimum point for a function of two variables. Lagrange Multiplier Theorem.
5	Integral calculus Multiple Integration. Double Integral: Definition and Calculation as Iterates. Regular Domains. Calculus of areas, center of gravity and moments of inertia of flat planes. Change of variables. Jacobian formula, calculating integrals in polar, spherical and cylindrical coordinates.

SYLLABUS

Hrs	Frontal teaching
4	Definition of rotor of a three-dimensional vector field. Rotor of a two-dimensional field. Irrotational fields. Definition of divergence of a three- or n-dimensional vector field. Solenoid fields. Differential identities involving div, rot, grad and vector fields. Divergence and rotor theorem.
5	Trigonometric Series and Fourier Series Total convergence of a set of functions: definition, continuity theorems, and derivation of the sum of a series of continuous or derivable functions. Convergence radius, infinite derivation of termination of the power series in the convergence range. Trigonometric series polynomials; Convergence criteria for trigonometric series: total convergence, punctual convergence criterion Vector spaces with scalar product, orthogonality and projection relationships. Trigonometric system: orthonormal relationships; Fourier coefficients of an integrable function. Fourier partial sum and geometric characterization. Bessel's Inequality and Riemann-Lebesgue's Theorem. Fourier Series: Quadratic Media Convergence and Parseval Equality. Regular stroke functions and Fourier series punctual convergence theorem for regular functions at intervals. Fourier series in any interval; Fourier coefficients of even or odd functions.

Hrs	Practice
6	Differential equation theory
7	Differential calculus
6	Integral calculus
5	Trigonometric and Fourier Series