UNIVERSITÀ DEGLI STUDI DI PALERMO

SCHOOL	POLYTECHNIC SCHOOL
ACADEMIC YEAR	2016/2017
FIRST CYCLE COURSE	BIOMEDICAL ENGINEERING
SUBJECT	CALCULUS
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50292-Matematica, informatica e statistica
CODE	01238
SCIENTIFIC SECTOR(S)	MAT/05
HEAD PROFESSOR(S)	GARGANO FRANCESCO — Ricercatore a tempo determinato — Univ. di PALERMO SCIACCA MICHELE — Professore Associato — Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	12
INDIVIDUAL STUDY (Hrs)	192
COURSE ACTIVITY (Hrs)	108
PROPAEDEUTICAL SUBJECTS	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**GARGANO FRANCESCO** Wednesday 14:30 15:30 Primo piano dipartimento di metodi e modelli matematici (sopra bar di ingegneria).Citofonare "dott. Gargano" **SCIACCA MICHELE** Tuesday 09:00 11:00 Dipartimento di Scienze Agrarie e Forestali (primo piano)

DOCENTE: Prof. FRANCESCO GARGANO- *Gruppo G2*

TEACHING METHODS	The course consists of frontal lessons and discussion in which illustrative problems are resolved. The objective of the course is to supply 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 acquaintances: - Differential calculus in multivariable functions. - Curve and integration over a curve. - Surface and volume integral. -Solution of differential equations, 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.
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 resolution of four exercises is demanded. The exercises make reference to all the objects of the program and are consistent to the examples and the discussion hours developed during the course, a in particular it contains exercises on: Differential calculus, curvilinear integration, surface/volume integration, differential equation. The exercises will be structured in several questions in order to determine whether the student has gained knowledge and understanding of the proposed arguments The final evaluation will be scaled according to the following conditions: 30-30 with honors 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 (no sufficient);
LEARNING OUTCOMES	Knowledge and Understanding The student, at the end of the course, will have acquired knowledge and methodologies to address and solve problems of differential and integral calculus of real functions of two or more real variables. . The student must know and distinguish conservative and non conservative fields and non-conservative and be able to determine the work done by these fields. The student must also know and understand the theorems and their proofs on the above topics. 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 non conservative. 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. Making judgements The student will develop a critical ability in characterizing the suitable and relevant solution to the proposed problem. The student will acquire the ability to formalize and analyze new problems in full autonomy, both in qualitative way and in rigorous way. The formative objectives will be reached using frontal lessons and problems and exercises solved in classroom. The attainment of the objectives is verified by written test and oral examination. Communication skills

	The student will acquire the ability to expose in clear and rigorous way, using adequately the disciplinary lexicon, the results of the characterized qualitative solution and problem analysis. The communication abilities will be verified in the oral examination. Learning skills The student will acquire the ability to contextualize own knowledges, eventually adapting in an independent way, in wide and multidisciplinary area of interests. For instance the students will be able to determine if a field of forces is conservative, or if a physical problem can be modeled though a differential problem admitting a solution.
EDUCATIONAL OBJECTIVES	The student at the end of the course will acquire the knowledge on the main topics, methodologies on infinitesimal differential calculus for functions of two or 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 to deal with intuitively simple math problems. The students will be also able to understand simple physical problems and to convert them in the correct mathematical language, for instance through differential equation.
PREREQUISITES	Classical knowledge of the concepts of mathematical logic. Solution of equation, system of equation, inequalities, system of inequalities. Basic knowledge of trigonometry. Basic knowledge of trigonometry. Classical knowledge of the concepts of mathematical analysis of function of one real variable.
SUGGESTED BIBLIOGRAPHY	M. Bramanti, C.D. Pagani, S. Salsa: Analisi matematica 2 Ed. Zanichelli, Bologna, 2009

SYLLABUS

Hrs	Frontal teaching
11	Limits for functions of multiple real variables: definitions,main properties and theorem. Continuity of a function. Differential calculus for functions of multiple real variables. Tangent plane. Diretional derivatives. Maxima and mimima. Taylor's formula.
3	Conservative and non conservative fields. Work of a conservative field.
3	Infinitesimal calculus for the curves. Regular curves. Length of the arc of a curve. Line integration
5	Theory of the integration in R^n. Double integral. Generalized double integral. Triple integral. Methods for the integration.
6	Differential equations. Cauchy's problem for system of n equation of the first order and for equation of order n. Autonomous bi dimensional system.

Hrs	Practice
8	Differential calculus for function or real multivariables. Determination of maxima and minima.
4	Line integral. Length of the arc of a curve
7	DIfferential equation. Cauchy problems.
5	Multiple integral

DOCENTE: Prof. MICHELE SCIACCA- *Gruppo G1*

TEACHING METHODS	Traditional classes and exercises.
ASSESSMENT METHODS	Mid-term written test (1 hour) and final evaluations (written of 2 hours and oral) of the program are provided for. The written tests (the first in the middle of the course and the second at the end) want to examine the student's skills, capacity and expertise provided by the course. Their structure includes: a) exercises, also applied to arguments related to the degree in Viticulture and Enology; b) 4 applied and theoretical questions (input) necessary to measure the knowledge gained, the capacity for summarizing and processing, and the acquisition of the required expertise. The oral exam consists in analyzing the written tests in order to assess the degree of acquired expertise and the possession of adequate capacity to explain and to deal with the content of the course. Criteria for the minimum: essential knowledge of the basic topics of the course and of the mathematical language, and minimal abilities to applications. The evaluation is expressed in thirtieths.
LEARNING OUTCOMES	1. Knowledge and understanding: Acquiring the basic mathematical instruments for the topics that will be proposed during the studies in agriculture. Knowledge of the terminology and how to use it. Handling several mathematical and physical expressions (text, graph, diagram, formula); 2. Implementation of the knowledge: Recognizing the graph of the elementary functions, knowing how to plot the graph of a function and to calculate the area of flat figures. 3. Making judgement: Being able to evaluate the implications and the analytical results. 4. Communicative skills: Ability to articulate clearly the knowledge gained during the course, using the specific language. 5. Learning capacity: Ability to use the knowledge gained during the course, to analyze and solve problems from mathematical point of view.
EDUCATIONAL OBJECTIVES	The main objective of the course is to provide students with the main instruments for analyzing problems from mathematical point of view. Therefore, the educational objectives will be: 1. to promote the intuitive and logical abilities; 2. to acquire skills for abstracting and formalizing; 3. to develop the abilities for critical examination and to outline logically the knowledge gained; 4. to be familiar with the application of analyzing and drawing together to some concrete situations; 5. to be familiar with looking for alternative constructive solutions; 6. to be familiar with generalizing the solution to a specific problem in algorithms; 7. to improve the ability to use methods, instruments and mathematical models in different situations; 8. to promote the comprehension of the cross-cutting concepts in order to grasp analogies between different fields.
PREREQUISITES	1. Knowledge of numerical sets N, Z, Q, R and operations in them. 2. Equations and inequalities in N, Z, Q, R. 3. Powers and properties. 4. Logarithms and properties. 5. Main topics on: straight line, circle, parabola, ellipse and hyperbola.
SUGGESTED BIBLIOGRAPHY	1. R. A. Adams, C. Essex - Calcolo differenziale - Casa Editrice Ambrosiana. 2. P. Marcellini, C.Sbordone - Analisi Matematica - Ed. Liguori, Napoli. 3. P. Marcellini, C.Sbordone - Esercitazioni di Matematica - Ed. Liguori, Napoli.

SYLLABUS

Hrs	Frontal teaching
2	An overview on: numerical sets N, Z, Q, R; powers and properties; logarithms and properties; equations and inequalities. Applications.
2	FUNCTION OF REAL VARIABLE: Definition, domain and codomain of a real function. Operations with the functions. Graph of a function. Isometric and homothetic transformations in the plane. Maximum and minimum of a function. Monotone functions. Symbols of infinity.
3	An overview on: straight line, circle, parabola, ellipse and hyperbola. Plots and properties.
4	LIMIT AND CONTINUITY OF A FUNCTION: Definition of limit and continuity of real-valued functions. Operations with limits. List of limits. Properties of continuous functions on an interval. Points of discontinuity and their classification.

SYLLABUS

Hrs	Frontal teaching
6	DIFFERENTIAL CALCULUS: Derivative and differential of a function. Point of non-differentiability. Operations differentiable. The derivative of composite functions and inverse functions. Fundamental theorems of differential calculus (Fermat's theorem, Rolle's theorem, Lagrange's theorem) and their consequences. Characterization of monotone functions with derivative. Maximum and minimum of a differentiable function. Higher order differentiability of functions. Characterization of convexity of functions with second order derivative sign. Asymptote. Plot of a function graph. Taylor's formula.
6	INTEGRAL CALCULUS: Primitive and indefinite integral of a function. Properties of integrals. Methods of integration: integration by parts formula and change of variable formula. Riemann integral. Riemann integrable functions. Properties of integrable functions. Fundamental theorem of calculus. Calculation of plane areas. Improprial integral. Applications.
4	Numerical sequence. Series and power series. Introduction on Fourier series.
2	Complex numbers.

Hrs	Practice
25	Exercise.