Università degli Studi della Basilicata
Scuola di Ingegneria

COURSE: **MATHEMATICAL ANALYSIS II**			
ACADEMIC YEAR: **2017/2018**			
TYPE OF EDUCATIONAL ACTIVITY: **BASIC**			
PROFESSOR: **SORIN DRAGOMIR**			
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Language: **ITALIAN**			
ECTS: (lessons e tutorials/practice): **6**	n. of hours: (lessons e tutorials/practice) **60**	Campus: **POTENZA** Dept./School: **SCUOLA DI INGEGNERIA** Program: **ENVIRONMENTAL AND CIVIL ENGINEERING; MECHANICAL ENGINEERING**	Semester: **I**

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES
The course will concern:

- differential and integral calculus for functions of several real variables;
- theory of differential forms;
- elements of local differential geometry of curves and surfaces;
- elements of potential theory,

as well as developing and achieving abilities in differential and integral calculus in several real variables allowing understanding of specific applications of mathematical analysis to physics and engineering.
Particular attention will devoted to the foundations and the main theorems of the above arguments.
Knowledge: Developing a good knowledge of the mathematical language together with abilities in differentiable and integral calculus in several real variables. The aim is to provide a tool for fruitfully following successive lessons in Mathematical Physics, Physics and Engineering.
Skills: Analyzing a mathematical analysis problem in several real variables and finding the solution by evaluating the suitable solving method and by using the theoretical notions learned through the course.
Learning ability**:** Attending the lessons will give a better comprehension of the arguments and will make easier the individual preparation for the final examination. The student should gradually become independent from the teacher and try to learn more by reading other textbooks, such as those appearing in the proposed list.

PRE-REQUIREMENTS
Pre-requirements consist of the contents of the courses of *Geometry* and *Mathematical Analysis I*

SYLLABUS

1- [15 hours] Differentiable functions of several real variables. Directional derivative, differential, gradient. Existence and continuity of partial derivatives implies differentiability. Theorem of Schwartz. Chain rule. Taylor's formula with a reminder. Critical points of quadratic forms and eigenvalue theory. Maximum and minimum points for real valued functions of several real variables. Necessary/sufficient conditions for critical points to be local maxima or minima. Eigenvalues of Hessian matrices.

2- [5 hours] Homogeneous functions and Euler's equation. Hints to the theory of partial differential equations. Convection equation. Laplace equation. Heat equation. Wave equation. Maxwell's equations.

3- [5 hours] Local differential geometry of plane and space curves. Curvature, torsion, Frenet's formulae. Integrals along regular curves.

4- [10 hours] Differential forms. Closed forms, exact forms. Criteria of exactness for differential forms.

5- **[10 hours]** Double integrals on normal domains. Change of variables for double integrals. Triple integrals on normal domains.

6- [5 hours] Local differential geometry of surfaces in space. Regular surfaces, first and second fundamental form. Curves on surfaces. Surface integrals.

7- [10 hours] Elements of potential theory. Gauss, Green and Stokes formulae. Applications of integral calculus to mechanics and to the theory of partial differential equations.

TEACHING METHODS

Theoretical lessons, Classroom tutorials for a total of 60 hours. Bi-weekly home work assignments.

EVALUATION METHODS

Written examination followed by oral examination [limited to the case of a score slightly smaller than necessary for reaching sufficiency]. Evaluation of results obtained in solving the exercises proposed within the bi-weekly homework assignments will contribute to the final grade.

The arguments of the written examination (as well as the arguments of the oral examination) include all the contents of the course and they are chosen so that to ensure both the study and understanding of the material of the course and the ability of using the knowledge and methods acquired for learning the contents of the successively taught mathematics, physics and engineering disciplines.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Textbooks:

E. Giusti, *Analisi Matematica 2*, Bollati Boringhieri Ed. s.r.l., Torino, 1989.

G. Di Fazio, P. Zamboni, *Analisi Matematica Due*, Monduzzi Ed., Bologna, 2008.

G. Fiorito, *Analisi Matematica 2*, Spazio Libri Ed., Catania, 2007.

R.A. Adams, *Calcolo Differenziale 2. Funzioni di più variabili*, Casa Editrice Ambrosiana, 1992, (Edizione italiana a cura di Luigi Quartapelle).

N. Fusco, P. Marcellini, C. Sbordone, *Analisi Matematica Due*, Liguori Editore, Napoli, 1996

INTERACTION WITH STUDENTS

The professor sends to the students by e-mail:

- the lecture notes, shortly after teaching each lesson;
- the Bi-weekly homework assignments;
- the solutions to the exercises proposed in the Bi-weekly homework assignments, after the date of delivery established from time to time for each homework.

Office hours:
Tuesday 15:00 - 17:00 and Thursday 15:00 - 17:00, Dipartimento di Matematica, Informatica ed Economia.

EXAMINATION SESSIONS (FORECAST)

Thursday February 8, 2018; Thursday April 12, 2018; Thursday June 28, 2018; Thursday September 20, 2018; Tuesday November 20, 2018.

SEMINARS BY EXTERNAL EXPERTS YES □ NO X

FURTHER INFORMATION