UNIVERSITY OF BASILICATA STUDIES
DEPARTMENT OF MATHEMATICS, INFORMATICS AND ECONOMICS

COURSE: Complements of Analysis

ACADEMIC YEAR: 2019-2020

TYPE OF EDUCATIONAL ACTIVITY: Characterizing

TEACHER: Antonio Azzollini

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phone: 0971205856	mobile (optional):

Language: Italian

ECTS: (lessons e tutorials/practice) 5 + 1	n. of hours: (lessons e tutorials/practice) 40 + 12	Campus: Potenza Dept.: DiMie Program: First level degree in Mathematics

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

Knowledge: The course aims to make the students learn the foundaments of the theories of the surfaces, of the ordinary differential equations and of the Fourier series. Ability: The student will have to gain a strong theoretical expertise and develop practise in solving exercises and problems related with integral calculus on surfaces, ordinary differential equations and systems, Cauchy problems and Fourier series theory .

PRE-REQUIREMENTS

Basic knowledge of analysis (course of Analysis I and Analysis II)

SYLLABUS

The surfaces (15 hh):

Regular simple surfaces. Tangent plane and normal line at a point of a regular simple surface. Implicit form. Cartesian surfaces. Orientation. Definition of area Minkowski's definition of area. Rotation surface, Guldino's theorem. Integrals on a surface. Differential forms of degree two and related integral. Stokes' Theorem. Orientable and nonorientable surfaces. Moebius strip. Gauss-Green formulas. Divergence theorem. The equation rot u = v.

The theory of the ODE (24 hh):

Metric spaces and completeness. Banach-Caccioppoli theorem. Completeness of . Local and global existence and uniqueness theorem for systems of ODE in normal form. General integral, particular integral, singular integral. Global existence of the general integral theorem. Gronwall's lemma and the continuous dependence from the initial data in the Cauchy problem. Complements on linear equations (12) variation of the constants method (Lagrange). Study of particular types of equations: separable variables, of the type $y' = f(ax+by+c)$, $y' = f(y/x)$, $y' = f()$, $y' + g(x)y + h(x)y = 0$, 1 (Bernoulli), $y' + g(x)y + h(x)y = k(x)$ (Riccati), $x = g(y')$, $y = g(y')$, $y = xy' + g(y')$ (Clairaut), $y = xf(y') + g(y')$ (d'Alembert), $f(x, y', y'') = 0$ Cauchy problem related with ODE of order n in normal form, Local existence and uniqueness theorem. ODE of second order: of the type $f(y, y', y'') = 0$, $f(x, y, y', y'') = 0$ with f homogeneous in (y, y', y''), Eulero equation. The equation $X(x,y)dx + Y(x,y)dy = 0$: integrating factor method. Systems of ODE. Nondegenerate linear systems . Theorem on the number of arbitrary constants. Degenerate linear systems.

Fourier series (13 hh):

The trigonometric series. Fourier coefficients of a generally continuous summable functions. Fourier series. An approximation lemma. Riemann-Lebesgue lemma. Riemann localization principle. Dirichlet kernel. Dini's convergence Theorem. Cesàro's theorem on the sequences. Cesàro summation. A sufficient condition for the ordinary convergence of a series converging according to Cesàro. Hardy's theorem (without proof). Fejér kernel. Fejér's convergence theorem. A sufficient condition for the uniform convergence of Fourier series. The Gibbs' phenomenon. Weierstrass' approximation theorem.

TEACHING METHODS

Theoretical lessons and exercises.

EVALUATION METHODS

- Written examination, consisting in three exercises about the topics in the syllabus. The exam is passed if the student achieves a vote greater than or equal to 18/30, and the student can attend the oral examination. With a vote equal to 16/30 or 17/30 the student can attend to oral examination after a preliminary test to fill the gap.
- Oral examination, where the student must show to be able to connect and compare the different subjects dealt with during the course. Final vote arises by an overall evaluation of the performance in the two examinations.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

C. D. Pagani, S. Salsa, Analisi Matematica Vol. 2,

Zanichelli N. Fusco, P. Marcellini, C. Sbordone, Elementi di Analisi Matematica II, Ed. Liguori, M. Picone, G. Fichera, Corso di Analisi Matematica, Vol. I & II, Ed. Veschi,

M. Tenenbaum, H. Pollard, Ordinary Differential Equations, Dover Publications. (In particular: Ch. 7, p.393-417, 421-423.)

W. Walter, Ordinary Differential Equations, Graduate Texts in Mathematics, Springer. (In particular: Ch. 1 (tranne Sec. XIV, p.24-27, Supplement p.33-35; Sec. VI, p.41-45); Ch. 4, Sec. 17, p.175-189).

Lecture notes on the Gibbs' phenomenon

INTERACTION WITH STUDENTS

Office hours: on tuesday 15.00 - 18.00 at the Office room n° 34, pad. 3/d, 2nd flat. A contact is also possible by the e-mail, writing to the address antonio.azzollini@unibas.it.

The office hours may vary in the second semester.

EXAMINATION SESSIONS (FORECAST)[1]

February 4, 2020
February 18, 2020
May 12, 2020
July 7, 2020
September 8, 2020
November 17, 2020

SEMINARS BY EXTERNAL EXPERTS YES NO x

FURTHER INFORMATION

1Subject to possible changes: check the web site of the Teacher or the Department/School for updates.