UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

# Consiglio Interclasse in Matematica

| General information | |
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| Academic subject | ***Elements of Advanced Analysis 2*** |
| Degree course | *Mathematics* |
| Academic Year | *2021-22* |
| European Credit Transfer and Accumulation System (ECTS) | 7 |
| Language | *Italian* |
| Academic calendar (starting and ending date) | *II Semester* |
| Attendance | *Strongly recommended* |

| Professor/ Lecturer | |
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| Name and Surname | Marcello D'Abbicco |
| E-mail | marcello.dabbicco@uniba.it |
| Telephone | 080 544 2721 |
| Department and address | *Dept. Mathematics, floor 2, room 36* |
| Virtual headquarters | *Microsoft Teams profile: marcello.dabbicco@uniba.it* |
| Tutoring (time and day) | On appointment by e-mail |

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| ***Syllabus*** | |
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| **Learning Objectives** | *Acquiring language and techniques of modern analysis, especially functional analysis in locally convex spaces, convolution product, Fourier transform, distribution theory, Sobolev spaces, Laplace transform, Cauchy problem for partial differential equations* |
| **Course prerequisites** | *Mathematical knowledge which usually is acquired during a degree of L–35 class. Especially: classical analysis of one and several variables, general topology, linear algebra, Lebesgue measure and integration theory.* |
| **Contents** | *1. Functional analysis in locally convex spaces*<br>*2. Convolution product and Fourier transform*<br>*3. Distributions theory*<br>*4. Sobolev spaces*<br>*5. Cauchy problem for evolution equations in $R^n$*<br>*6. Laplace transform and application to evolution equations on intervals*<br>*The detailed program is available on www.dabbicco.com* |
| **Books and bibliography** | *W. RUDIN, Analisi funzionale, McGraw-Hill*<br>*W. RUDIN, Analisi reale e complessa, Boringhieri*<br>*G. GILARDI, Analisi 3, Mc Graw-Hill*<br>*F. TOMARELLI, Mathematical Analysis Tools for Engineering, Esculapio* |
| **Additional materials** | *Lecture notes, website www.dabbicco.com* |

| **Work schedule** | | | |
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| Total | Lectures | Hands on (Laboratory, working groups, seminars, field trips) | Out-of-class study hours/ Self-study hours |
| **Hours** | | | |
| *175* | *72* | *0* | *103* |
| **ECTS** | | | |
| *7* | *7* | *0* | |
| **Teaching strategy** | | | |
| | *Lectures, supported by slides and lecture notes. Exercises will be proposed, for which teamwork is allowed.* | | |

| **Expected learning outcomes** | |
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| **Knowledge and understanding on:** | ○ Acquiring fundamental tools of functional analysis in locally convex spaces<br>○ Acquiring and practicing convolution product, Fourier and Laplace transforms in different functional and distributional spaces<br>○ Acquiring proof strategies |
| **Applying knowledge and understanding on:** | ○ Ability to use differential operators, convolution product, Fourier and Laplace transform, in functional and distributional spaces<br>○ Ability to use the acquired tools to solve and study initial value problems and initial value/boundary value problems for evolution partial differential equations |
| **Soft skills** | • *Making informed judgments and choices*<br>○ Evaluate the consistency of the logic reasoning in a proof<br>○ Find the correct mathematical tools to face complex analysis problems<br>○ Find the most elegant, short, formally correct and complete strategies to solve exercises<br>• *Communicating knowledge and understanding*<br>○ Use in correct and clear way the advanced mathematical formal language to present the acquired knowledge, describe and solve problems<br>○ Explain in a clear way the solutions obtained for the proposed problems<br>• *Capacities to continue learning*<br>○ Acquire an adequate study methodology, with bibliographic investigation, and ability to autonomously go deep in the topics, solve exercise and questions proposed |

| **Assessment and feedback** | |
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| Methods of assessment | *Oral test. Optionally, one to three intermediate tests are available during the course.* |
| Evaluation criteria | • *Knowledge and understanding*<br>○ Correct and complete discussion<br>○ Appropriate use of the mathematical tools in the proofs<br>○ Correct answer to the questions during the oral test<br>• *Applying knowledge and understanding*<br>○ Correct tools used to completely solve the problems<br>• *Autonomy of judgment*<br>○ Best tools to solve the question or problem proposed<br>• *Communication skills*<br>○ Formally correct mathematical language<br>○ Clarity of the exposition and of the answers<br>• *Capacities to continue learning*<br>○ Correct solutions to the proposed exercises |
| Criteria for assessment and attribution of the final mark | *The exam is sufficient with 18/30 mark.* |
| **Additional information** | |
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