MATHEMATICS

Cycle	XXXVI
Coordinator	Prof.ssa Alessandra LUNARDI Department of Mathematical, Physical and Computer Sciences email: alessandra.lunardi@unipr.it
Duration	3 years
Starting date of the PhD program	01/11/2020
Partner Institution	• University of Modena e Reggio Emilia • University of Ferrara
Partner Institution for University Cooperation Agreements	• KU Leuven (Belgium) • Universidade do Minho (Portugal)

Research Topics

- Statistical mechanics
- Probability
- Discrete mathematica and combinatorial geometry
- Algebraic and geometric topology of manifolds
- Partial differential equations
- Differential equations and dynamical systems
- Calculus of variations and applications to variational problems
- Infinite dimensional analysis
- Mathematical models and methods for complex systems
- Mathematical methods of quantum mechanics
- Modelization and scientific calculus
- Numerical methods for integral equations
- Numerical optimization and applications
- Combinatorial optimization
- Sequential, parallel, and real-time algorithms
- Hopf algebras and quantum groups
- Projective algebraic geometry
- Geometry and complex analysis
- Differential geometry
- History of mathematics
- Didactics of mathematics
- Thermomechanics of continuous systems
- Exterior differential systems
- Kinetic methods in physics, economy, and social sciences
- Number theory
- Artificial intelligence
- Automatic reasoning

Training Objectives
The main aim is to produce highly qualified researchers in the field of Mathematics, with advanced skills on mathematical models and methodologies that can be used also in interdisciplinary applied sciences. This aim will be achieved through series of lectures, conferences, participations to workshops and congresses, research periods in foreign institutions that one one hand introduce the students to the academic research community and on the other side let them establish work relationships along their PhD career and later. Education is addressed to the ability of recognizing significant research problems, to formulate solutions and to transmit knowledge through written works and oral presentations. At the end of the PhD program any Doctor should be able to carry on scientific research autonomously, to produce original considerable scientific results and to integrate into the international scientific community.

Admission requirements
Regardless of age and citizenship, applicants holding at least one of the following academic qualifications can apply for admission: - Laurea specialistica or Laurea magistrale (second cycle master's degree) - Laurea Vecchio Ordinamento (degree obtained under the previous Italian regulations); - Second cycle Master's degree obtained abroad, equivalent to the above mentioned Italian degrees and recognized as suitable for the admission to doctoral program Undergraduate applicants may also submit applications with the obligation of getting their degree by **October 31st 2020.**

POSITIONS PUT OUT TO COMPETITION	
With Scholarship	11
Without Scholarship	1
TOTAL	**12**

Positions with University Scholarship		
N°	*Funding entity*	*Research Topic, if any*
3	Scholarship University funds	---
3	Scholarship funded by University of Ferrara	---
3	Scholarship funded by University of Modena e Reggio Emilia	---

Position with Scholarship LINKED TO SPECIFIC TOPICS (art. 11 of the Call for applications)		
During the Oral Exam, applicants may express their interest in being assigned a scholarship dedicated to a specific research topic to the Examination Board. The Board will express its judgement on eligibility to be assigned the scholarship in consideration of the specific competences, experience and specific aptitudes of the applicants.		

N°	*Funding entity*	*BOUND RESEARCH TOPIC*
1	Funded by University of Modena e Reggio Emilia – Department of Physics, Informatics and Mathematics (Project NEW CONTROL)	• Analysis and identification of manifold learning techniques for pre-processing neural networks simulations, in order to optimize the algorithms on multi-core platforms for specific safety critical applications such as autonomous driving

1	Funded by University of Modena e Reggio Emilia – Department of Physics, Informatics and Mathematics (Project CLASS)	• Study and implementation of RT (Real Time) scheduling algorithms for fog computing applications in urban-smart city environments, on heterogeneus multi/many-corse embedded platforms
1	POSITION WITHOUT SCHOLARSHIP (Project CEMP)	• Analysis, development and testing of active safety algorithms (Speed limiter, Forward Collision Warning and Blind Spot detection) and interaction with the dynamics of a 2-wheel vehicle

ADMISSION PROCEDURES

Assessment of QUALIFICATIONS: up to 60 points
(a minimum score of 30 points shall be required to be admitted to the Oral Exam)
ORAL EXAM: up to 60 points
Minimum score for ELIGIBILITY: 70/120

Foreign Language	Language the fluency of which shall be assessed during the Oral Exam: **ENGLISH**. The evaluation of the knowledge of this language will be oral and will consist in conversation and translation of a scientific text.

APPLICANTS SHALL TAKE THE EXAM REMOTELY.
For further details please refer to the relevant provision laid down in art. 7 of the Call for applications**.**

THE INTERVIEW MAY BE HELD ALSO IN ENGLISH

LIST OF QUALIFICATIONS TO BE SUBMITTED AND THEIR ASSESSMENT

Mandatory documents to be attached to the on-line application

− **ANNEX A** (art. 5 of the Call for Applications)
− Scanned Copy of a **valid identification document** with photo
− **Curriculum Vitae et studiorum** (art. 4 of the Call for Applications)
− **Abstract of the second cycle master's degree thesis.** Undergraduate applicants may submit the draft of the thesis approved by their supervisor (abstract/draft of the thesis: 10.000 characters including spaces)
− **Certificates and academic transcript of records for both Bachelor' and Master' degrees** containing the following details for each degree held: (art. 4 of the Call for Applications):
  o University that granted the degree
  o Type of degree (first cycle/second cycle/single cycle)
  o Name of the degree program
  o Date of graduation
  o Final mark
  o List of exams and corresponding scores (academic transcript of records)
  o Translation into Italian or English (only for degrees issued in languages other than Italian or English)

Further qualifications that may be attached to the application, if in possession of the applicant
(only qualifications attested by a document drawn up in Italian or in English)

− **Statement of Research Interest:** Short text – maximum 2 pages – in Italian or in English, aimed at explaining the candidate's reasons to attend the PhD program and at describing the specific her/his research interests. It may contain the proposal for a research project;

− **Scientific Publications:** Articles on national and international journals, contribution presented at conferences or symposia, book chapters etc.
− **Reference Letters:** A maximum of 2 written by professors or researchers at the University of origin of the candidate or from other universities or from experts in the research areas working in public or private research facilities
− **Academic qualifications:** First or second level Master's degree obtained in Italy and/or specialization degree in subjects consistent with the research topics of this PhD program
− **Mobility experience abroad** (e.g. Erasmus or similar);
− **Any other document** certifying the applicant's traning and abilities (grants, awards, etc.)

EVALUATION CRITERIA		
QUALIFICATION	**EVALUTATION CRITERIA**	**POINTS**
Curriculum Vitae et studiorum	Including academic career and postgraduate experience, accompanied by a statutory declaration in lieu of the certification of the exams passed with the relevant marks, as well as the final graduation mark.	**Up to 10 points**
Graduation thesis	Scientific content and presentation	**Up to 20 points**
Statement of Research Interest	Candidate's maturity and depth in the presentation of her/his interests, her/his motivation and a possible research project	**Up to 20 points**
Scientific publications	Scientific relevance of the results and their editorial positioning	**Up to 5 points**
Reference Letters	Significant presentation of the candidates in the letters, relevance of the qualifications for the PhD purposes.	**Up to 5 points**
ORAL EXAMINATION	**EVALUATION CRITERIA**	**POINTS**
The ORAL PROOF consists in a presentation and discussion of the scientific interests of the candidate; it aims to find out the aptitude of the candidate for scientific research and her/his general knowledge of basic topics relevant to the subject matters of the PhD course	o knowledge of foreign languages: max 10 points o good argument concerning research interests: max 25 points o preparation on the topic of the PhD course: max 25 points	**Up to 60 points**

SCHEDULE OF THE ADMISSION EXAMS		
ORAL EXAM	**DATE**	16 September 2020 (with possible extension to 17 September 2020 and the following days)
	TIME	09:00 am (Italian time)
	PLACE	remotely using the **Microsoft Teams platform**
OTHER INFORMATION		For foreign candidates, the admission examinations may be held in English at the candidate's choice.