


INFORMATION TECHNOLOGIES	
CYCLE	XLI
COORDINATOR	Prof. Alberto BONONI email: <a href="mailto:alberto.bononi@unipr.it">alberto.bononi@unipr.it</a> Department of Engineering and Architecture
DURATION	3 years
STARTING DATE OF THE PHD PROGRAM	01/11/2025
POSITIONS PUT OUT TO COMPETITION	1
ADMISSION PROCEDURES	Assessment of QUALIFICATIONS and Research Project Oral Exam in PRESENCE or REMOTELY
ADMISSION REQUIREMENTS	Regardless of age and citizenship, applicants holding at least one of the following academic qualifications can apply for admission: <ul style="list-style-type: none"> <li>– Laurea specialistica or Laurea magistrale (second cycle master's degree)</li> <li>– Laurea Vecchio Ordinamento (degree obtained under the previous Italian regulations);</li> <li>– Second cycle Master's degree obtained abroad, equivalent to the above mentioned Italian degrees and recognized as suitable for the admission to doctoral program</li> </ul> Undergraduates can also apply for admission to the selection, with the obligation to obtain the degree by <b>31.10.2025</b>
TRAINING OBJECTIVES	
The course aims at educating the future Ph.D.'s so that they will enter the research world with an active role, within both universities and industries	
RESEARCH AREAS	
<ul style="list-style-type: none"> <li>• Computer systems and automatic control</li> </ul>	

Position with Scholarship LINKED TO SPECIFIC TOPICS (art. 6 of the Competition notice)		
N°	Funding entity	BOUND RESEARCH TOPIC
1	Scholarship financed with National Cybersecurity Agency funds - Cup D92J25000170001 	Novel Algorithms and Protocols for QKD Based on Quantum Entanglement and Qudits  Secure cryptographic key distribution is a highly relevant problem in computer science. Quantum Key Distribution (QKD) is the most theoretically secure solution for key distribution, based on physical principles that make it secure independently of computational capacities and thus offering a long-term strategy. However, it is a difficult solution to realize ensuring at the same time high key rate and long-distance service. Current QKD implementations, including commercial ones, assume the presence of intermediate trusted nodes to allow for long-distance key distribution. The proposed research project has as main target the design of novel QKD protocols based on quantum entanglement, with the peculiarity of using qudits (quantum systems with $d>2$ levels) instead of qubits. Entanglement-based QKD protocols

		do not need trusted nodes for coping with long distances. Using qudits should also allow for reaching high key rates, leveraging the fact that qudits enable efficient quantum error correction. A further objective of the research will be the integration of these protocols into a complete cryptographic system, also including Post-Quantum Cryptography (PQC) algorithms, whose robustness will be studied also by means of advanced Approximate Unitary Synthesis (AUS) techniques.
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ADMISSION PROCEDURES
<b>Assessment of QUALIFICATIONS:</b> up to 70 points (a minimum score of 40 points shall be required to be admitted to the Oral Exam) <b>ORAL EXAM:</b> up to 50 points <b>Minimum score for ELIGIBILITY:</b> 70/120

ORAL EXAM PROGRAM		
<b>THE ORAL EXAM TAKES IN THE PRESENCE</b> and with the possibility of carrying out the interview <b>REMOTELY</b> for candidates residing abroad or temporarily abroad for study / work reasons. To this end, candidates must submit <b>a motivated REQUEST</b> as per the model attached to the competition announcement)		
<b>The ORAL test involves the presentation and discussion of the research project</b> by the candidate and is aimed at verifying the candidate's aptitude for scientific research and his general preparation on topics related to the research topics of the doctoral course		
<b>Foreign Language</b> the fluency of which shall be assessed during the Oral Exam	<b>ENGLISH</b>	The evaluation of the knowledge of this language will be oral and will consist of a brief interview on a technical topic (for example a translation of a scientific text).

SCHEDULE OF THE ADMISSION EXAMS		
ASSESSMENT OF QUALIFICATIONS		It is the candidate's responsibility to verify the outcome of the evaluation of qualifications, which can be consulted in their reserved area by connecting to the page <a href="http://unipr.esse3.cineca.it/Home.do">http://unipr.esse3.cineca.it/Home.do</a> in the days preceding the date of the Oral Exam
ORAL EXAM	DATE	16 September 2025 (with possible extension in the following days)
	TIME	03:00 pm (Italian Time)
	PLACE	Department of Engineering and Architecture SCIENTIFIC ENGINEERING HEADQUARTERS Parco Area delle Scienze, 181/A – Campus Universitario 43124 PARMA – ITALY
FURTHER INFORMATION		<p><b>The choice of the Research Topic to be expressed in Annex A is not binding on the assignment of the research project, and it is intended to assess candidates skills during the admission exam. <u>The PhD research topic will be assigned by the Academic Board.</u></b></p> <p><b>For foreign candidates all documents written in a language other than Italian will have to be translated into English, otherwise they will not be evaluated</b></p>

	<b>THE INTERVIEW MAY BE HELD ALSO IN ENGLISH</b>	For foreign candidates, the admission examinations may be held in English at the candidate's choice.
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LIST OF QUALIFICATIONS TO BE SUBMITTED AND THEIR ASSESSMENT		
MANDATORY DOCUMENTS TO BE ATTACHED TO THE ON-LINE APPLICATION		
ANNEX A	(art. 3.2 of the Competition notice)	
Identification Document	Scanned Copy of a valid identity document with photo (i.e. identity card, passport)	
Curriculum Vitae et studiorum	No specific CV format is required (see art. 3.2 of the Competition notice)	
Abstract of degree thesis	<b>Abstract of the second cycle master's degree thesis.</b> Undergraduate applicants must submit the draft of the thesis approved by their supervisor (abstract/draft of the thesis: 10.000 characters including spaces)	
Academic Qualifications	<b>Certificates and academic transcript of records for both Bachelor' and Master' degrees</b> containing the following details for each degree held: (art. 3.2 of the Competition notice): University that granted the degree - Type of degree (first cycle/second cycle/single cycle) Name of the degree program - Date of graduation - Final mark - List of exams and corresponding scores (academic transcript of records) - Translation into Italian or English (only for degrees issued in languages other than Italian or English).	
Research Project	Max 10.000 characters, written in English, it will have to focus on an original research topic and structured as follows: introduction of the problem in the scientific context, significance of the problem, expected results, argumentation. <u>It does not represent a constraint with respect to the following choice of the doctoral thesis</u> , that shall be defined together with the supervisor and approved by the Academic Board. However, this project must be prepared after having contacted and consulted one of the research groups related to the PhD course in Information Technologies (information on the research groups and their contacts can be found at <a href="https://dia.unipr.it/en/node/3080">https://dia.unipr.it/en/node/3080</a> ).  <b>Failure to submit the project will result in exclusion from procedure for admission to the course.</b>	
LIST OF EVALUABLE QUALIFICATIONS		
(only qualifications attested by a document drawn up in Italian or in English)		
Curriculum Vitae et studiorum	Evaluation of the marks of the exams and of the master's degree mark (if available). The candidate is required to provide the average of the marks of all the exams of the master's degree, in addition to the details of the same It will also be evaluated the congruence of the degree obtained with the PhD themes.	Up to 25 points
Graduation thesis	It will be evaluated the congruence of the Master's Degree thesis with the doctoral program research topics	Up to 5 points
Research Project	Points relating to the research project shall be allocated on the basis of the following criteria: <ul style="list-style-type: none"><li>Scientific value and originality of the proposal: max 10 points</li><li>description and structure of the proposal: max 10 points</li><li>proposal feasibility: max 10 points</li></ul>	Up to 30 points
Scientific Publications	Articles on national and international journals, papers presented at conferences or symposia, book chapters etc. Evaluation of the editorial position of the publication and its impact on the scientific community on the basis of the available indicators. It will be evaluated only publications from the past five years.	Up to 5 points

<b>Reference Letters</b>	Maximum 1 letter from professors or researchers belonging to the Collegio Docenti (PhD board) of the PhD in Information Technologies, after a preliminary interview with them. <b>It must be sent directly by the signer to the address e-mail: <a href="mailto:alberto.bononi@unipr.it">alberto.bononi@unipr.it</a></b> (The candidate, therefore, must not upload them through the procedure of the competition online registration).	<b>Up to 2 points</b>
<b>Other experiences (training, work, research, teaching, etc.)</b>	Duration evaluation (for scholarships and internships), score (for the GRE test), prestige (for awards)	<b>Up to 3 points</b>
<b>EVALUATION ORAL EXAM</b>		
<b>Interview Program</b>	<b>Evaluation CRITERIA</b>	<b>POINTS</b>
<b>The ORAL EXAM includes the presentation of the research project</b> and is intended to assess the suitability of the applicant to pursue scientific research as well as the general knowledge of issues connected to the PhD course	<ul style="list-style-type: none"> <li>○ knowledge of the foreign language: max 5 points</li> <li>○ research project presentation: max 25 points</li> <li>○ general knowledge of issues connected to the PhD course: max 20 points</li> </ul>	<b>Up to 50 points</b>