UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

PHD PROGRAM IN

INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING

Objectives, Organizazion and Activity Plan

Objectives

The ITEE PhD program provides education and training to future leading actors in research and innovation in information technologies and electrical engineering in industries as well as in scientific and technological (private and public) institutions. These areas increasingly demand for advanced education and cross-disciplinary competences, and ability to develop new knowledge, methodologies and technologies.

The program admits M.Sc. graduated students from Italy and abroad, owning a solid back-ground and motivated to advance their knowledge and abilities in research and innovation in an internationally recognized scientific context, deemed as Department of Excellence in Italy since 2018. It fosters a multidisciplinary vision of research, rooted in the disciplines mainly characterizing the hosting DIETI department: Computer Science; Automation and Robotics, Biomedical, Computer, Electrical, Electronic, and Telecommunication Engineering. The full list of disciplines characterizing the ITEE PhD Program is in appendix.

Organization

The ITEE PhD program is subject to the University Doctoral Regulation. It is administratively managed by the Department of Electrical Engineering and Information Technologies (DIETI). It is accredited by the National Agency for Evaluation of Universities and Research (ANVUR) up to the 35th cycle. Its activation for the 36th cycle is subject to the verification of the requirements for accreditation by the Ministry of Universities and Research.

The duration of the PhD program is three years.

Admission is based on a selection process, through an annual open call. A number of positions is reserved to applicants from abroad. Admission to the doctorate involves an exclusive and full-time commitment.

The starting date of every academic year is November 1st.

Every student is assigned by the ITEE Board a supervisor (or tutor), and optionally a co–supervisor (or co-tutor). Students may be assigned a co-tutor from the external funding entity too, in case of research themes/scholarships funded by companies or external public or private research institutions.

Bimonthly periodic reports are approved by the PhD Coordinator.

By the end of every academic year, on the basis of a detailed report of the individual activities and research, the ITEE Board decides the admission of the student to the subsequent year, or proposes to the Magnificent Rector the exclusion of the student from the program.

At the end of the three-years program, the student has to present to the ITEE Board a detailed report of personal activities and of (co-)authored publications.

Students will gain the Philosophiæ Doctor title ("Dott.Ric." or "Ph.D.") upon successful passing a final exam ("thesis defense"), after the duration of the program. The final exam encompasses the evaluation of an individual doctoral research thesis contributing to the advancement of knowledge or methodologies in the selected field. The doctoral thesis is evaluated before the defense by at least two highly qualified professors ("thesis evaluators") - possibly belonging

to foreign institutions - different from those who contribute to granting the Ph.D. title. The Ph.D. title is granted by the Magnificent Rector of the Federico II University of Naples.

Activity plan

The activity plan is individual: every student shall determine with the supervisor the educational activities to be periodically reported in the personalized study plan.

Individual activity plans have to encompass an overall number of at least 180 credits within the duration of the program.

The ITEE PhD study plan envisages three kinds of activities, which all need to be encompassed in individual study plans (according to the rules set below):

- Courses / PhD Schools;
- Seminars / Tutorials;
- Research.

Every PhD student is expected to spend a study and research period between 3 and 18 (even not continuous) months in an internationally recognized academic or research hosting institution abroad. Activities abroad need to be approved by the ITEE Board in advance.

All the above activities shall entitle students to earn corresponding educational credits.

The number of credits for courses and PhD schools is typically defined by the PhD Board, depending on their duration, level and final assessment. Credits are gained upon successful course completion, as attested by the lecturer, typically on the basis of the final assessment.

The number of credits for seminars is typically 0.2 credits per hour. Students may also earn credits attending tutorials at international conferences. Credits are gained upon successful attendance, as attested by the lecturer or by the Coordinator.

The number of credits for individual research activities is attested by the student supervisor. Research activities include all kinds of not *ex cathedra* activities, such as: study of books and of the scientific literature; experimental and laboratory activities; attendance to scientific conferences and workshops and to technical meetings; participation to research projects meetings; talks, presentations and seminars; preparation of technical reports, of scientific articles and of the doctoral theses. Study and research periods abroad are included and shall be reported in the research activities.

The organization of the educational activities in individual study plans is expected to adhere to the range of yearly credits per kind of activity set in the following table, unless differently agreed with the PhD Board.

Year	Courses (credits)	Seminars (credits)	Research (credits)	Tutorship
I	min 20 - max 40	min 5 - max 10	min 10 - max 35	min 0 - max 1.6
II	min 10 - max 20	min 5 - max 10	min 30 - max 45	min 0 - max 1.6
III	min 0 - max 10	min 0 - max 10	min 40 - max 60	min 0 - max 1.6
TOTAL	min 30 - max 70	min 10 - max 30	min 80 - max 140	min 0 - max 4.8

The range of yearly credits per kind of activity is driven by the following criteria:

- Attendance to advanced or interdisciplinary courses is expected to be favored in the first half of the duration of the PhD program, with the goal for the student of *broadening* personal knowledge in areas not covered in own prior MSc career. The categorization of courses is described below;

- In the second year, the individual activity plan is expected to favor *deepening* knowledge in disciplines related to personal research interests; research activities in the second year start to become prevalent;
- The student is also expected - mainly in the first two years - to attend *ad hoc* courses for stenghtening personal language and computer skills useful for research activities, and courses about research and innovation management and entrepreneurship;
- Lab activities, attendance to conferences and seminars, and study and research periods abroad may take place during the whole PhD program duration;
- In the third year, the student is expected to favor research activities in the scientific area of interest, which will result in the preparation of the doctoral research thesis.

Throughout the whole ITEE program, students may also earn from 0 to 4.8 credits (within the limit of 40 hours per academic year) for tutorship or supplementary teaching activities of undergraduate and graduate students. Tutorship duties are assigned by the coordinators of the undergraduate or graduate curricula under authorization of the ITEE Board with the consent of the student, and need to refer to scientific disciplines characterizing the ITEE program (listed in appendix). Tutorship activities are attested by the ITEE Coordinator.

Courses are categorized in three types:

A) **Advanced/interdisciplinary courses**

A1) *Ad hoc* PhD courses

A2) Courses shared with MSc curricula

B) English language, scientific writing, advanced computer skills courses

C) *Ad hoc* PhD courses on research enhancement, entrepreneurship and intellectual property

Type A1 courses are to be attended by all PhD students whose research area or interests (in a broad meaning) are related to the course topic.

Type A2 courses may be freely selected by students, based on own past studies and on personal study and research intestests, upon agreement with their PhD supervisor, with the goal of broadening and deepening personal knowledge and competences. Students may choose to attend other type A2 courses offered in MSc curricula of the Federico II University or of different universities, subject to prior approval by the PhD Board.

Type B courses are mandatory; unattendance need to be justified to the Coordinator. English language courses at various levels or dedicated to PhD students are provided by the Linguistic Center of the University (CLA). An individual entrance placement test shall determine the course level.

Type C courses are mandatory; unattendance need to be justified to the Coordinator.

Type A1, B and C courses are offered yearly or every other year, anyway allowing students to attend them in their three-years study plan. Type A2 courses are offered yearly.

Individual study plans not adhering to the above rules need to be motivated and approved by the ITEE Board.

The list of courses of all above types follows.

List of courses of the ITEE PhD program

Course title	Course type	Credits	Semester	Final assessment	SSD	Sharing with other PhD or MSc programs
Intelligenza Artificiale ed Etica	A1	1.6	I	No	INF/01	
5G in Telemedicine and E-Health	A1	3	I	Yes	ING-INF/02	PhD in ICT for Health
Relativity and Electromagnetism	A1	6	I	Yes	ING-INF/02	PhD in ICT for Health
Quantum Computation	A1	6	I	Yes	ING-INF/03	PhD in Quantum Technologies
From observability to privacy and security in discrete event systems	A1	4	I	Yes	ING-INF/04	
Safety Critical Systems for Railway Traffic Management	A1	3.3	I	Yes	ING-INF/05	
Software robustness and security testing	A1	4	I	Yes	ING-INF/05	
Design and Implementation of Augmented Reality Software Systems	A1	4	II	Yes	ING-INF/05	PhD in ICT for Health
Distributed photovoltaic systems	A1	4	II	Yes	ING-INF/01	
Electronic Scan Antennas for Radar Signal Processing Applications	A1	2	II	Yes	ING-INF/03	
Statistical Data Analysis for Science and Engineering Research	A1	3	II	Yes	ING-INF/05	
Virtualization technologies and their applications	A1	4	II	Yes	ING-INF/05	
Mathematics of the Finite Element Method	A1	5	II	Yes	MAT/08	PhD in Mathematics
Social, ethical, and psychological issues in artificial intelligence	A2	6	I	Yes	INF/01	Informatica
Machine Learning - Statistical learning	A2	6	I	Yes	INF/01	Informatica
Human Robot Interaction	A2	6	I	Yes	INF/01	Informatica
Modelli numerici per i campi	A2	9	I	Yes	ING-IND/31	Ing. Elettrica/Elettronica/ Automazione e Robotica
Introduction to Quantum Circuits	A2	9	I	Yes	ING-IND/31	Ing. Elettronica
Nanotechnologies for Electrical Engineering	A2	6	I	Yes	ING-IND/31	Ing. Elettrica
Reti Elettriche Intelligenti - Generatori, convertitori e dispositivi di accumulo	A2	6	I	Yes	ING-IND/32-33	Ing. Elettrica
Reti Elettriche Intelligenti - Integrazione delle risorse distribuite nella rete	A2	6	I	Yes	ING-IND/32-33	Ing. Elettrica
Data Analytics	A2	6	I	Yes	ING-INF/03	Informatica
Quantum Information	A2	6	I	Yes	ING-INF/03	Ing. Telecom. e Media Digitali

Course title	Course type	Credits	Semester	Final assessment	SSD	Sharing with other PhD or MSc programs
Radiolocalizzazione e Navigazione Satellitare	A2	6	I	Yes	ING-INF/03	Ing. Telecom. e Media Digitali
Sistemi radar	A2	9	I	Yes	ING-INF/03	Ing. Telecom. e Media Digitali
Teoria dell'Informazione	A2	6	I	Yes	ING-INF/03	Ing. Telecom. e Media Digitali
Data Management and Computer Networks	A2	6	I	Yes	ING-INF/05	Data Science
Hardware and Software Architectures for Big Data – Mod. A	A2	6	I	Yes	ING-INF/05	Data Science
Sistemi Distribuiti	A2	6	I	Yes	ING-INF/05	Ing. Informatica
Machine Learning e Big Data per la Salute	A2	9	I - II	Yes	ING-INF/05	Ing. Biomedica
Machine Learning - Neural networks and deep learning	A2	6	II	Yes	INF/01	Informatica
Biometric systems	A2	6	II	Yes	INF/01	Informatica
Electrodynamics of Continuous Media	A2	9	II	Yes	ING-IND/31	Ing. Matematica
Introduzione al Ferromagnetismo	A2	3	II	Yes	ING-IND/31	Ing. Elettrica
Misure a Microonde ed Onde Millimetriche	A2	9	II	Yes	ING-INF/02	Ing. Elettronica
Tomografia	A2	9	II	Yes	ING-INF/02	Ing. Telecom. e Media Digitali
Elaborazione Numerica dei Segnali	A2	6	II	Yes	ING-INF/03	Ing. Telecom. e Media Digitali
Tecniche di elaborazione dei segnali per la bioingegneria	A2	9	II	Yes	ING-INF/03	Ing. Biomedica
Visione per Sistemi Robotici	A2	9	II	Yes	ING-INF/03	Ing. Biomedica
Identificazione e Controllo Ottimo	A2	6	II	Yes	ING-INF/04	Ing. Gestionale
Robotics Lab	A2	6	II	Yes	ING-INF/04	Ing. Automazione e Robotica
Robot Interaction Control	A2	6	II	Yes	ING-INF/04	Ing. Automazione e Robotica
Field and Service Robotics	A2	6	II	Yes	ING-INF/04	Ing. Automazione e Robotica
Analisi e Prestazioni di Internet	A2	6	II	Yes	ING-INF/05	Ing. Informatica
Big Data Analytics and Business Intelligence	A2	6	II	Yes	ING-INF/05	Ing. Informatica
Cloud and datacenter networking	A2	3	II	Yes	ING-INF/05	Ing. Informatica
Data Management and Computer Networks - Modulo B	A2	6	II	Yes	ING-INF/05	Data Science
Hardware and Software Architectures for Big Data – Mod. B	A2	6	II	Yes	ING-INF/05	Data Science
Intelligenza artificiale	A2	6	II	Yes	ING-INF/05	Ing. Informatica
Metodi formali	A2	3	II	Yes	ING-INF/05	Ing. Informatica
Protocolli per Reti Mobili	A2	6	II	Yes	ING-INF/05	Ing. Informatica
Secure Systems Design	A2	6	II	Yes	ING-INF/05	Ing. Informatica
Software security per sistemi industriali	A2	3	II	Yes	ING-INF/05	Ing. Informatica
Biomedical Imaging and Computer Interface for Biological	A2	12	II	Yes	ING-INF/06	Bioingegneria Industriale

Course title	Course type	Credits	Semester	Final assessment	SSD	Sharing with other PhD or MSc programs
Systems						
Strumentazione e Ingegneria Clinica	A2	9	II	Yes	ING-INF/06	Ing. Biomedica
Incertezza dei dati	A2	6	II	Yes	ING-INF/07	Data Science
Instrumentation and Measurements for Smart Industry	A2	6	II	Yes	ING-INF/07	Ing. Telecom. e Media Digitali
Misure su sistemi wireless	A2	9	II	Yes	ING-INF/07	Ing. Elettronica
Ottimizzazione Combinatoria	A2	6	II	Yes	MAT/09	Matematica
Statistical Learning and Data Mining	A2	6	II	Yes	SECS-S/01	Ing. Automazione e Robotica
Machine Learning	B	4	II	Yes	INF/01 – ING-INF/05	PhD in ICT for Health
Strategic Orientation for STEM Research & Writing	B	3.6	II	Yes	-	PhD in ICT for Health
Scientific Programming and Visualization with Python	B	2	I	Yes	ING-INF/05	PhD in Structural Eng.
Matlab Fundamentals	B	2	I or II	Yes (+certification)	-	Polytechnic and Fundamental Sciences School
Scientific writing	B	2	II	Yes	-	-
English language	B	variable	variable	Yes	-	University Linguistic Center (CLA)
Management R&S	C	3	II	No	-	Dept of Veterinary Medicine
Innovation management, entrepreneurship and intellectual property	C	5	II	Yes	-	StartCup Campania

Course types:

A1) *Ad hoc* PhD courses (advanced/interdisciplinary)

A2) Courses shared with MSc curricula (advanced/interdisciplinary)

B) English language, scientific writing, advanced computer skills courses

C) *Ad hoc* PhD courses on research enhancement, entrepreneurship and intellectual property

List of scientific disciplines of the ITEE Phd program

The ITEE PhD program has its roots in the disciplines mainly characterizing the educational and research activities in the DIETI Department: Computer Science, Automation and Robotics Engineering, Biomedical Engineering, Computer Engineering, Electrical Engineering, Electronic Engineering, and Telecommunication Engineering.

The ITEE PhD program is accredited by the Italian Ministry of University and Research (MUR), based upon evaluation by the National Agency for Evaluation of the University and Research system (ANVUR). The program is accredited since the XXXII cycle. Accreditation for the XXXVI cycle is subject to the verification of the requirements by MUR/ANVUR.

The complete list of the scientific disciplines - according to the national classification of academic disciplines - characterizing the ITEE PhD program is reported below. The 12 disciplines are coherent with the educational objectives of the ITEE PhD program, as per accreditation by MUR/ANVUR. Courses in the ITEE study plan belong to the disciplines in the list. All 12 disciplines are represented in the ITEE PhD Board.

Tutorship or supplementary teaching activities - optionally assigned to ITEE students under authorization of the ITEE Board and with the consent of the student according to Article 17 of the University Doctoral Regulation - need to refer to one of the scientific disciplines in the list below.

Discipline	Code
Electronic engineering	ING-INF/01
Electromagnetic fields	ING-INF/02
Telecommunications engineering	ING-INF/03
Systems and control engineering	ING-INF/04
Computer engineering	ING-INF/05
Biomedical engineering	ING-INF/06
Electrical and electronic measurements	ING-INF/07
Electrical engineering	ING-IND/31
Power electronic converters, electrical machines and drives	ING-IND/32
Electrical energy systems	ING-IND/33
Computer science	INF/01
Operational research	MAT/09

ITEE PhD Coordinators

Prof. Stefano RUSSO (since 35th cycle)

Professor of Computer Engineering

Prof. Daniele RICCIO (up to 34th cycle)

Professor of Electromagnetic Fields

ITEE PhD Board
(since XXXV cycle)

RUSSO STEFANO (Coordinator)	Professor of Computer Engineering
ALBANESE RAFFAELE	Professor of Electrical Engineering
AMBROSINO ROBERTO	Professor of Systems and Control Engineering
ANDREOTTI AMEDEO	Professor of Electrical Energy Systems
ANGRISANI LEOPOLDO	Professor of Electrical and Electronic Measurements
BOCCIA MAURIZIO	Professor of Operational Research
CESARELLI MARIO	Professor of Electronic and Informatic Bioengineering
CILARDO ALESSANDRO	Professor of Computer Engineering
COTRONEO DOMENICO	Professor of Computer Engineering
DE MAIO ANTONIO	Professor of Telecommunications Engineering
DI MARTINO SERGIO	Professor of Computer Science
GAROFALO FRANCESCO	Professor of Systems and Control Engineering
IANNUZZI DIEGO	Professor of Power Electronic Converters, Electrical Machines and Drives
IODICE ANTONIO	Professor of Electromagnetic Fields
PERON ADRIANO	Professor of Computer Science
PESCAPE' ANTONIO	Professor of Computer Engineering
POGGI GIOVANNI	Professor of Telecommunications Engineering
ROMANO SIMON PIETRO	Professor of Computer Engineering
RUBINACCI GUGLIELMO	Professor of Electrical Engineering
SANTINI STEFANIA	Professor of Systems and Control Engineering
STROLLO ANTONIO	Professor of Electronic Engineering