PhD ICTE - Teaching schedule 2024

	Teacher(s)	Course name	SSD	Location	Hours	Month
1	**Maurizio Migliaccio, Stefano Perna, Ferdinando Nunziata, Andrea Buono**	**Synthetic Aperture Radar: an electromagnetic perspective**	ING-INF/02	DING	32	January / February
	Description	Nowadays, synthetic aperture radar (SAR) represents a key tool to provide effective and continuous monitoring of the Earth's surface. The full understanding of SAR measurements relies on a physical analysis of the interaction between the microwaves and the observed scene on one side, and of the acquisition mechanism peculiar of this type of radar on the other side. In these lectures, the main mechanism ruling the interaction between the microwaves and the observed scene, namely the scattering, is reviewed from its theoretical foundations up to the approximate solutions developed to deal with operational cases. The theoretical aspects will be accompanied by numerical simulations contrasted with actual SAR measurements. Moreover, main SAR acquisition modes are reviewed. In particular, starting from the standard Stripmap imaging mode, more advanced acquisition modes capable of pursuing wide spatial coverage and/or fine spatial resolution will be presented, by highlighting the role of radar antenna design for the achievement of such observation capabilities. Furthermore, particular emphasis will be given to the polarimetric mode, which is an innovative and important option in several operating SAR missions. To be fully exploited, it must be understood since its physical meaning. Hence, wave and radar (scattering) polarimetry representations will be illustrated with great care of their electromagnetic differences. It will be showed how the polarimetric scattering can be effectively exploited to support quantitative SAR remote sensing. Finally, actual SAR imagery will be considered together with scattering-based processing to develop advanced products related to selected marine applications. Depending on the specific application, the selection of the most appropriate SAR imaging mode - including spatial resolution, swath width and polarimetric architecture - that best fits user needs and technological constraints will be discussed.				
2	**Donatella Darsena**	**Advanced Topics and Applications in Signal Processing**	ING-INF/03	DING	16	January / February
	Description	This course aims to cover some topics on interdisciplinary concepts that are fundamental for advanced technologies in the areas of signal processing and communications. One- and/or two-dimensional signals, in original and transformed domains, will be considered.				
3	**Gaetano Tartaglione**	**Artificial intelligence for control engineering**	ING-INF/04	DING	16	February
	Description	The course deals with the design of a control system by using artificial intelligence algorithms. Starting from an overview of basic model-based controllers (P, PI and PID controllers), some data-driven control techniques are introduced. For many physical applications, obtaining an exact model of the system dynamics is prohibitive. Control synthesis using an approximate model can lead to poor or undesirable control response due to the modeling error. Data-driven algorithms seek strategies to mitigate performance loss and to ensure stable, closed-loop performance in the face of uncertainty.				
4	**Nazila Fough, Robert Gordon University, Aberdeen, Scotland.**	**Hybrid Underwater Wireless Communication**	ING-INF/02	Remotely	8	April / May
	Description	Oil and gas industry has the need in real-time assets exploration monitoring. This has an impact also on safety procedures. As matter of fact, underwater wireless sensor networks (UWSN) to achieve real-time asset monitoring, is fundamental. Current acoustic communication technology is limited to transmitting small quantities of data but multi-mode alternatives (hybrid acoustic and optical communication) can be exploited. The real world solution depends on the physical scenario. All these matters will be covered exploiting a simulation procedure.				
5	**Stefania Campopiano e Agostino Iadicicco**	**Photonics: optical sources and receivers, optical fibers and optical fiber sensors**	ING-INF/01	DING	16	June / July
	Description	Photonics is the technology of generating, controlling, and detecting photons, which are particles of light. Photonics is everywhere around us: from communications and health, to lighting and photovoltaics and to everyday products like IoT sensors and mobile phones. The impact of advanced light technology on our society is still evolving, with the invention and first demonstration of the laser being roughly 60 years ago and with the development of the optical fibers that have revolutionized the telecommunications. New advances in these fields are expected in the next years that will enable the enhancement of the quality of life by creating jobs, safeguarding health, safety, and security, and much more. Future opportunities abound for photonics-enabled advances in many fields, especially in sensing field where the need for new sensors is still multiplying. Participants will gain insight in such technologies. On completion of this course, students should be able to: define and explain the propagation of light in optical fiber; define and explain the physics governing light sources and receivers; classify optical fiber sensor accordingly to operating principles.				
6	**Luigi Romano e Roberto Nardone**	**Confidential Computing in the Cloud**	ING-INF/05	DING	16	June / July
	Description	The course provides an overview of the business models and of the enabling technologies of cloud computing. Then, it explores the issues of confidentiality in the cloud, with emphasis on protection against attacks by high privilege software (notably: the Operating System or the Hypervisor) and users (notably: the System Administrator and the Cloud Provider). Topics include: Cloud delivery models; Virtualization technologies; Trusted Execution Environment technologies; Current commercial offerings for Confidential Computing in the cloud. The theoretical treatment of the aforementioned topics will be interleaved with hands-on experience sessions, where testbeds will be set-up for the execution of functional trials and experimental campaigns.				
7	**Fabio Baselice**	**Advanced techniques for image denoising: biomedical applications**	ING-INF/06	DING	16	June / July
	Description	The course presents the most adopted approaches for image denoising. More in detail, the acquisition model and the assumptions on noise statistical distribution in several scenarios are first discussed. Several denoising filters are implemented, from the simple moving average to the non-local approaches. Applications to biomedical imaging are specifically considered. Contents: Acquisition models; Noise typologies, and their characteristics; Image quality metrics; Moving average filter; Geometric filter; Statistical filters; Adaptive filters; Wiener filter; Bayesian filters; Non local approach based filters; Case studies: MR images, US images.				
8	**Massimiliano de Magistris**	**Numerical models for circuits and EM fields**	ING-IND/31	DING	16	June / July
	Description	The course introduces the basic concepts of numerical analysis for circuits and EM fields. Numerical solution of linear and non linear algebraic systems, Ordinary Differential Equations and are introduced, along with the Finite Differences and Finite Elements discretization schemes for Partial Differential Equations. Main Topics: Basic problems in numerical analysis of circuits; Formulations and algorithms for the numerical solutions of linear, non-linear and dynamic circuits; Classification and evaluation of the numerical errors, stability and convergence of algorithms; PDE space-discretization through FD and FEM.				

9	**Alessandra Budillon**	**Statistical Signal Processing**	ING-INF/03	DING	16	September / October
	Description	This course aims to cover some topics about the two basic approaches to statistical signal processing: estimation and detection. Estimation theory shows how to find the best possible optimal approach for extracting information about a signal, such as the signal's waveform or some signal aspects. The intent of detection theory is to provide rational techniques for determining which of several models—of data generation and measurement is most "consistent" with a given set of data.				
10	**Salvatore D'Antonio e Luigi Coppolino**	**Industrial Control System Security**	ING-INF/05	DING	16	September / October
	Description	The Course presents the architecture and the main components of an ICS (Industrial Control System), common deployment strategies, and typical constraints of such environments. Main standards related to ICS security, from threat analysis (ISO 27005) to certification programs (ISA 99 / IEC 62443) are presented and the usage of MITRE ATT&CK® for ICS to setup defensive strategies is explored. Main threats affecting ICS systems, including APTs, malware, and zero-day attacks, are discussed. Common attack and defence strategies are analysed with the help of practical case studies from the real world. The setup of an incident report and response strategy is explored by introducing common tools and approaches for information sharing, threat intelligence, and incident reporting.				
11	**Yu, Xidian University, Cina**	**Artificial Intelligence in Remote Sensing**	ING-INF/03	Remotely	8	September / October
	Description	The course will offer an introduction to Artificial Intelligence for Remote Sensing image processing providing the basic principles of deep learning, a theoretical and practical introduction to Convolutional Neural Networks and on their application on remote sensing data.				