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Master courses ING 4

Common Subjects to all Specializations

To obtain 30 ECTS you must add the common subjects and the subjects of the specialization you selected.

Autumn Semester

Course code	Course Title	ECTS Crédits
Project Unit *		
INGPA-INF4000-10	Project Management	8
INGPA-PRJ4000-09	Pluridisciplinary Team Project	
LANGUAGES AND HUMAN SCIENCES UNIT		
INGPA-LFH4000-01	English	3
INGPA-LFH4000-03	Team Management	
INGPA-LFH4000-05	Budget Management	
Minor Unit		
MIN	Minor **	2
TOTAL ECTS		13

* Innovative project centered on a multidisciplinary subject. The PPE meets a dual challenge: the ability to build a genuine team project and to ensure its technical implementation.

** If you do not have a B2 level in French your minor will be *French as a foreign language* courses.

If you have a B2 level in French, you will be able to choose between 7 Minors:

- Gestion d'une organisation et management par projets
- Recherche et développement
- Marketing
- Négociation commerciale
- Entreprenariat
- Création numérique
- Projet personnel

Spring Semester

Course code	Course Title	ECTS Crédits
Project Unit *		
INGPA-PRJ4000-10-MENT	Pluridisciplinary Team Project - Grade Mentor	8
INGPA-PRJ4000-10-SOUT	Pluridisciplinary Team Project - Defence	
INGPA-PRJ4000-10-VALO	Pluridisciplinary Team Project - Valorisation	
LANGUAGES AND HUMAN SCIENCES UNIT		
INGPA-LFH4000-02	English	3
INGPA-LFH4000-08	Individual Relationship Management	
INGPA-LFH4000-11	Corporate Management	
Minor Unit		
MIN	Minor **	2
TOTAL ECTS		13

* Innovative project centered on a multidisciplinary subject. The PPE meets a dual challenge: the ability to build a genuine team project and to ensure its technical implementation.

** If you do not have a B2 level in French your minor will be the course: *French as a foreign language*.

If you have a B2 level in French, you will be able to choose between 7 Minors:

- Gestion d'une organisation et management par projets
- Recherche et développement
- Marketing
- International
- Entreprenariat
- Création numérique
- Projet personnel

Informations Systems

Managing of information is a genuine challenge for companies. It is necessary in order to adapt to a rapidly changing global market and to respond to competition. It also gives an opportunity to create value based on new technology.

The subject matter in this major teaches engineers to analyze, design, build and manage information systems to meet the strategy- needs of businesses while leveraging the latest technologies and methods. The use of data for decision making, modeling and constructing information systems, services and web architectures, security, networks, and artificial intelligence are some of the subjects being taught. The opportunities are numerous in the specialized area of information technology (software, it services, service providers and access), in publi- service and generally any industry requiring management information or a presence on world markets.

Learning Outcomes

- Ability to design and implement information systems to meet business needs using the most appropriate technologies in architecture, decision, intelligence and security.
- Ability to solve real problems of both businesses and society using information technology.
- Ability to help companies profit from new icts and to develop the business function.

Recommended:

- Basic knowledge in computer networks and operating systems
- Basic knowledge of Matlab and Python.

Head of Information Systems specialization:

Jean-Michel Busca : jeanmichel.busca@ece.fr

Autumn Semester

Course code	Course Title	ECTS Crédits
Specialization Unit		
INGPA-INF4000-21	Web Technologies	3.5
INGPA-INF4000-13	Advanced Databases	3.5
INGPA-INF4000-16	Operating Systems	3.5
INGPA-NET4000-11	Computer Networks 1	2
INGPA-NET4000-39	Infrastructure IT	1.5
INGPA-INF4000-25	DevOps with SRE	3
TOTAL ECTS		17

Spring Semester

Course code	Course Title	ECTS Crédits
Specialization Unit		
INGPA-INF4000-36	Machine Learning 1	3.5
INGPA-INF4000-32	Information Systems Security I	3.5
INGPA-NET4000-12	Computer Networks Security	3
INGPA-NET4000-06	Management of Information Systems	1
Option 1*		
INGPA-INF4000-12	Microsoft C#	3
INGPA-INF4000-18	Advanced Java	3
Option 2*		
INGPA-INF4000-19	Mobile Programming	3
INGPA-INF4000-38	Mathematics for Data Scientist	3
TOTAL ECTS		17

* You have to choose between one of the two subjects for each option. For each class in the options, you will have 3 ECTS.

Embedded Systems

Little known to the general public, embedded systems, however, play a very important role in our lives. Just take a look around to understand their importance: cellphones, pass navigo (transportation), credit cards, cars, tgv, airplanes, alarms, air conditioning, gps, and multimedia consoles.

An embedded system can be defined as a computer (software and hardware) embedded in a constrained environment (low power consumption, reduced memory capacity, real-time, security, and robust). Its ability to communicate also allows it to exchange acquisition and control information at a distance. In a highly competitive global context, embedded systems are a key differentiator for a large number of sectors: energy, transportation, defense, aerospace, healthcare, media, telecoms, smart cards, production, logistics, and consumer electronics. At the heart of social issues, embedded systems contribute fully to stimulating innovation in the areas of intelligent transportation, personal assistance, sustainable mobility, homecare, and the controlling consumption.

What we can learn from most embedded systems contributes fully to stimulating innovation in the areas of intelligent transportation, personal assistance, sustainable mobility, homecare, and the controlling consumption.

Learning Outcomes

Ability to design and implement electronic- systems in different settings (automobiles, other land transport, aviation, and mobile communication devices) using all the possibilities offered by real-time computing and telecommunications.

Head of Embedded Systems specialization:

Olivier Chesnais: olivier.chesnais@ece.fr

Autumn Semester

Course code	Course Title	ECTS Crédits
Specialization Unit		
INGPA-PRJ4000-02	Technical Project	3
INGPA-INF4000-02	Advanced programming in C	3
INGPA-ELE4000-06	Microcontrollers	3
INGPA-ELE4000-11	Digital Signal Processors	3
INGPA-INF4000-08	Embedded Linux	3
INGPA-INF4000-35	Analysis and design with SCADE	2
TOTAL ECTS		17

Spring Semester

Course code	Course Title	ECTS Crédits
Specialization Unit		
INGPA-INF4000-26	Drivers Linux	2
INGPA-INF4000-11	Real Time	3
INGPA-ELE4000-12	Digital circuit design FPGA-VHDL	3
INGPA-ELE4000-03	Sensors & Interface	3
INGPA-NET4000-03	Industrial local networks	3
INGPA-NET4000-04	Computer networks	3
TOTAL ECTS		17

New Energies and Environment

It covers all of the high-tech professions involved in energy production and distribution, as well as consumption management.

It builds on a body of knowledge indispensable for any energy engineer ranging from thermodynamics to material science, from fossil fuel to renewable energy, and from nuclear generation to Smart Grid technologies. It also covers embedded energy sources such as batteries and fuel, which is the key to miniaturization, mobility and the transportation of the future. Considerable attention is devoted to buildings, which represent 40% of total energy consumption. Thermal materials are studied to understand the technologies of insulation, photonics, and solar panels to control the production of photovoltaic energy. Science and high-tech come together to design buildings with low energy consumption, create housing for the future and steer its main energy functions.

Beyond energy production, this major explores the professions directly related to the protection of the environment and sustainable development:

- ☒ The control and management of energy infrastructures, in order to optimize the use of fossil fuels and renewable energy sources.
- ☒ Smart metering using sensor networks, real-time information systems and the telecommunications that are associated with them.
- ☒ Energy automation functions of private homes and corporations, based on the knowledge of materials and the operation of solar panels.
- ☒ Expertise in fuels and batteries is fundamental to mass production of energy efficient hybrid vehicles and mainstreaming embedded systems.

Learning Outcomes

Ability to design and implement renewable energy production systems, intelligent systems that control energy infrastructure, consumption management and energy storage using all high-tech possibilities of control, sensor networks and information systems

Head of Energy and Environment specialization:

Dr. Philippe Haik: philippe.haik@ece.fr

Autumn Semester

Course code	Course Title	ECTS Crédits
Specialization Unit		
INGPA-ENE4000-02	Applied Chemistry	2
INGPA-ENE4000-03	Physics for Energy 1	2
INGPA-ENE4000-16	Energy Practical Work (UPMC) 1	1
INGPA-ENE4000-06	Fossil Fuel : Combustion	2
INGPA-PRJ4000-11	Introduction to Embedded Systems (Project)	2
INGPA-ENE4000-05	Energy Markets	2
INGPA-ENE4000-11	Ergonomics & User Experience	1.5
INGPA-ENE4000-07	Renewable Energy 1	3
INGPA-ENE4000-14	Oil & Gas Industry	1.5
TOTAL ECTS		17

Spring Semester

Course code	Course Title	ECTS Crédits
Specialization Unit		
INGPA-ENE4000-09	Electrotechnics & Power Electronics	1.5
INGPA-ENE4000-23	Physics for Energy 2	1
INGPA-INF4000-04	Web Project for Energy	1.5
INGPA-ENE4000-24	Energy Practical Work (UPMC) 2	0.5
INGPA-ENE4000-08	Renewable Energy 2	2
INGPA-ENE4000-13	Nuclear Energy	1.5
INGPA-ENE4000-18	Introduction to Energy Conversion & Storage	1.5
INGPA-MAT4000-01	Blockchain for Energy	2
INGPA-ENE4000-21	Introduction to Niagara	2
INGPA-ENE4000-22	Sustainable Development	2
INGPA-ENE4000-01	Smart grid, Smart city, Smart everywhere : besoins et enjeux	1.5
TOTAL ECTS		17

Internet of Things Networks and Services

While access to broadband internet (fixed or mobile) has become widespread and the cost of connection falls due to competition, the economic focus of the telecommunication industry has shifted in favor of manufacturers of connected devices and service providers. In the past few years, the usages of connected objects have increased and offer the promise of changing daily consumer behavior.

The internet of things accompanies traditional economy into its transition to digital form. We witness today examples in many fields such as wearables, connected cars, smart homes, smart city and digital payments. Mountains of data accumulated by all these connected objects create value. For some, it is “the oil of the 21st century”. Relating the usage of an object situated in a remote cloud to an economic model, the object then becomes a service.

To develop these services, it is necessary to have an overall vision. The first step is to think like the designer and reflect upon the user experience. The last step will be to understand the market and analyze the value chain of the connected services. What is in between these steps is obtaining the technical engineering skills, which is the goal of this specialization.

Within this specialization, you will progressively acquire the technological skills relating to internet and radio networks. The first semester focuses on the connected objects and quick prototyping. The second semester puts emphasis on web and mobile applications. The third semester specifically addresses on services architecture and construction of platforms. It includes two-week long seminars built as “dev camps” where students will practice their 360° vision of a service design.

Learning Outcomes

Ability to design an end to end connected service incorporating the user experience and economic relevance.

Ability to propose a connected object prototype, to develop a mobile and web application, to define network architecture, to deploy and operate a service platform.

Head of Internet of Things, Networks and services specialization:

Dr. Jaques Rossard: jacques.rossard@ece.fr

Autumn Semester

Course code	Course Title	ECTS Crédits
Specialization Unit		
INGPA-NET4000-01	IP networks	3
INGPA-INF4000-07	Information systems urbanization	1
INGPA-DES4000-01	UX Design	3
INGPA-INF4000-01	Web Technologies	3
INGPA-ELE4000-09	Bootcamp	1
INGPA-ELE4000-05	IoT	3
INGPA-INF4000-05	Human-focused Design	3
TOTAL ECTS		17

Spring Semester

Course code	Course Title	ECTS Crédits
Specialization Unit		
INGPA-NET4000-02	Mobile and radio networks	2
INGPA-NET4000-06	IoT networks	2
INGPA-INF4000-28	Programming Mobile Applications	2
INGPA-DES4000-03	Prototyping platforms	3
INGPA-ELE4000-10	Human-Machine new interactions	2
INGPA-DES4000-08	Introduction to 3D design	2
	Quantum IoT	2
INGPA-DES4000-02	Introduction to Fablab tools	2
TOTAL ECTS		17

Health and Technologies

The goal of the health & technology major is to train engineers who will be able to work with healthcare professionals, design, implement and deploy innovative technology strategies to improve the quality of care and support for patients and thus respond to the current challenges of healthcare systems (aging populations, disparities in access to care, and improving preventive care) ; by putting the user at the heart of their approach and integrating source analysis of the environment, understanding the needs and issues of acceptability of new technologies by the patients, health care staff and caregivers. The program trains students in science, technology and medical engineering in a multidisciplinary and collaborative framework. This is made possible because the courses are taught by researchers in science and medicine, engineers, and health professionals (doctors, nurses, and occupational therapists) in the form of lectures and labs, but also using experience feedback, case studies, seminars on the latest technological advances and project work. Visits to hospitals, companies and research laboratories complete the training.

Learning Outcomes

Command of a broad technological field for the development of the healthcare system. Electronic and computer skills for the design and development of medical devices having various applications (imaging, robotics, and health ict); implementation of health information systems, and regulatory monitoring.

Head of Health and Technology specialization:

Dr. Frédéric Ravaut: frederic.ravaut@ece.fr

Autumn Semester

Course code	Course Title	ECTS Crédits
Specialization Unit		
INGPA-SAN4000-01	Cardiovascular system	1
INGPA-SAN4000-16	Respiratory and renal physiology	1
INGPA-SAN4000-09	ENT and ophthalmic system	1
INGPA-SAN4000-07	Ultrasound imaging	1.5
INGPA-PHY4000-01	Mechanical	2.5
INGPA-SAN4000-04	Ionizing radiation imaging	1.5
INGPA-SAN4000-00	Health Care Institutions in France	1.5
INGPA-SAN4000-02	Evaluation of a medical device	1.5
SAN4000-25 NE	Conduite de projet santé	0
INGPA-SAN4000-20	Cardio stimulation	1
INGPA-SAN4000-22	Monitoring of vital functions	1
INGPA-SAN4000-24	API and webservice	1
INGPA-SAN4000-03	reatment / analysis of physiological signals	2.5
TOTAL ECTS		17

Spring Semester

Course code	Course Title	ECTS Crédits
Specialization Unit		
INGPA-SAN4000-13	Immunology and Physiology of biological Tissues	1.5
INGPA-ELE4000-02	Automatic	1.5
INGPA-SAN4000-10	Medical Robotics	1.5
INGPA-SAN4000-14	Prothesis 1	1.5
INGPA-SAN4000-21	Interface Bio-artificiel	0
INGPA-SAN4000-26	Dispositifs médicaux et propriété intellectuelle	1.5
INGPA-SAN4000-23	Network and medical data connectivity	1.5
INGPA-SAN4000-08	Image Processing	2.5
INGPA-INF4000-03	Health and Web interface	2.5
INGPA-INF4000-12	Programmation Labview	0
INGPA-SAN4000-05	MRI	1.5
INGPA-SAN4000-06	Laser Imaging	1.5
TOTAL ECTS		17

Finance and Quantitative Engineering

The Quantitative Finance major focus mainly on the quantitative methods associated with the key areas of finance such as trading, actuarial science, risk hedging and financial analysis.

With advanced mathematical and computational tools, students gain mastery in the techniques involved in the valuation of assets and derivatives, modeling and forecasting risk, and assessing the costs of the means of production, and also deepening their knowledge of information systems in the field of financial services in general. They learn to create programs, calculate probabilities, and use the most advanced trading room software in order to provide solutions to the problems posed by financial institutions.

Banking regulations, international accounting issues, and the regulation of commodity markets are all courses that complement the essential concepts of macroeconomic- monetary policy and interest rates.

Thus, the most recent dynamic- analysis models are taken into account as well as the banking and institutional experiences in light of the current financial crisis. It is in this spirit of social responsibility that the study of finance linked to aspects of human activity offers solutions to such crises. Learning through research projects (VPE) is therefore essential, for example, around shadow banking and the systemic- risk of bank failure.

Learning outcomes

Ability to manage, model, innovate, design and develop tools for financial analysis under situations of gains (income) or losses (risk).

Head of Quantitative finance specialization:

Dr. Duc Pham Hi: duc.pham-hi@ece.fr

Autumn Semester

Course code	Course Title	ECTS Crédits
Specialization Unit		
INGPA-FIN4000-01	AMF Certification	3
INGPA-FIN4000-10	Introductory Monte Carlo	2
INGPA-FIN4000-17	Variational calculus	2
INGPA-FIN4000-14	Machine Learning algorithms	3
INGPA-FIN4000-05	Regulatory measures of risk	3
INGPA-INF4000-14	Practice of VBA	2
INGPA-INF4000-15	Online Corporate finance	2
TOTAL ECTS		17

Spring Semester

Course code	Course Title	ECTS Crédits
Specialization Unit		
INGPA-FIN4000-09	Cryptocurrency & regulations	2
INGPA-FIN4000-01	Blockchain practice	2
INGPA-MAT4000-04	Stochastic calculus	2
INGPA-FIN4000-13	Asset valuation & simulations	2
INGPA-FIN4000-08	Bank accounting	2
INGPA-FIN4000-11	Online bank funding	2
INGPA-FIN4000-16	Python	2
INGPA-FIN4000-12	Artificial intelligence	3
TOTAL ECTS		17