Exchange Program: Electrical and Electronic Engineering

*Course catalog proposal – **Fall** semester (September – January):*

		Expected level	Lectures*	Tutorials	Practical works	Projects	ECTS**
Electronic systems	*Basic functions of electronic systems*	Bachelor	10 h	10 h	8 h		4
	Foundations of electronic circuits	Bachelor	10 h	10 h			3
	Digital communication systems	Master	10 h	8 h	24 h		5
Electrical engineering	*Basics of Electrotechnics*	Bachelor	14 h	10 h	16 h		5
	Power electronics I	Bachelor	6 h	6 h	8 h		3
	Power electronics II	Master	12 h	10 h	12 h		4
Engineering science	*Heat exchanges*	Master	10 h	8 h	6 h		3
Mathematics and software tools	*Foundations of computer science*	Bachelor	10 h	14 h	14 h		5
	Mathematics for engineers	Bachelor	16 h	20 h			5
	Probability and statistics	Master	10 h	16 h	4 h		4
	Signal processing	Master	12 h	10 h	8 h		4
Projects* **	*Supervised project 1*	Bachelor or Master				600 h	30
	Supervised project 2	Bachelor or Master				400 h	20
Language** **	*French reading or French writing or French culture (confirmed level)*			48 h			4

* The lectures are basically taught in French.
** One ECTS credit equals 25 hours of work, which includes both supervised pedagogical activities and homework.
*** One project is mandatory.
**** This course is mandatory. The lessons are taught at the University Center for Teaching French to International Students (Centre Universitaire d'Enseignement du Français pour Etudiants Etrangers - C.U.E.F.E.E. - http://international.univ-tours.fr/cuefee).

Course details

Basic functions of electronic systems Lectures: 10 h Tutorials: 10 h Practical works: 8 h 4 ECTS	Prerequisites: foundations of analog and digital electronic circuits. Course objectives: - To get a better understanding of basic functions used in analog and digital electronics. - To be able to choose, calculate and size an electronic circuit. - To be able to read and understand technical datasheets of electronic devices. Course description: topics include basic functions of digital electronics, transistor commutation, operational amplifier, digital-analog converters, passive and active filtering. Course evaluation: course grade will be based on midterm exams, and final exam.
Foundations of electronic circuits Lectures: 10 h Tutorials: 10 h 3 ECTS	Prerequisites: analog and digital electronics concepts. Course objective: to define methods to calculate analog and digital electronic circuits. Course description: topics include: - Foundations of analog electronic circuits: main theorems reminder to simply electronic circuits, bias circuits for diodes and bipolar junction transistors, principles and applications of quadrupoles. - Foundations of digital electronic circuits: basic devices (CMOS cells), design of specific integrated circuits (ASIC), systems on chips, programmable circuits (CPLD, FPGA). Course evaluation: course grade will be based on quizzes and written tests.
Digital communication systems Lectures: 10 h Tutorials: 8 h Practical works: 24 h 5 ECTS	Prerequisites: foundations of electronic circuits, knowledge in signal processing (Fourier analysis, deterministic signals, stationary random processes...). Course objectives: - To define basic knowledge of digital data transmission. - To be able to implement a communication chain between several electronic systems. - To be able to evaluate the quality of a transmission chain. Course description: topics include transmission chain (transmitter, receiver, codec, transmission channel coding), types of data transmission (synchronous,

	asynchronous, full-duplex), digital modulation (QAM, FSK…), communication systems. Course evaluation: course grade will be based on quizzes and written tests.
Basics of electrotechnics Lectures: 14 h Tutorials: 10 h Practical works: 16 h 5 ECTS	Prerequisites: electricity basis. Course objective: to know the operating conditions of key elements used in electrotechnics. Course description: topics include electromagnetism and induction, transformers and their operation, and electrical machines (dc machine, asynchronous machine, synchronous machine). Course evaluation: course grade will be based on midterm exams, and final exam.
Power electronics I Lectures: 6 h Tutorials: 6 h Practical works: 8 h 3 ECTS	Prerequisites: basic understanding of electrical circuit analysis. Course objectives: - To get a better understanding of the basic concepts of static converters. - To be able to choose a power structure depending on the application requirements. Course description: topics include foundations of static converters, and the dc-dc conversion (choppers, switched mode power supplies). Course evaluation: course grade will be based on midterm exams, and final exam.
Power electronics II Lectures: 12 h Tutorials: 10 h Practical works: 12 h 4 ECTS	Prerequisites: power electronics I. Course objectives: - To develop specific know-how of static converters' operation. - To get a better understanding of the applications of inverters and power factor correctors. Course description: topics include basic structures of electrical energy transformation, dc-ac conversion (inverters, operation principles, constraints, and applications), ac-dc conversion (rectifiers, operation principles, constraints, and applications), and power factor correction. Course evaluation: course grade will be based on midterm exams, and final exam.

Heat exchanges Lectures: 10 h Tutorials: 8 h Practical works: 6 h 3 ECTS	Prerequisites: calculus and differential equations. Course objectives: - To introduce basic concepts related to the 3 main modes of heat transfer (conduction, convection, radiation). - To provide methods and tools to solve heat transfer problems in simple cases without any complex software tool. Course description: topics include key notions in heat transfer (conduction: 1D steady state problem solving; convection: convection exchange coefficient calculation in simple cases; radiation: radiative balance definition between black bodies separated by transparent media, behaviors of black bodies and real ones), methods to model the heat transfer behavior of systems (balance equations for combined transfer, selection of right boundary and initial conditions to formulate a well-posed problem), methods to optimize the energy performances of a system. Course evaluation: course grade will be based on midterm exams, quizzes, and final exam.
Foundations of computer science Lectures: 10 h Tutorials: 14 h Practical works: 14 h 5 ECTS	Prerequisites: no prerequisite is necessary. Course objective: to get a better understanding of basics of algorithmic approach in computer science. Course description: topics include basic knowledge in operating systems (graphic interfaces, networks), basic algorithmic approaches (variables, encoding, arrays, functions, and recursive functions). Course evaluation: course grade will be based on midterm exam (lab activities), and final exam.
Mathematics for engineers Lectures: 16 h Tutorials: 20 h 5 ECTS	Prerequisites: basic concepts in real analysis (especially topics related to convergence of sequences, series, and integrals). Course objectives: - Introduction to functions of a complex variable. - To be able to define and use methods to solve linear systems. - To learn more about interpolation. - To practice mathematics using a specific software tool (MATLAB). Course description: topics include complex analysis (complex functions, holomorphic functions, integration, the residue theorem and its applications).

	Course evaluation: course grade will be based on midterm exams, and final exam.
Probability and statistics Lectures: 10 h Tutorials: 12 h Practical works: 8 h 4 ECTS	Prerequisites: strong background in high school algebra. Course objective: to provide a foundation in probability theory and statistical. The aim is to solve applied problems, and prepare for more advanced courses in probability and statistics. Course description: topics include sample spaces, conditional probability and Bayes' rule, random variables, discrete and continuous probability distributions, expectation, estimation, and hypothesis testing. Course evaluation: course grade will be based on midterm exams, quizzes, homework, and final exam.
Signal processing Lectures: 12 h Tutorials: 10 h Practical works: 8 h 4 ECTS	Prerequisites: signals and systems, probability, linear algebra, and calculus. Course objectives: - To define methods and tools for signal processing. - To be able to analyze signals and images. Course description: topics include random signals, spectral analysis, digital filtering, techniques used to eliminate noise in signals, image processing. Course evaluation: course grade will be based on midterm exams, and final exam.

Supervised projects in engineering: Computer Sciences, Electronics and Energy Systems, Mechanics and System design, Urban and Territorial Planning and Environment

The project will be of interest for foreign students who want to improve their skills in a specific field of engineering. Fields are detailed at: https://polytech.univ-tours.fr/english-version-/graduate-school-of-engineering-university-of-tours-france-468583.kjsp

The project will be performed in a laboratory associated with the Graduate School of Engineering Polytech Tours under the supervision of a lecturer, assistant professor or professor of Polytech Tours. The language will be English or French. It is recommended that students interested attest a B1 level in English or in French (in some cases and exceptionally the A2 level can be OK).

Students can directly contact Professors of Polytech Tours or be recommended by a foreign colleague. They can choose a project proposed by a lecturer, assistant professor or professor of Polytech Tours or propose a topic to the professors of Polytech Tours (in co-supervision with a foreign colleague for instance). The students will be examined by a written report and an oral presentation (in english or in french). Because this course unit will be carried out within a laboratory, there will be less pressure regarding the students' level of French.

Two types of supervised projects are proposed:

* *Supervised project 1*: **30 ECTS** on a single project (supervised at least by a professor of Polytech Tours, possibly in collaboration with a colleague from the home university of the student) that validates theoretical and/or technical skills in the field of engineering;
* *Supervised project 2*: **20 ECTS** (project) completed by **10 ECTS** (disciplinary courses taught within Polytech Tours or French courses for foreign students).

Supervised project in engineering 1 Project: 600 h 30 ECTS Level First or second year of Master	**Supervised project in engineering: Urban and Territorial Planning and Environment** **Duration:** one semester (autumn [from September to the end of January] or spring [from the end of January to the end of June] semester) **Application deadline:** before July, the 1rst, for students coming for the autumn semester; before December the 1rst, for students coming for the spring semester **Content:** The project will be focused on one of the following fields: Computer Sciences, Electronics and Energy Systems, Mechanics and System design, Urban and Territorial Planning and Environment (aquatic and/or terrestrial). It must be carried out individually in a laboratory, under the supervision of a lecturer, assistant professor or professor of Polytech Tours (possibly in collaboration with another colleague). At the beginning of the project a work plan will be submitted by the student with the guidance of his/her supervisor at Polytech Tours. *Caution: Before applying for this course all students must obtain the approval of their future supervisor. Students can also directly contact international.polytech@univ-tours.fr* **Prerequisite** For First year of Master students: 110 ECTS already validated in the specific scientific/ engineering field. For Second year of Master students: 145 ECTS already validated in the specific scientific/ engineering field. **Assessment method** - The project is examined by a written report (in English or French) completed by an oral presentation for 30 ECTS.
Supervised project in engineering 2 Project: 400 h	**Supervised project in engineering: Urban and Territorial Planning and Environment** **Duration:** one semester (autumn [from September to the end of January] or spring [from the end of January to the end of June] semester) **Application deadline:** before July, the 1rst, for students coming for the autumn semester; before December the 1rst, for students coming for the spring semester

20 ECTS (i.e. 400 hours of work) + 10 ECTS (disciplinary courses taught within Polytech Tours or French courses for foreign students) Level First or second year of Master	**Content:** The project will be focused on one of the following fields: Computer Sciences, Electronics and Energy Systems, Mechanics and System design, Urban and Territorial Planning and Environment (aquatic and/or terrestrial). It must be carried out individually in a laboratory, under the supervision of a lecturer, assistant professor or professor of Polytech Tours (possibly in collaboration with another colleague). At the beginning of the project a work plan will be submitted by the student with the guidance of his/her supervisor at Polytech Tours. *Caution: Before applying for this course, all students must obtain the approval of their future supervisor. Students can also directly contact international.polytech@univ-tours.fr* **Prerequisite** For First year of Master students: 110 ECTS already validated in the specific scientific/engineering field. For Second year of Master students: 145 ECTS already validated in the specific scientific/ engineering field. **Assessment method** - The project is examined by a written report (in English or French) and an oral presentation for 20 ECTS; - Disciplinary courses taught within Polytech Tours and/ or French courses for foreign students (10 ECTS)**.**