EMECIS first year modules

The aim of the first year is to provide the students with a solid interdisciplinary background across the main areas of computer and systems engineering

This year consists of two semesters S1 (from September till the end of February) and S2 (from March till the end of June). Each semester consists of 30 ECTS credits**.** An ECTS corresponds to a total student work (homework included) of about 25 hours. Two homework hours are supposed necessary for each hour with the professor. **Thus 1 ECTS corresponds to 7-8 hours with professor.**

Each module will be validated by using each institution local grading system. The grading system conversion agreed between UNIGE - UTC/ECTS is in the following table:

UTC/ECTS Local grade	A	B	C	D	E	F/FX
UNIGE Local grade	30 lode 30-28	27-25	24-22	21-20	19-18	fail

A1.1 The first semester modules in UNIGE:

Modules	**ECTS**
Operations Research	9
System Identification	6
Software Engineering	9
Real Time Operating Systems	6

A1.2 The first semester modules in UTC:

The student will select six modules (30 ECTS) from the following:

Modules	**ECTS**
Experimental data analysis	6
Stochastic modeling foundation	3
Scientific computing tools	3
Command synthesis methodology	3
Safety operating forecast	3
Modeling of discrete event systems	6
Computer systems	6

Network systems	6
Artificial intelligence	6
Management, Business, Economics	4
foreign language	4

A1.3 Programs of the first semester modules in UNIGE

<table>
<tr><td colspan="2">CODE and COURSE NAME:
OPERATIONS RESEARCH 80155</td><td colspan="2">Prof. SANGUINETI M.</td></tr>
<tr><td>ECTS: 9</td><td colspan="2">SSD: MAT/09</td><td>Language: italian</td></tr>
<tr><td colspan="2">Year: I UNIGE</td><td colspan="2">Semester: 1</td></tr>
<tr><td>Lectures: 72</td><td>Laboratory:</td><td>Practical Work hours:</td><td>Private study: 153</td></tr>
<tr><td colspan="4">Goals of the Course
The Course introduces the students to optimization models and methods, which can be used to solve decision problems. It is organized in the main parts of problem modeling, tractability, and solving methodologies via linear programming, graph optimization, and combinatorial optimization, from theory to algorithms that can be implemented on a computer. The topics are presented illustrating their methodological, theoretical, and applicative aspects, in such a way to provide the students in Information Engineering with suitable knowledge on main models and algorithms.</td></tr>
<tr><td colspan="4">Contents:
- Introduction to Operations Research
- Linear programming: simplex algorithm, analysis of post-optimality, duality
- Graph and network optimization
- Combinatorial optimization and integer linear programming
- Basic concepts of complexity theory
- Unconstrained and constrained nonlinear programming
- Multistage optimization
- Case-studies in computer science and software engineering:
-Design of relational databases (index selection problem),
-Execution of programs: flow graph e estimation of the execution time
- Software tools for Operations Research</td></tr>
<tr><td colspan="4">Learning Outcomes
The aim of the Course consists in providing the expertise that allows one to face applicative problems by developing models and methods capable of operating in the presence of limited availability of resources. The students will be taught to:
- understand and model a decisional process (design, management, etc.) in terms of an optimization problem, by identifying the decision variables to be optimized, the constraints, and the objective to be maximized or minimized;
- contextualize the problem within the forms considered “canonical” (linear/nonlinear, discrete/continuous, deterministic/stochastic, etc.);
- realize the matching between the solving algorithm (to be chosen among the available ones or to be designed) and a suitable software tool.</td></tr>
<tr><td colspan="4">Pre-requisites: none</td></tr>
<tr><td colspan="4">Examination: Written and oral examination.</td></tr>
<tr><td colspan="4">Teachers’ contacts/consulting hours: marcello.sanguineti@unige.it By appointment</td></tr>
<tr><td colspan="4">Recommended texts: Lecture notes provided by the teachers.</td></tr>
</table>

<table>
<tr><td colspan="2">CODE and COURSE NAME: 80186 SYSTEM IDENTIFICATION</td><td colspan="3">Prof. BAGLIETTO M.
http://www.dist.unige.it/mbaglietto/mbaglietto_cv.pdf</td></tr>
<tr><td colspan="2">ECTS: 6</td><td>SSD: ING INF/04</td><td colspan="2">Language: English</td></tr>
<tr><td colspan="3">Year: I UNIGE</td><td colspan="2">Semester: 1</td></tr>
<tr><td>Lectures: 38 h</td><td>Laboratory:</td><td colspan="2">Practical Work hours: 10 h</td><td>Private study: 60 h</td></tr>
<tr><td colspan="5">Objectives: to acquire skills for
• Identification of parameters of systems with known structure based on measured input-output data
• Design of mathematical models for systems with unknown structure.
• Estimate the state of dynamic systems from input-output measurements.</td></tr>
<tr><td colspan="5">Contents:
• Different models for dynamic systems and their applications.
• Parametric and non-parametric models
• Identification techniques for linear models.
• Nonlinear models. Examples and identification methods.
• Validation procedures.
• Introduction to state estimation.
• State estimation in the presence of disturbances.
• Kalman filter and its extension to the nonlinear case.
• Techniques for parameter identification of linear systems in the presence of disturbances.</td></tr>
<tr><td colspan="5">Abilities: After completing this course the students will be able to:
o design models for dynamic systems from input/output data
o implement algorithms for state estimation</td></tr>
<tr><td colspan="5">Pre-requisites: none</td></tr>
<tr><td colspan="5">Examination: oral examination</td></tr>
<tr><td colspan="5">Teachers' contacts/consulting hours:
marco.baglietto@unige.it
Office: v. Opera Pia 13 (PAD E), 2nd floor.
Tel. 010-353-6548
Meets students by appointment</td></tr>
<tr><td colspan="5">Recommended texts:
L. Ljung, "System Identification: Theory for the User", Prentice Hall
Y. Bar-Shalom, X. R. Li, T. Kirubarajan, "Estimation with Applications to Tracking and Navigation", John Wiley & Sons
Further readings: will be given by lecturer</td></tr>
</table>

<table>
<tr><td colspan="3">CODE and COURSE NAME :
SOFTWARE ENGINEERING 80154</td><td>Prof. NARIZZANO M.</td></tr>
<tr><td colspan="2">ECTS: 9</td><td colspan="2">SSD: ING INF /05</td><td>Language: Italian</td></tr>
<tr><td colspan="3">Year: I UNIGE</td><td>Semester: 1</td></tr>
<tr><td>Lectures: 72</td><td>Laboratory:</td><td>Practical Work hours: 13</td><td colspan="2">Private study: 140</td></tr>
<tr><td colspan="5">Goals of the Course
The goal of the course is to learn a wide spectrum of software processes from initial requirements elicitation through design and development to system evolution.</td></tr>
<tr><td colspan="5">Contents: Introduction to software engineering. Software Processes models. Software Requirements methodologies. Software Modelling.
Software Verfication & Validation. Software Testing. Software Model Checking.</td></tr>
<tr><td colspan="5">Learning Outcomes : At the end of the course students should be able to analyze, model, verify and test a software system.</td></tr>
<tr><td colspan="5">Pre-requisites: The course assumes background in Computer and Systems Engineering as acquired in basic Systems Theory, Control Theory, Computer Engineering, and Programming courses.</td></tr>
<tr><td colspan="5">Examination: Written and oral examination.</td></tr>
<tr><td colspan="5">Teachers' contacts/consulting hours: massimo.narizzano@unige.it. Friday Morning From 10:00 till 12:00 or on appointment.</td></tr>
<tr><td colspan="5">Recommended texts: During the course part of the following books are used: Software Engineering – I. Sommerville - Pearson, Writing Effective Use Cases – A. Cockburn – Pearson, UML Distilled – M. Fowler – Pearson, Principles of Model Checking - Cristel Baier, Joost-Pieter Katoen – MIT Press, Foundations of Software Testing – A.P. Mathur – Pearson.</td></tr>
</table>

CODE and COURSE NAME: **80169 REAL TIME OPERATING SYSTEMS**		**Prof. A. SGORBISSA**	
ECTS: 6	**SSD: ING INF/05**	**Language: English**	
Year: I UNIGE		**Semester:** 1	
Lectures: 25h	**Laboratory: 15h**	**Guided project :**	**Private study:** 85 h

Goals of the Course: By attending the course, the student will learn how to deal with issues concerning real-time applications and real-time operative systems, real-time design and programming, device driver programming.

Contents:

Real-time operating systems

- Basic principles;
- Real-time scheduling algorithms for periodic tasks: Rate Monotonic, Earliest Deadline First, Deadline Monotonic;
- Real-time scheduling algorithms for aperiodic tasks: scheduling in background, Polling Server, Deferrable Server;
- Protocols for accessing shared resources: Priority Inheritance, Priority Ceiling.

Soft real-time systems

- Real-time programming in Posix;
- Thread, mutex and conditional variables;
- Rate Monotonic on Posix Linux;
- Periodic servers;
- Interprocess communication for real-time systems.

Linux device drivers.

- System calls
- I/O and interrupt programming
- case study: programming a driver for the parallel port.

Hard real-time systems

- QnX, VxWorks, Windows CE.
- RTAI: periodic and aperiodic tasks; communication mechanisms.

Learning Outcomes: At the end of the course the student will be able to correctly state and solve problems concerning the design of real-time applications, to program a Linux-based operating system at kernel level, and to implement real-time applications in Linux Posix and RTAI.

Pre-requisites: The student must have basic competences in programming.

Examination: The student will be required to pass a written exam, focusing both on issues presented during lectures and during exercises. In particular, the student will be asked to answer some theorical questions, focusing on the design of a real-time application, and some practical questions, focusing on the implementation of a real-time application using the tools presented during the class.

Teachers' contacts/consulting hours: antonio.sgorbissa@unige.it on appointment

Recommended texts:

1) Jane W.S. Liu, *Real-Time Systems,* Prentice Hall, 2000.
2) Giorgio C. Buttazo, *Hard Real-time Computing Systems,* Kluwer Academic publishers, 1997.
3) Documentation on http://www.qnx.com.

Further readings:

- W.A.Halang, K.M.Sacha, *Real-time Systems,* World Scientific 1992

will be provided by lecturer.

A1.4 Programs of the first semester modules in UTC

SCI03 : EXPERIMENTAL DATA ANALYSIS (T. Denoeux) – TM – 6 ECTS - Automn

This course will provide basic knowledge in probability, statistics, data analysis and signal processing, useful for the various disciplines taught in the Master program. Teaching will be based on the study of numerous concrete cases.

Detailed program:

- Basis of Probability theory
- Random sampling, estimation
- Confidence intervals, significance tests

SCI04 : STOCHASTIC MODELLING FOUNDATION (N. Limnios)

½ UE, + ½ SCIO7– CS - 3 ECTS - Automn

The objective of this course is to give the basics of probability and statistics to Master 1 students in order to obtain a common base of knowledge for information technology, biology and mechanical simulation of random systems.

SCI05 : SCIENTIFIC COMPUTING TOOLS (S.Mottelet)

TM - ½ UE, suite avec ½ SCIO6 -- 3 crédits - Automn

Skills in the use of a numerical computation software as Scilab are essential in a scientific master's curriculum. This course aims to present this tool by using it to solve pluridisciplinary problems.

SCI06 : COMMAND SYNTHESIS METHODOLOGY (P.Bonnifait) – CS – 3 ECTS - Automn

This course begins by describing the main representations of the behavior of linear dynamical systems.

It then presents the conventional structures of regulation and their tuning.

This course is limited to the continuous time approach.

SCI07 : SAFETY OPERATING FORECAST (W. Schön) - CS – 3 ECTS - Automn

The aim of this module is to provide the basis of systems dependability forecasting methods (reliability, availability, maintainability, safety and security) and the associated fundamental concepts (failure rate, MTTF)

A2.1 The second semester modules in UNIGE:

Modules	**ECTS**
Computer Security	9
Transactional systems & data warehouse	6
Methods and Tools for Industrial Automation	9
6 ECTS between	
Concurrent and distributed programming	6
Human computer interaction	6
Artificial intelligence	6

A2.2 The second semester modules in UTC:

The student will select seven modules (min. 30 ECTS) from the following:

Modules	**ECTS**
Introduction to system engineering	6
Experimental protocol, instrumentation and treatment	6
Power flow and transduction in systems	5
Graphs and combinatorial problems	6
Operating Systems	6
Object Programming	6
multi-agent systems	6
Real-time systems	6
Observation of dynamic systems and fusion	6
Management, Business, Economics	6
foreign language	4

A2.3 Programs of the second semester modules in UNIGE

<table>
<tr><td colspan="3">CODE and COURSE NAME:
80156 COMPUTER SECURITY</td><td colspan="2">Prof. ARMANDO A.
(http://www.ai-lab.it/armando/cv.pdf)</td></tr>
<tr><td colspan="2">ECTS: 9</td><td>SSD: ING INF/05</td><td colspan="2">Language: English</td></tr>
<tr><td colspan="3">Year: I UNIGE</td><td colspan="2">Semester: 2</td></tr>
<tr><td>Lectures: 72</td><td colspan="2">Laboratory:</td><td>Practical Work hours:</td><td>Private study: 153</td></tr>
<tr><td colspan="5">Goals of the Course
The course provides an introduction to the principles, methods, and fundamental applications of computer security.</td></tr>
<tr><td colspan="5">Contents:
Security requirements, security mechanisms, and attacks.
Fundamentals of cryptography: classical cryptographic techniques; symmetric ciphers (block ciphers, DES); hash functions; public key cryptography (RSA, Diffie-Hellman, PKI)
Applications: confidentiality, authentication, non-repudiation (digital signature);
Security Protocols: design and analysis of vulnerabilities (Needham Schroeder Public Key authentication protocol, Otway-Rees, Andrew Secure RPC protocol, Denning and Sacco key exchange protocol; introduction to Kerberos e IPSec)
Web security: cross-site scripting, SQL injection, cookie poisoning, buffer overflow;
Access Control: discretionary and mandatory access control; access control matrices model; role-based access control.</td></tr>
<tr><td colspan="5">Learning Outcomes : At the end of the course, students will be able to assess the security issues associated with software applications and will be able to identify the security techniques necessary to meet the security requirements.</td></tr>
<tr><td colspan="5">Pre-requisites: foundamentals on programming and computer networks</td></tr>
<tr><td colspan="5">Examination: Written and practical examination.</td></tr>
<tr><td colspan="5">Teachers' contacts/consulting hours : alessandro.armando@unige.it Tuesday, 2:00pm-5:00pm</td></tr>
<tr><td colspan="5">Recommended texts:
Teaching material (slides and exercises) are available on AulaWeb.
Charles P. Pfleeger Shari Lawrence Pfleeger. Security in Computing, 4/E. ISBN-10: 0132390779, ISBN-13: 9780132390774, Prentice Hall Editor, 2007. (Available also in Italian)
William Stallings and Lawrie Brown. Computer Security: Principles and Practice, 2/E ISBN 10: 0132775069, ISBN-13: 9780132775069, Prentice Hall Editor, 2012</td></tr>
</table>

CODE and COURSE NAME: **86794 TRANSACTIONAL SYSTEMS & DATA WAREHOUSE**			**Prof.** ANTONIO BOCCALATTE
ECTS: 6	**SSD: ING INF/05**		**Language: Italian**
Year: I UNIGE			**Semester:** 2
Lectures: 48	**Laboratory:**	**Practical Work hours:**	**Private study: 102**

Goals of the Course:
Become familiar with the key issues relating to transactional systems with particular reference to the Management and recovery of transactions. Be able to design a data warehouse architecture. Be able to use the most popular algorithms / products for data analysis

Contents:
The course will focus on architectural aspects of transactional systems, query processing, transaction management and recovery.
The second part of the course will address the issues of data warehouse project is the conceptual point of view and from the point of view of logic, will present the models Fact and Snowflake and architecture of a Data Mart.
In the third part the course will analyze and discuss techniques of data mining and knowledge discovery for the retrieval of information in large amounts of data, with particular reference to the Frequent Pattern Analysis and techniques of classification and prediction.

Learning Outcomes:
Design capabilities compared to the training objectives.

Examination:
Individual project and discussion

Teachers' contacts/consulting hours:
antonio.boccalatte@unige.it

References:
The data warehouse toolkit – Kimball and Ross – Wiley&sons DataMining: Concepts and Techniques - Jiawei Han and Micheline Kamber

CODE and COURSE NAME: **86795 - METHODS AND TOOLS FOR INDUSTRIAL AUTOMATION**			**Prof. GIGLIO D.**
ECTS: 9	**SSD: ING INF/04**		**Language: Italian**
Year: I UNIGE			**Semester:** 2
Lectures: 72	**Laboratory:**	**Practical Work hours:**	**Private study: 153**

Goals of the Course:

At the end of the course, the student will be able to suitably formalize and solve decision problems to optimize the performance of a discrete production system (also by means of the use of specific software tools).

Contents:

Decision problems for manufacturing systems (introduction to discrete production systems, models and methods for strategic and tactical planning, the aggregate planning problem, implementation with IBM Cplex, MRP and lot-sizing) – *Simulation models* (discrete-event simulation, definition and building of a simulation model, analysis of output data, simulation with Matlab/Simulink, simulation with ExtendSim) – *Scheduling theory and applications* (introduction and basic algorithms, scheduling with dynamic programming, branch&bound, scheduling and mathematical programming, implementation with IBM Cplex, periodic scheduling) – *Introduction to optimal control* (example of optimal control problems, Hamilton-Jacobi theory, Pontryagin theory, optimal control of production systems, use of Matlab/Simulink to solve control problems).

Learning Outcomes:

The course has the objective of providing some models and methods for the formalization and the solution of important decision problems for the class of discrete production systems. With reference to such a class of systems, some planning, scheduling, and control problems will be defined and dealt with; besides, a specific part of the course is dedicated to the discrete-event simulation for the analysis of the performance of a production system.

Pre-requisites:

Basic knowledge of systems theory; basic knowledge of programming.

Examination:

Written and oral assessment; small project solved by means of one of the tools used during the course.

Teachers' contacts/consulting hours:

davide.giglio@unige.it

References:

Teaching materials are provided by the Lecturer-in-charge (slides, technical notes, examples and exercises). Some reference books are listed in the introduction slides.

<table>
<tr><td colspan="3">CODICE E NOME CORSO: 80170-CONCURRENT AND DISTRIBUTED PROGRAMMING</td><td colspan="3">Prof. MIGLIARDI
http://harness.cipi.unige.it/migliardi/MAURO/m.curr.en.html</td></tr>
<tr><td colspan="2">ECTS: 6 CFU</td><td colspan="2">SSD:
ING-INF/05</td><td>Language: -</td></tr>
<tr><td colspan="3">Year: I UNIGE</td><td colspan="3">Semester: 2</td></tr>
<tr><td>Lectures: 48</td><td colspan="2">Laboratory:</td><td colspan="2">Practical Work hours:</td><td>Private study: 102</td></tr>
<tr><td colspan="6">Goals of the Course: Fundamentals of parallel, concurrent and distributed programming.
Acquire hands-on familiarity with the parallel, concurrent and distributed tools provided by J2SE 6.0.</td></tr>
<tr><td colspan="6">Contents:
Introduction to classical synchronization: semaphores, monitors, messages and mailboxes.
Concurrent programming with threads in J2SE 6.0.
Distributed and Network programming: client-server paradigm, peer-to-peer. Network programming support in J2SE 6.0.
Remote Procedure Call (RPC): classic and object oriented paradigm. Marshalling and serialization problem for primitive data and structured objects. Stub/proxy and skeleton concepts, how to use and generate them. Reflection and how to use them for dynamic, skeletonless and stubless invocation. OO RPC examples: RMI & CORBA in J2SE 6.0.</td></tr>
<tr><td colspan="6">Learning Outcomes
The capability to leverage J2SE 6.0 to design and implement a concurrent and/or distributed software architecture.</td></tr>
<tr><td colspan="6">Pre-requisites: none</td></tr>
<tr><td colspan="6">Examination: Written test and oral discussion.</td></tr>
<tr><td colspan="6">Teachers' contacts/consulting hours: mauro.migliardi@unipd.it By appointment only.</td></tr>
<tr><td colspan="6">Recommended texts: Cay S. Horstmann, Gary Cornell, Core Java, Volume I--Fundamentals, 8th Edition, Prentice Hall
Cay S. Horstmann, Gary Cornell, Core Java, Volume II--Advanced Features, 8th Edition, Prentice Hall.
Sun Microsystems, Java Tutorial, http://java.sun.com/docs/books/tutorial/index.html
D. Lea, Concurrent Programming in Java(TM): Design Principles and Pattern (2nd Edition), Addison-Wesley Pub Co.</td></tr>
</table>

COURSE TITLE AND COURSE NUMBER: HUMAN COMPUTER INTERACTION 80158		**CAMURRI A.** http://www.infomus.org/people/person.php?name=acamurri	
Credits: 6	**SSD: ING INF/05**		**Language:** English
Year: I		**Semester:** 2	
Lectures: 48h	**Practicals:** -	**Examples:**	**Private study:** 102h

Objectives:
The course faces theories and techniques for the design of interactive systems and multimodal systems.

Contents:
Main topics include the following:

1. Interactive real-time systems for audio-visual processing (incl. Exercises with the EyesWeb open software platform).
2. Devices for human-machine interaction.
3. Interaction Design; Theories and techniques for GUI design. User-centered design.
4. Sketches. Storyboarding.
5. Predictive models (GOMS, KLM, Motor theories: Fitts's Law etc.)..
6. Evaluation of GUIs based on experimental psychology methods (T test, ANOVA).
7. Design of visual and auditory displays.
8. Multimodal interaction.
9. Emotional interfaces, models of expressiveness and of communication of non-verbal content.
10. Examples of applications: therapy and rehabilitation; Clutural and artistic applications; audivisual consumer applications;

Information appliances. Invisible/Disappearing Computing. Tangible Bits. Ambient Intelligence

Abilities: After completing this course the students will be able to face the design of interactive multimedia systems and manage the interaction design process.

Exam: written exam, followed by oral exam.

Contacts: meetings with students on request, at Casa Paganini, Piazza S.Maria in Passione 34, www.casapaganini.org.

Course Materials:
- Course slides available on Aulaweb.
- The EyesWeb software platform, available at www.infomus.org
- Preece, Rogers, and Sharp, *Interaction Design,* Wiley, 2007 2nd Edition,
- Schneiderman, *Designing the User Interface,* Addison Wesley, 2010.
- J. Raskin, *The Humane Interface,* ACM Press, 2000.
- Cook, Music, Cognition and the Computerized Sound, MIT Press, 2001.

Further readings:
will be provided during the course.

Course name: 80165 - **ARTIFICIAL INTELLIGENCE**			**Prof. GIUNCHIGLIA E.**
Credits: 6	**SSD: ING-INF/05**		**Language:** English
Year: I			**Semester: 2**
Lectures: 48h	**Practicals:** -	**Examples:**	**Private study:** 102h

Objectives:
The goal of the course is to present advanced issues of artificial intelligence from the perspective of a computerized autonomous agent

Contents:
The first part covers basic methods of artificial intelligence – the logic of knowledge representation, inference rules and problem solving including: uniformed search, informed search with heuristic functions, constraint satisfaction problems and adversarial games. The second part deals with practical planning and acting of an autonomous agent (i.e., situation space, plan space, plan decomposition, hierarchic decomposition, contingency planning), and with probabilistic reasoning. The third part discusses agent design problems in the area of knowledge acquisition (learning from observations, in neural networks and reinforcement learning), and machine perception (image and speech understanding).

Abilities: After completing this course, the students will be able to: Produce and analyse the knowledge inference rules, Acquire the knowledge using: active observation, neural networks processing. Process the visual information and recognize speech using the machine perception.

Contacts: meetings with students on request: giunchiglia@unige.it

Recommended texts: S. Russell, P. Norvig, Artificial Intelligence: A Modern Approach. Prentice Hall, Upper Saddle River, N.J., 2002. Further readings: - G.F. Luger, W.A. Stubblefield, Artificial Intelligence. Structures and Strategies for Complex Problem Solving, Addison Wesley, 1997 - J-P. Delahaye, Formal Methods in Artificial Intelligence, Oxford 1987

Contact and Office hours: …

A2.4 Programs of the second semester modules in UTC

SCI08 : INTRODUCTION TO SYSTEM ENGINEERING (W. Schön) – TM – 6 ECTS – Springer

The aim of this module is to introduce the main methods uses for system engineering (main lifecycles, functional analysis methods, model driven methods, requirements engineering¿). In a second part, these methods are illustrated by case studies from different application domains.

SCI09 : DISCOVERING METHODS AND TOOLS FOR SCIENTIFIC RESEARCH (S. Bensamoun) – TSH – 4 ECTS - Springer

The purpose is to discover the work of the researcher through research projects in the domain of Health care, transport, etc
Program

SCI10 : EXPERIMENTAL PROTOCOL, INSTRUMENTATION AND TREATMENT – (S. Boudaoud) – TM – 6 ECTS - Springer

The aim of this course is the initiation of the master students to the conception of an experimental acquisition chain. In fact, this chain should contain sensors, conditioning and sampling devices allowing after signal processing of the obtained data. Several subjects as elaborating an experimental protocol, sensor technology and signal processing methods will be covered.

SCI11 : POWER FLOW AND TRANSDUCTION IN SYSTEMS (C. Prelle) – TM 6 - ECTS - Springer

This course provides knowledge of energy flows in systems. It discusses the different energy sources and their storage. The bond-graph formalism is used to describe the energy flow in systems. The different sources of energy in a system will be presented. Des examples will be taken in several areas such as embedded systems, biomechanics or sensor networks.

EMECIS second year modules

The aim of the second year is to provide the students with advanced competence on the main areas of cyber-physical systems, data analysis and distributed systems.

This year consists of two semesters: S1 (from September till the end of February) dedicated to courses and S2 (from March till the end of June) dedicated to the work related the master thesis. Each semester consists of 30 ECTS credits**.** An ECTS corresponds to a total student work (homework included) of about 25 hours. Two homework hours are supposed necessary for each hour with the professor. **Thus 1 ECTS corresponds to 7-8 hours with professor.**

Master thesis may be defended starting July till the end of the academic year.

A3.1 The third semester modules in UNIGE:

The student will select 30 ECTS from the following modules:

Modules	**ECTS**
Modeling and Verif. of Cyber-Physical Systems	6
Data Analysis and Data Mining	6
Technologies for Wireless Networks	6
Embedded Systems	6
Optimization and Control of Logistic Systems	6
Multimodal Systems	6

A3.2 The third semester modules in UTC:

Modules	**ECTS**
Advanced Data Analysis	3
Safe design of systems	3
Modeling and propagation of uncertainties	3
optimization	3
Modeling, control and observation of dynamic systems	3
Control, monitoring and observation of dynamic systems	3
Foundations of interconnection networks	3
Advanced statistical learning	3
Algorithms and protocols for interconnecting systems	3
Estimation for robotics navigation	3

Autonomous robotic systems	3
Smart Interactive Systems	3
Foreign language	4

A3.3 Programs of the third semester modules in UNIGE

<table>
<tr><td colspan="3">CODE and COURSE NAME: 80474 - MODELING AND VERIFICATION OF CYBER-PHYSICAL SYSTEMS</td><td colspan="2">Prof. Tacchella A.
http://www.dibris.unige.it/public/staff/dettagli_staff.php?id=69&view=1</td></tr>
<tr><td colspan="2">ECTS: 6 Cfu</td><td colspan="2">SSD:
ING-INF/05</td><td>Language: Inglese</td></tr>
<tr><td colspan="3">Year: II</td><td colspan="2">Semester: 1</td></tr>
<tr><td>Lectures: 48</td><td colspan="2">Laboratory:</td><td>Practical Work hours:</td><td>Private study: 102</td></tr>
<tr><td colspan="5">Goals of the Course: The goal of the course is to consolidate elements of Computer and Systems Engineering acquired by the students along their careers, and to provide a uniform approach to Cyber-Physical Systems (CPS), i.e., engineered systems that are built from and depend upon the synergy of computational and physical components. In particular, the course is meant to introduce the students to the theory of Hybrid and Probabilistic Automata, and to lead them through hands-on-experience with state-of-the-art simulation, synthesis and verification tools for CPS.</td></tr>
<tr><td colspan="5">Contents: Introduction to system verification. Modeling and verification of discrete-state systems. Modeling and verification of real-time and hybrid systems. Modeling an verification of probabilistic systems.</td></tr>
<tr><td colspan="5">Learning Outcomes : At the end of the course students should be able to model, simulate and verify distributed computational units controlling physical processes.</td></tr>
<tr><td colspan="5">Pre-requisites: The course assumes background in Computer and Systems Engineering as acquired in basic Systems Theory, Control Theory, Computer and Software Engineering, and Programming courses.</td></tr>
<tr><td colspan="5">Examination: homeworks (10%), final project (50%) and presentation (40%)</td></tr>
<tr><td colspan="5">Teachers' contacts/consulting hours : armando.tacchella@unige.it by appointment</td></tr>
<tr><td colspan="5">Recommended texts: Cristel Baier, Joost-Pieter Katoen - Principles of Model Checking – MIT Press - 2008</td></tr>
</table>

<table>
<tr><td colspan="3">CODE and COURSE NAME:
86798 - DATA ANALYSIS AND DATA MINING</td><td colspan="2">Prof.</td></tr>
<tr><td colspan="2">ECTS: 6</td><td>SSD: ING-INF/05</td><td colspan="2">Language:</td></tr>
<tr><td colspan="3">Year: II</td><td colspan="2">Semester:1</td></tr>
<tr><td>Lectures: 48</td><td colspan="2">Laboratory:</td><td>Practical Work hours:</td><td>Private study: 102</td></tr>
<tr><td colspan="5">Goals of the Course the goal of this course is to provide an introduction to the main topics in data analysis and data mining</td></tr>
<tr><td colspan="5">Contents:
Introduction to data analysis: data understanding and pattern finding, explanation finding, prediction.
Data understanding: attributes, data quality, data visualization, correlation analysis, outlier detection, missing values.
Principles of modeling: model classes, fitting criteria and score functions, error functions for classification, model fitting algorithms.
Errors: experimental errors, sample errors, model errors, algorithmic errors, bias and variance.
Model validation: holdout, cross-validation, bootstrap, model complexity.
Data preparation: dimensionality reduction, record selection, cleaning.
Finding Patterns: dissimilarity, hierarchical clustering, density-based clustering, frequent pattern mining and association rules.
Finding explanations: decision trees, Bayesian methods, Regression, Rule Learning.
Predictors: nearest neighbor, neural networks, SVMs, Kernel methods, Ensemble methods.</td></tr>
<tr><td colspan="5">Learning Outcomes: On completion of this course students should have gained a good understanding of the basic concepts, principles and techniques of data analysis and data mining.</td></tr>
<tr><td colspan="5">Pre-requisites: Working knowledge of programming and data structures</td></tr>
<tr><td colspan="5">Examination: written and oral examination</td></tr>
<tr><td colspan="5">Teachers' contacts/consulting hours : to be defined</td></tr>
<tr><td colspan="5">Recommended texts:
- Course Slides
- Berthold, M.R., Borgelt, C., Höppner, F., Klawonn, F., Guide to Intelligent Data Analysis, 2010.
- Hastie, T., Tisbshirani, R., Friedman, J., The Elements of Statistical Learning : Data Mining, Inference, and Prediction, 2009.</td></tr>
</table>

<table>
<tr><td colspan="3">CODE and COURSE NAME: 80171 TECHNOLOGIES FOR WIRELESS NETWORKS</td><td colspan="2">Prof. BOLLA</td></tr>
<tr><td colspan="2">ECTS: 6</td><td colspan="2">SSD: ING INF/03</td><td>Language: Inglese</td></tr>
<tr><td colspan="3">Year: II</td><td colspan="2">Semester: 1</td></tr>
<tr><td>Lectures: 48</td><td colspan="2">Laboratory:</td><td>Practical Work hours:</td><td>Private study: 102</td></tr>
<tr><td colspan="5">Goals of the Course: The following arguments represents the minimum knowledge required to the students for following the course in an effective way: basic concepts of data networking, circuit and packet switching, functional architectures, ISO OSI architecture, TCP/IP architecture, physical layer main characteristics (cables, optical fiber), data layer basic characteristics, Ethernet/IEEE 802.3 protocol, Layer 2 bridging/switching, IPv4 basic concepts, IP routing basics, TCP/UDP basic knowledge.</td></tr>
<tr><td colspan="5">Contents:
1 Introduction to the wireless networks
2 Architectures and protocols for packet wireless networks
2.1 WLAN: the IEEE 802.11 (WiFi) standard
2.2 Wireless access networks (IEEE802.16)
2.3 PAN: the Bluetooth (IEEE802.15) standard
3 Radio-mobile cellular networks
3.1 Introduction
3.2 Global System for Mobile communications (GSM)
3.3 GPRS/EDGE
3.4 UMTS/LTE
4 Mobility management in IP packet networks</td></tr>
<tr><td colspan="5">Learning Outcomes At the end of the course the student will have a quite complete knowledge about the wireless networks architectures, technologies and protocols including the WLAN, cellular networks, and mobile management issues.</td></tr>
<tr><td colspan="5">Pre-requisites: The following arguments represents the minimum knowledge required to the students for following the course in an effective way: basic concepts of data networking, circuit and packet switching, functional architectures, ISO OSI architecture, TCP/IP architecture, physical layer main characteristics (cables, optical fiber), data layer basic characteristics, Ethernet/IEEE 802.3 protocol, Layer 2 bridging/switching, IPv4 basic concepts, IP routing basics, TCP/UDP basic knowledge</td></tr>
<tr><td colspan="5">Examination: Oral examination</td></tr>
<tr><td colspan="5">Teachers' contacts/consulting hours : raffaele.bolla@unige.it by appointment</td></tr>
<tr><td colspan="5">Recommended texts:
1. Course Slides
2. S. Tanembaum, Computer Networks, (5th Edition), 2010.
3. W. Stallings, Wireless Communications and Networks (2nd Edition), Prentice Hall, 2004.</td></tr>
</table>

<table>
<tr><td colspan="2">COURSE NAME AND COURSE NUMBER: 80190 – EMBEDDED SYSTEMS</td><td colspan="2">Prof. Denei S.</td></tr>
<tr><td>Credits: 6</td><td colspan="2">SSD: ING-INF/04</td><td>Language: English</td></tr>
<tr><td colspan="2">Year: II</td><td colspan="2">Semester: 1</td></tr>
<tr><td>Lectures: 48</td><td>Practicals:</td><td>Tutorials / Projects:</td><td>Private study: 102</td></tr>
<tr><td colspan="4">Goals of the Course: This course presents the fundamentals of embedded systems from both the architectural point of view and the basics of programming</td></tr>
<tr><td colspan="4">Contents:
The following topics are treated:
- General overview of existing families of micro-controllers, DSPs, FPGAs, ASICs
- Basics of developing for embedded systems: coding, compiling, linking, downloading, executing.
- Different kinds of memory devices and memory organization.
- On-chip and off-chip peripherals units and basic I/O operations: ADC, DAC, PWM, Parallel port, Counters, Timers.
- Buses and communication channels.
- Interrupt-driven programming.
- Fundamentals of real-time programming for embedded systems.</td></tr>
<tr><td colspan="4">Learning Outcomes :
After completing this course the students will be able to:
- Understand why embedded systems are different.
- Identify and quantify the main requirements for a given application in terms of resources (memory, computational power, bus speed, I/O channels, …).
- Read and understand the user manuals of alternative architectures and select the right one for a given application.
- Identify the peripheral units most suitable for the application and program their functioning.
- Design event-driven projects and real-time applications for micro-controllers.
- Code, compile, link, download, debug and execute programs for micro-controllers</td></tr>
<tr><td colspan="4">Pre-requisites: basic programming in C</td></tr>
<tr><td colspan="4">Examination: 70% continuous assessment and final project, 30% from end of semester examination</td></tr>
<tr><td colspan="4">Teachers' contacts/consulting hours : simone.denei@unige.it by appointment</td></tr>
<tr><td colspan="4">Recommended texts:
- Q. Li, C. Yao, Real-Time Concepts for Embedded Systems, CMP Books, 2003.
- (ISBN:1578201241).
- D. E. Simon, An Embedded Software Primer, Addison-Wesley Professional, 1999. (ISBN: 020161569X)
- A. S. Berger, Embedded Systems Design: An Introduction to Processes, Tools and Techniques, CMP Books, 2001. (ISBN: 1578200733)</td></tr>
</table>

<table>
<tr><td colspan="2">CODE and COURSE NAME:
80268 OPTIMISATION AND CONTROL OF LOGISTIC SYSTEMS</td><td colspan="2">Prof. Sacone S.</td></tr>
<tr><td>ECTS: 6</td><td>SSD: ING-INF/04</td><td colspan="2">Language: Italian/English</td></tr>
<tr><td colspan="2">Year: II</td><td colspan="2">Semester:1</td></tr>
<tr><td>Lectures: 48</td><td>Laboratory:</td><td>Practical Work hours:</td><td>Private study:102</td></tr>
<tr><td colspan="4">Goals of the Course
The objective of the course is to describe the main features of logistic networks and to make students able to analyze and solve the decisional problems typically encountered in the context.</td></tr>
<tr><td colspan="4">Contents:
Introduction to logistics.
Hierarchical architecture for decisions in complex systems with specific focus on logistic networks.
Strategic decisions in logistics: location problems in multimodal systems, network design problems.
Tactical decisions in logistics: inventory control problems, service network design problems.
Operational decisions in logistics: vehicle loading problems (general loading problems and specific cases with specific focus on trains and ships), vehicle routing problems, vehicle scheduling problems, crew scheduling.
On-line monitoring and control of operations in logistics.</td></tr>
<tr><td colspan="4">Learning Outcomes :
Capacity of analyzing decisional problems: ability to identify models, problems statement and solution methods.</td></tr>
<tr><td colspan="4">Pre-requisites:
basics of operations research, basics of systems theory.</td></tr>
<tr><td colspan="4">Examination: Oral examination</td></tr>
<tr><td colspan="4">Teachers' contacts/consulting hours :</td></tr>
<tr><td colspan="4">Recommended texts:
Gianpaolo Ghiani, Gilbert Laporte, Roberto Musmanno, "Introduction to Logistics Systems Planning and Control", John Wiley and Sons, New York, 2004.</td></tr>
</table>

<table>
<tr><td colspan="2">CODE and COURSE NAME:
80164 - MULTIMODAL SYSTEMS</td><td colspan="2">Prof. Volpe G.</td></tr>
<tr><td>ECTS: 6</td><td>SSD: ING-INF/05</td><td colspan="2">Language: Italian
(English if foreign students attend)</td></tr>
<tr><td colspan="2">Year: II</td><td colspan="2">Semester: 1</td></tr>
<tr><td>Lectures: 48h</td><td>Laboratory:</td><td>Practical Work hours:</td><td>Private study: 102h</td></tr>
<tr><td colspan="4">Goals of the Course
This course aims at providing a foundational knowledge on multimodal interactive systems, by means of theoretical and practical lectures. The main goal is to make students able to design and develop complex multimodal interactive systems for the creative and cultural industry field, which includes several application scenarios, such as museum and cultural heritage, performing arts, edutainment, entertainment, therapy and rehabilitation, networked media.</td></tr>
<tr><td colspan="4">Contents:
Lectures cover the following major topics:
- Introduction to multimodal systems: post-WIMP interfaces, multimodal interfaces: definitions and motivations, mixed reality environments, frameworks for multimodal interactive systems.
- Analysis and synthesis of human full-body movement and gesture: expressive gestures, motion capture systems, RGBD capture devices, basic computer vision techniques for real-time extraction and analysis of movement features, techniques for analysis and representation of gesture features, selected case studies.
- Introduction to social signal processing: motivations, social features, techniques for real-time analysis of synchronization and leadership, selected case studies including mobile applications.
- Sound and music computing: the audio signal, analog and digital recording and playback, audio files formats, techniques for extraction and analysis of audio features (temporal, spectral, and cepstral features), introduction to sound synthesis techniques.
Practical lectures, which students can attend using their laptops in the classroom, consist of hands-on enabling students to learn and use primary technologies, including multimodal analysis from mobile devices (smartphones, tablets), webcams, and possibly Kinect sensors. A visit to the Casa Paganini research center will be organized to show students the use of professional devices such as high-resolution video-cameras and motion capture systems (Qualisys). The EyesWeb platform is adopted for providing examples and developing projects.</td></tr>
<tr><td colspan="4">Learning Outcomes: foundational knowledge on multimodal interactive systems and on the technologies they are grounded on; expertise in designing and developing multimodal interactive systems in a broad range of application scenarios related with the creative and cultural industry.</td></tr>
<tr><td colspan="4">Pre-requisites: basic programming skills, foundations of human-computer interaction.</td></tr>
<tr><td colspan="4">Examination: a written test followed by a discussion with the teacher.</td></tr>
<tr><td colspan="4">Teachers' contacts/consulting hours: students can contact the teacher by email (gualtiero.volpe@unige.it) or at the end of the lectures to make an appointment.</td></tr>
<tr><td colspan="4">Recommended texts: the teacher will made the slides of the course available in AulaWeb and will suggest for each topic a selection of further readings mainly consisting of journal papers.</td></tr>
</table>

A3.4 Programs of the third semester modules in UTC

SCI20 Advanced Data Analysis

Description

The aim of this course is to learn to students the techniques for characterizing and classifying data (times series) from complex system. In fact, for diagnostic purposes, the data variability can contain relevant information that allows the construction of discriminative vectors. These vectors permit the separation of data modalities by classification. For this purpose, several methods (nonlinear, statistical, functional) for extracting information to construct discriminative vectors will be described. Standard classifying methods based on statistical learning will also learned. Applications on computer will allow to students the quantification of efficiency of discriminative vector/classifying method combination. The studied methods will be tested on real data from technological plateforms.

Program

Analysis of the signal variability and discriminative vector conception :

- Energy, amplitude.
- Spectrum
- Stationnarity, randomness
- Shape, structures, time and amplitude dynamics
- Entropy, information
- Linearity, nonlinearity

Statistical learning

- SVM , regression, perceptron
- Neural networks
- Decision trees
- Extension from the binary case to the multi classes case

Applications of discriminative vector/classifying techniques combination and efficiency evaluation

Duration

6 weeks + 1 exam (Supervised 32 hours - 16 lessons, 16 TD)

Person in charge

Sofiane Boudaoud

SCI21 Dependable system design

Description

The aim of this module is to introduce the main design techniques for dependable systems, particularly for the safety-critical systems

Program

The different methodological aspects concerning the design of dependable systems will be introduced:

- Hardware redundancy: 1ooN architectures, voters PooN
- Informational redundancy: errors detection and correction, coded processors, application to distributed systems
- Effects of uncertainty
- Robust design, reliability of structures
- Fault tolerance, fault removal
- Fail-safe and fail-operational systems

Duration

6 weeks + 1 exam (Supervised 32 hours - 16 lessons, 16 TD)

Person in charge

Walter Schön

SCI22 Modeling and propagation of uncertainties

Description

Uncertainties are present at all levels in the analysis and modeling of complex systems. In particular, one can distinguish between aleatory uncertainties, induced by the variability of studied phenomena, and epistemic uncertainties due to imperfectness of knowledge. The two classical formalisms for modeling uncertainties and propagating them in reasoning and computation mechanisms are Probability Theory and the set-membership approach (including Interval Analysis). More recently, the theory of belief functions, which extends these two approaches, has been developed. This course introduces the theoretical foundations of these three formalisms, as well as the main practical methods allowing for their application in complex system engineering.

Program

- Set-membership approach: introduction to interval analysis, constraint satisfaction problems, contractors.
- Probability theory: fundamental notions, Bayesian networks, maximum entropy principle, Monte-Carlo simulation, elements of Bayesian decision theory.
- Theory of belief functions; mathematical properties of belief functions on a finite set, main combination rules, extension and marginalization, propagation methods based on random sets, decision rules.

Duration

6 weeks + 1 exam (Supervised 32 hours - 16 lessons, 16 TD)

Person in charge

Thierry Denoeux

SCI23 Optimization

Description

This course introduces different methods and tools used for optimization problems. It relies on multidisciplinary applications reflecting the activities of labex MS2T laboratories.

Program

This course has three components:
- Combinatorial optimization: search-tree methods (successive and progressive process separations assessments - SES / SEP), introduction to complexity theory and model descriptions problems
- Evolutionary methods, metaheuristics, genetic algorithms
- Optimization in continuous variables: unconstrained problems solver, first and second order problems under constraints, optimality conditions, solution methods with/without Lagrangian approach

Duration

6 weeks + 1 exam (Supervised 32 hours - 16 lessons, 16 TD)

Person in charge

Pierre Villon

SCI31 Modeling, control and observation of dynamical systems

Description

After having introduced the basic concepts of dynamic systems modeling, this course introduces the concepts of model-based control. Specific methods of control for systems of systems are then described. Finally, the course focuses on state observation methods and their use in various areas with different types of dynamical systems.

Program

- Unified representation, modeling examples.
- Analysis of the properties of systems: stability, controllability, observability, passivity.
- Linear and nonlinear control Techniques
    - State feedback
    - Global linearization
    - Optimal control
    - Robust control
- Introduction to the control for systems of systems
    - Distributed and networked control
    - Hierarchical control
    - Cooperative control
- Linear state observers
- Examples and case studies

Duration

6 weeks + 1 exam (Supervised 32 hours - 16 lessons, 16 TD)

Person in charge

Ali Charara

TIS01 Foundation of interconnection networks

Description

A System of System is composed by the relationship between entities, relying on an interconnection network. This course introduces the fundamental aspects of interconnection networks, from a structural and algorithmic point of view. No previous knowledge on communication protocol is required.

Interconnection networks, whatever is their implementation admit common characteristics and properties. The aim of this course is to give necessary information for their understanding, including modelling and algorithms, as well as recent advances.

Program

- Modeling interconnection networks: graphs and interconnection networks, particular networks, models of communication, routing, global communication
- Models for distributed computing: process and communication, synchronisation, causality, snapshot
- Protocols of communication: layered organization, alternated-bit and sliding window, distributed algorithms of broadcasting, waves and routing
- Fault-tolerance in networks: consensus, agreement, failure detectors, self-stabilization
- Specificities of dynamic networks: modeling, properties, protocols
- Resource sharing in networks: resource management, election, mutual exclusion, dinning philosophers, congestion in networks, fairness, introduction to mathematical tools.

Duration

6 weeks + 1 exam (Supervised 32 hours - 16 lessons, 16 TD)

Person in charge

Bertrand Ducourthial

TIS02 Advances in Statistical Machine Learning

Description

Large datasets are available today on the Web, for instance from user-generated content (collaborative content creation as on Wikipedia, sharing information as on Flickr, Facebook or Twitter) or navigation logs collected by Websites. The domain of statistical machine learning provides tools to exploit large datasets to build explanatory or predictive models. The recent advances in this field, which can deal with large-scale, heterogeneous and complex data are nowadays important tools in many application domains such as image processing, information retrieval or natural language processing. In this lecture, we will present the fundamental techniques of statistical machine learning, the recent approaches to deal with large amounts of complex data, as well as some practical applications.

Program

- Elements of statistical learning theory
- Sequential models: conditional random fields, hidden Markov models
- Kernel methods for structured data
- Advances in neural networks: "deep learning", convolutional networks, …
- Large-scale learning

Duration

6 weeks + 1 exam (Supervised 32 hours - 16 lessons, 16 TD)

Person in charge

Nicolas Usunier

TIS04 Estimation for robotic navigation

Description

This course presents real-time estimation methods for autonomous navigation of mobile robots and intelligent vehicles. The canonical problems (localization, simultaneous localization and mapping, detection and tracking of moving objects) are covered with feature approaches and occupancy grids.
Finally, the course addresses issues of collaborative estimation for robotic systems interacting with each other when wireless communication means allow them to communicate.
The course leads to a practical study on real experimental data.

Program

- Description and formalization of canonical problems by feature or occupancy grids
- Multisensor Data Fusion and performance indicators: precision, accuracy, confidence, integrity, availability
- Optimal Linear Estimation, Dynamic State Observer by Kalman filter (KF), Extensions of KF to nonlinear systems and introduction to Particle Filtering
- Data Association, Multi-Hypothesis Tracking, Outliers rejection
- Set-membership State Observer, Set Inversion via Interval Analysis, Constraint Propagation, Set-robust inversion, a priori injection
- Cooperative Estimation by exchange of states or observations

Duration

6 weeks + 1 exam (Supervised 32 hours - 16 lessons, 16 TD)

Person in charge

Philippe Bonnifait

TIS05 Control of autonomous robots in cooperation

Description

This course focuses on the modeling and control of autonomous robotic systems in real time from the perspective of non-linear control theory. It deals specifically with terrestrial and aerial mobile robots and their configuration in swarms to illustrate the concepts of systems of systems control.

Program

- Kinematic and dynamic models
- Stabilization and control:
    - global, input-output, feedback linearization
    - backstepping
    - bounded control using saturations (nested, separated)
- Reactive navigation (optical flow, obstacle avoidance, tentacles)
- Hierarchical and decentralized approaches for swarms of robots (cooperative control network)

Duration

6 weeks + 1 exam (Supervised 32 hours - 16 lessons, 16 TD)

Person in charge

Isabelle Fantoni

TIS06 Intelligent Interactive Systems

Description

Interaction is central for the design of systems of systems. Three main types of interaction can be considered:

- Interaction between users and systems
- Interaction between autonomous systems (agents) interconnected on a network
- Integration of these aspects for interactive agents, search agents, personal assistants...

The goal of the course is to study these different types of interaction and the associated models, rules, standards and protocols, as well as the specific knowledge of the agents (in particular about the other agents - human beings or artificial - and their behavior). These models must allow the design, specification, validation and control of interactive systems particularly when they are based on cooperative and communicating agents.

Program

Human(s)-system(s) interaction

- Task models, interaction models, user models
- Adaptive systems
- Tactile, vocal, gestural interactions – Multimodality
- Mobile applications development

Interaction between systems

- State Machines
- UML Diagrams of interaction

Context sensitive systems

- Context servers
- Adaptation, learning, co-evolution

Multi Agents Systems

- Agents Models
- Interaction and communication between agents
- Standards and protocols (FIPA)
- Methods of development
- Multi-agents platforms

Duration

6 weeks + 1 week exam (32 h - 16 h lessons, 16h practical work)

Person in charge

Dominique Lenne

TIS07 Algorithms and protocols for the interconnection of systems

Description

This course presents algorithms, protocols, and communication technologies that are used in the design of systems of systems. It focuses on advanced topics in data communication in wired and wireless infrastructure (ad'hoc and wireless sensor networks) with the support of mobility, security, dynamism, real-time, and quality of service issues. All these concepts are fundamental in the design of several applications of systems of systems including Vehicular networks, Unmaned Area Vehicules (UAVs), Body-Area Networks, Smart Grids, Smart Cities, etc. where group communication constitutes a important building bloc of such systems.

Program

- Design of IP networks architectures and wireless communication
    - Fundamentals of Internet architectures
    - Wireless communication Technologies sans fil : 802.11p, Zigbee
    - Advanced IP architectures: Mobile IP, IPv6, Nemo.

- Ad'hoc and Dynamic network design
    - Ad'hoc network routing protocols
    - Algorithms and protocols for dynamic networks
    - Vehicular Ad'hoc Unmanned Area Vehicular (VANETs & UAVs)

- Wireless Sensor Network (WSN) Design
    - WSN routing protocols,
    - Data aggregation and energy saving in WSN
    - WSN for Heatlthcare

- Real-time and group communication
    - Real-time and quality of service communication architectures and protocols
    - Multicast communication protocols
    - Mobile multicast Communications

- Design of secure systems
    - Basics and security services
    - Key management protocols
    - Trust and secure routing protocols

Duration

6 weeks + 1 exam (Supervised 32 hours - 16 lessons, 16 TD)

Person in charge

Abdelmadjid Bouabdallah

Other modules

SCI24 Seminars

Description

After having followed research seminars of the Labex laboratory, a student can ask for the validation of two ECTS.
He has then to review some papers of one seminar speaker and do an oral presentation during which he has to summarize the studied problem, the state of the art and the contribution.

Duration

2 hours per week reserved for the seminars during 14 weeks

Person in charge

Philippe Bonnifait

SCI25 Project workshop

Description

In this course, multi-skills groups composed of 4 to 6 students will work on a project linked to the three Master specializations. The objective is to apply the previously studied concepts, methods and tools on a project while encouraging interactions with the other students in the group which have skills in other domains. In this workshop, the students will also be trained to multidisciplinary engineering by taking into account the specific constraints to each field.
Each project will be supervised by a project leader (academic or industrial) and a teaching staff composed of researchers from different fields with skills in relation with the project.
The workshop integrates several aspects as systems design, modeling/simulation or development and characterization of experimental devices.

Duration

14 weeks
3h per week reserved for the project workshop

Person in charge

Laurent Petit

A4 Fourth semester

The fourth semester is devoted the Master Thesis, valued for 30 ECTS credits. Each student will be jointly supervised by at least two advisors each from the two institutions (the principal advisor from the hosting institution). The research topic could be supervised and located either in university or in the R&D department of industry.

The research work is finalised by a written dissertation of the Masters Thesis, which must be done individually and must contain elements of original work. The dissertation must be defended in front of a committee of experts. The composition and the procedures related to theses commissions will comply with regulations of the two Universities.

The dissertation should demonstrate:

- A comprehensive understanding of techniques applicable to the chosen topic of research,
- Originality in the application of computer/systems engineering knowledge,
- The ability of the student to evaluate critically current research in the field of computer/systems engineering and, where appropriate, to propose new hypothessis and solutions.

Degrees will be awarded according to national assessment structures, namely:

- France based on the M1 and M2 result: Très Bien Bien, Assez bien, Passable et Echoué,

- Italy based on the M1 and M2 result in 110/110 (pass mark 66)

ECTS/UTC	A	B	C	D	E	F (Failed)
UNIGE	110 ≥ mark ≥ 99	99 > mark ≥ 88	88 > mark ≥ 77	77 > mark ≥ 70	70 > mark ≥ 66	66 > mark

MSc Thesis
Credits: 30 Semester 4 (all partners) Compulsory: Yes
Format : Supervised research work
Supervisors : All staff
The thesis is carried out under the supervision of a member of the staff and leads to a substantial dissertation summarizing significant original research in computer/systems engineering. During this semester the student will apply the principles and techniques learned during the different courses to solve a practical problem. The dissertation will be defended once in front of a jury composed of 5 members at least, two of which are not the supervisors.
Objectives: After completing this course the students will be able to: - Research the background and literature relating to a practical problem, - Write a dissertation about the work, - Give an oral presentation and answer questions about the project.
Assessment: 75% on the dissertation, 25% on the oral presentation.