INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

4th YEAR COMPUTER AND NETWORKS ENGINEERING

Practical info

Location(s)

Toulouse

Improve your management abilities

ECTS
4 crédits

Hourly volume
45h

Management I3CCGE51

Introducing

Objectives

At the end of this module, the student will

¿ Know the legal environment and responsibilities of a business
activity
¿ Be able to objectively assess the financial health of a company and evaluate the rentability of an investment
¿ Realize a market diagnosis (benchmarking) and a business diagnosis in order to make decisions and set goals and strategies
¿ Collect the market data and put in action a business plan adapted to the means and goals of the company
Module L 2
The objectives, defined in reference to the CEFRL for the 5 language activities, are specific for the language studied Chinese, German, Spanish ¿ and the level of the student.

They can be consulted on :

https://moodle.insa-toulouse.fr/course/view.php?id=44

In certain cases, students may be authorised to follow an English module instead of another language

Necessary prerequisites

Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Toulouse School of Management

Practical info

Location(s)

Toulouse

Fundamentals in Computer Science

ECTS
7 crédits

Hourly volume
72h

Introducing

Objectives

This course is heterogeneous course and groups 3 parts :
- Functionnal Programming ¿ Caml (¿FP- Caml¿)
- Formal Logic and Logic Programming in Prolog (¿FL- Prolog¿)
- Advanced Algorithmics (« AA »)
At the end of this module, students are expected to :

[FP-Caml]
- understand and write pure functional programs,
- design recursive functions to iterate over recursive data types,
- define variants or parameterized types,
- more generally think in terms of higher-order functions
in order to write reusable codes.
- describe the semantics of simple lambda terms
- have a basic theoretical understanding of the type systems theory

[FL-Prolog part]
- translate natural language statements into formulas of
propositional logic and of 1st order predicate calculus
- apply several methods in order to check the validity and
the consistency of a formula
- explain the fundamentals of logic programming and of
Prolog.
- express problem solving as a demonstration (proof) based on axioms and theorems describing the particular
properties of the problem.
- design a Prolog program and trace its execution

[AA Part]
Some paradigms in algorithmics for discrete optimization :
- Exhaustive enumeration
- Divide and Conquer
- Dynamic Programming
- Greedy Algorithms

Practical info

Location(s)

Toulouse

Hardware Computing µcontrollers

ECTS
4 crédits

Hourly volume

Introducing

Objectives

At the end of this module, the student will have understood
and be able to explain (main concepts):
o Programming specificities of the peripheral units for microcontroller.
o How to take into account hardware constraints for the design of embedded system.

The student will be able to:
o To select an architecture processor adapted to the software application and to the process configuration.
o To conceive and test the techniques of the programming by hardware interruption.
o To use debug tools and test in the context of crossdevelopment.
o To find information into datasheet.

Necessary prerequisites

I2MAIF11 : Informatique matérielle Electronique numérique
I3MAIF22 : Langage dassemblag

Practical info

Location(s)

Toulouse

Internet and Security

ECTS
5 crédits

Hourly volume

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- Network interconnection part:
o the basic concepts and techniques allowing interconnecting local area networks in the Internet: repeater, bridge, router
o the basic concepts and techniques allowing interconnecting LAN in the Internet : subnetting, CIDR, VLAN, VPN, applicative proxy, NAT
o the main protocols of the TCP/IP Internet architecture : UDP, TCP, IP, ARP/proxy ARP, ICMP, DHCP (Note : RIP, OSPF and BGP are briefly introduced).

- Distributed algorithm part:
o principal characteristics of the distributed systems (asynchronism, distribution of control and the data, absence of common knowledge, dynamicity,¿),
o their specific problems and the difficulty of their solution in a distributed context (mutual exclusion, management of the shared data, distributed choice, diffusion, detection of the termination,¿),
o some generic algorithmic tools allowing to solve them: causality, distributed recursivity (waves) and distributed iteration (phases), specific topological structures.

- Security part:
o principles of computer security through the properties that characterize it as well as the classification of the major threats and the corresponding countermeasures,
o main vulnerabilities of computer networks, in particular the Internet network as well as the corresponding countermeasures,
o main software vulnerabilities as well as some countermeasures.

The student will be able to:
- Network Interconnection part:
o do architecture choices allowing to take into account requirements and constraints associated to a LAN interconnection,
o do basic or complex addressing and routing schemas,
o set up (administrate) Ethernet and IP networks in the basic and advanced interconnection contexts considered in the course.

- Distributed algorithm part:
o solve generic problems involved in the implementation of systems distributed
o handle the most general tools allowing to conceptualize them.

- Security part:
o analyse a computer network and its software in order to identify the main vulnerabilities, from software and network point of view and to propose corresponding countermeasures to improve the security of the whole system.

Necessary prerequisites

Course Introduction to computer networks (3MIC)
Cours de programmation distribuée dans les réseaux (socket API) (3MIC)

Practical info

Location(s)

Toulouse

Object Oriented Design and Object Oriented Programming

ECTS
6 crédits

Hourly volume
85h

Introducing

Objectives

At the end of this module, the student will understandd and be able to explain (main concepts):
Object oriented application design based on the UML language, and the
object oriented programming (Java language)

The student will be able to:
* Master object theory and the UML design modelling language
* Master a design methodology based on use cases and integrating detailed analysis and design phases.
* Apply the object concepts and a design methodology using the JAVA language
* Understand the advantages of following best practices guidelines provided by the use of design patterns
* Configure and use the configuration management tools (e.g. Git, Maven, etc.)
* Explore the use of standard documents for project management, requirements specification, software design and software tests.
* Configure and use collaborative workspaces applied to the software development process (e.g., JIRA).
* Have an initial experience to the project management challenges in a software development process project.
* Plan and play designer and developer roles within a software development process.

Necessary prerequisites

Structured programming (ADA, C, Pascal, etc)
Object-oriented programming (basic)

Practical info

Location(s)

Toulouse

Improving one's autonomy and building one's own professional project level 2 S7

ECTS
4 crédits

Hourly volume
46h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

Physical and Sports Activities
The student will be able to:
to list the problems to be solved:
¿ Know the Physical and Sports Activity (rules, meaning, roles, etc.),
¿ Design the objective of the project.
to organize:
¿ Know the constraints, the resources, and the means available,
¿ Know how to choose and plan actions over time,
¿ Know how to get involved in the group and the project: know how to adapt, dare to stimulate action, know how to give up, propose, etc.
to regulate:
¿ Know how to observe,
¿ Know how to carry out a balance sheet,
¿ Know how to readjust the choices if necessary.

Individualized Professional Project
The student should be able to:
¿ Develop your professional vision and define a strategy.
¿ Customize, present and compare your project to professionals
¿ Enrich your professional network
¿ Set development axes, objectives and action plans

Necessary prerequisites

Learning outcomes 1st, 2nd, 3rd year.

Practical info

Location(s)

Toulouse

French I

ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

Political sciences semester 1

ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

Improve your management abilities

ECTS
4 crédits

Hourly volume
45h

Management I3CCGE51

Introducing

Objectives

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¿ Know the legal environment and responsibilities of a business
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Necessary prerequisites

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Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Toulouse School of Management

Practical info

Location(s)

Toulouse

Mobiles networks and wireless networks

ECTS
6 crédits

Hourly volume
55h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
Mobile networks and wireless networks functioning and deployment principles and their communication and network architecture

The student will be able to:
-understand the cellular architecture of mobile and wireless
networks
-design and deploy a mobile cellular network
-handle the communication and network architecture of mobile networks, the roaming and handover principles
-master the radio access network (RAN) and its impact on
the design of the whole network architecture
-understand the information transmission (voice, data, multimedia) in mobile and wireless network
-understand the energy management and the principles to
adapt the emission power in wireless and mobiles networks
-identify the specificity of wireless local and personal networks and their effects on the network architecture
-handle the main functioning principles of local and personal wireless networks
-design and deploy an enterprise local wireless network

Necessary prerequisites

Telecommunication and Network classes

Practical info

Location(s)

Toulouse

[FRANCAIS] Systèmes de transmission

ECTS
5 crédits

Hourly volume
68h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

- How the properties and limitations of channels influence transmission
- The different perturbation sources
- The properties of most antennas
- Modulation and demodulation techniques
- Coding and error-correction techniques.

The student will be able to:
- Identify the limitations of a channel and how they alter the signal
- Build a model of a transmission channel, so as to conceive an adapted and optimized transmission link
- Dimension an antenna, taking into account the propagation setting
- Use a software-defined radio module to carry out numerical modulations (ASK, FSK, PSK, APSK, QAM).

Necessary prerequisites

Electromagnetism, electronics, linear algebra, telecommunications and related hardware (basic notions).

Practical info

Location(s)

Toulouse

Internet and Security

ECTS
5 crédits

Hourly volume

Introducing

Objectives

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- Distributed algorithm part:
o solve generic problems involved in the implementation of systems distributed
o handle the most general tools allowing to conceptualize them.

- Security part:
o analyse a computer network and its software in order to identify the main vulnerabilities, from software and network point of view and to propose corresponding countermeasures to improve the security of the whole system.

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Practical info

Location(s)

Toulouse

Object Oriented Design and Object Oriented Programming

ECTS
6 crédits

Hourly volume
85h

Introducing

Objectives

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* Configure and use the configuration management tools (e.g. Git, Maven, etc.)
* Explore the use of standard documents for project management, requirements specification, software design and software tests.
* Configure and use collaborative workspaces applied to the software development process (e.g., JIRA).
* Have an initial experience to the project management challenges in a software development process project.
* Plan and play designer and developer roles within a software development process.

Necessary prerequisites

Structured programming (ADA, C, Pascal, etc)
Object-oriented programming (basic)

Practical info

Location(s)

Toulouse

French I

ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

Improving one's autonomy and building one's own professional project level 2 S7

ECTS
4 crédits

Hourly volume
46h

Introducing

Objectives

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Physical and Sports Activities
The student will be able to:
to list the problems to be solved:
¿ Know the Physical and Sports Activity (rules, meaning, roles, etc.),
¿ Design the objective of the project.
to organize:
¿ Know the constraints, the resources, and the means available,
¿ Know how to choose and plan actions over time,
¿ Know how to get involved in the group and the project: know how to adapt, dare to stimulate action, know how to give up, propose, etc.
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Individualized Professional Project
The student should be able to:
¿ Develop your professional vision and define a strategy.
¿ Customize, present and compare your project to professionals
¿ Enrich your professional network
¿ Set development axes, objectives and action plans

Necessary prerequisites

Learning outcomes 1st, 2nd, 3rd year.

Practical info

Location(s)

Toulouse

Political sciences semester 1

ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
1 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
2 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
4 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
5 crédits

Hourly volume

Practical info

Location(s)

Toulouse

Logic and problem solving artificial intelligence

ECTS
4 crédits

Hourly volume

Introducing

Objectives

This course is heterogeneous ; it is composed of 3 parts :
- Artificial Intelligence search algorithms for Problem Solving (AI-PS)
- Semantic Web (SW)
- Meta-heuristics (MH)

At the end of this module, students are expected to

[AI-PS]
Develop programs that implement
- A* algorithm for searching the best action plan in a problem-state space
- AO* Algorithm for searching the best problem decomposition graph
- Algorithms for 2-players games : minmax, negamax, alphabeta

[SW part]
Explain the major issues of the semantic web.
Implement the RDF graph model and its use for describing web resources and their metadata.
Design ontologies for knowledge representation, with the OWL language.
Develop an application that access to some ontologies and infers new knowledge through a reasoning.

[MH Part]
Be familiar with he main classes of discrete decision problems and optimization problems.
Implement three main classes of metaheuristics :
- Local search methods
- Evolutionary methods
- Hybrid methods

Necessary prerequisites

Algorithmics and programming
Logic for knowledge representation (1st order predicate calculus)

Tree search algorithms
Exact and approached methods (heuristics) for combinatorial optimization

Practical info

Location(s)

Toulouse

Software and hardware architecture for computer systems

ECTS
6 crédits

Hourly volume
65h

Introducing

Objectives

At the end of this module, the student will have understood
and be able to explain (main concepts):
- Manipulation of with various type automata, language
theory, parsers, compilers;
- Development of a compiler, management and allocation
of a program memory;
- Introduction to quantic computing
- Specification of hardware components and architectures
in a high-level language;
- Taking Into account the specific material constraints for
embedded systems with limited resources.
-architectures and technologies for green computing, green software for sustainable development
The student will be able to:
- Create parsers and compilers while considering constraints from the environment (embedded or not).
- Understand and design processor architectures
- Select a processor architecture adapted to the software
application and the environment.
- Specify a hardware system in a concurrent language used widely in industry, VHDL and implement this system
on an FPGA.

Necessary prerequisites

C programming, computer architecture

Practical info

Location(s)

Toulouse

Concurrent and real time system

ECTS
4 crédits

Hourly volume
53h

Introducing

Objectives

This module deals with specification, modelling and realisation of parallel, communicating and synchronised systems under time constraints

Necessary prerequisites

MSC: graph theory, Propositional calculus
PTR: language C

Practical info

Location(s)

Toulouse

Research Initiating Project

ECTS
4 crédits

Hourly volume
37h

Introducing

Objectives

The module aims at motivating students with research activities through a selection of tutored projects. Each project involve a team off 6 students tutored by a researcher or an industrial partner. Those projects also benefit from a preliminary training on documentary research techniques to facilit the writing of a state-of-theart review of the domain. A course to project management techniques is also provided to guide students during the realisation phase of the project.

At the end of this module, the student wil have a practical experience of the following activities :
- identify a bibliography on a given topic, and present it through a standard formulation (IEEE form).
- write a state-of-the-art synthesis.
- precise the perimeter of the realization phase.
- apply project management and collaborative work techniques.
- write a project report and prepare a presentation in english for its project defense.

Practical info

Location(s)

Toulouse

[FRANCAIS] Machine Learning

ECTS
2 crédits

Hourly volume

Introducing

Objectives

The objection of this course is to introduce the basic notions of machine learning and in particular the case of supervised learning.

Necessary prerequisites

Linear Algebra, Algorithms and complexity

Practical info

Location(s)

Toulouse

QSE , APS 2

ECTS
4 crédits

Hourly volume
38h

Practical info

Location(s)

Toulouse

Communication in organisations with LV2

ECTS
6 crédits

Hourly volume

Introducing

Objectives

Objectives:
At the end of this module, the student will have understood and be able to explain (main concepts):

-How to answer the demand of the civil society for technical and scientific information
-How to carry out critical analysis in order to give appropriate answers when questioned about such issues
-How to consider the circulation and content of information within the organizations in which they will be hired

The classes given in English will focus on the specific linguistic characteristics of the English used in scientific contexts in order for the students to understand and master them.
The students will also be made aware of the specificities of scientific English as relates to publications in his specific field of research.

Module L 2
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Necessary prerequisites

Necessary knowledge:
For classes in English : understanding of scientific English

Practical info

Location(s)

Toulouse

French II

ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

Political sciences semestre 2

ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

Advanced interconnection and long distance networks

ECTS
7 crédits

Hourly volume
103h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain the:
- network architectures and protocols used in operator networks. More precisely, those related to Quality of Service, IPv6, SNMP, inter-domain & intra-domain routing, MPLS and traffic engineering
- wide area data network services that are in use in business, namely VPN (Virtual Private Network) services (Layer 2 and IP) and Carrier Ethernet services
- basics of network optimization, network planning and traffic engineering as well as the accompanying models and algorithms
- main concepts and formalisms used for the description and verification of communication protocols.

The student will be able to:
- Apprehend and master the functioning of Internet core networks (that may conform to the DiffServ framework, with IPv6 and/or MPLS enabled portions, etc.) and manage them
- Design and deploy VPN services for business
- Manage network devices via SNMP
- Apply the appropriate algorithms to network planning and network optimization problems
- Apply formal modelling and verification techniques to communication protocols

Practical info

Location(s)

Toulouse

Architecture of telecommunication systems

ECTS
3 crédits

Hourly volume
41h

Toulouse

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

- the particularities of different types of networks (optical,
wireless, spatial networks) and their transmission channel.

- The specification, dimensioning, implementing and/or deployment process of equipments of telecommunication systems in order to optimize parameters such as quality of
service, throughput, coverage¿

Necessary prerequisites

I3MITC21 - Signals and telecommunications
I4RTC11 - Transmission Systems and Techniques

Practical info

Location(s)

Concurrent and real time system

ECTS
4 crédits

Hourly volume
53h

Introducing

Objectives

This module deals with specification, modelling and realisation of parallel, communicating and synchronised systems under time constraints

Necessary prerequisites

MSC: graph theory, Propositional calculus
PTR: language C

Practical info

Location(s)

Toulouse

Research Initiating Project

ECTS
4 crédits

Hourly volume
37h

Introducing

Objectives

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Practical info

Location(s)

Toulouse

[FRANCAIS] Machine Learning

ECTS
2 crédits

Hourly volume

Introducing

Objectives

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Necessary prerequisites

Linear Algebra, Algorithms and complexity

Practical info

Location(s)

Toulouse

French II

ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

Communication in organisations with LV2

ECTS
6 crédits

Hourly volume

Introducing

Objectives

Objectives:
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Necessary prerequisites

Necessary knowledge:
For classes in English : understanding of scientific English

Practical info

Location(s)

Toulouse

Communication in organisations

ECTS
6 crédits

Hourly volume
42h

Practical info

Location(s)

Toulouse

QSE , APS 2

ECTS
4 crédits

Hourly volume
38h

Practical info

Location(s)

Toulouse

Political sciences semestre 2

ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
1 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
2 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
3 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
4 crédits

Hourly volume

Practical info

Location(s)

Toulouse

[FRANCAIS] Challenge – Formation ECIU

ECTS
5 crédits

Hourly volume

Practical info

Location(s)

Toulouse