

République Algérienne Démocratique et Populaire
الجمهورية الجزائرية الديمقراطية الشعبية
Ministère de l'Enseignement Supérieur et de la Recherche Scientifique
وزارة التعليم العالي والبحث العلمي



المدرسة الوطنية العليا للإعلام الآلي
(المعهد الوطني للتكوين في الإعلام الآلي سابقا)
Ecole nationale Supérieure d'Informatique
ex. INI (Institut National de formation en Informatique)

Second cycle
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Program 2nd year
SIQ

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SECOND CYCLE (2nd year)

Table of distribution: 2nd year (Semester 3)

Teaching Unit EU	Semester volume (hours)					
	Lectures	Work directed	Work practices	Other	Total	Coefficients
EU Fundamental						
UEF2.1.1	30h00	15h00	15h00		60h00	4
Advanced networks	30h00	15h00	15h00		60h00	4
UEF2.1.2	60h00	30h00	30h00		120h00	8
Programming theory	30h00	15h00	15h00		60h00	4
Compilation	30h00	15h00	15h00		60h00	4
EU Methodology						
EMU2.1.1	60h00	60h00			120h00	8
Data analysis and mining	30h00	30h00			60h00	4
Queuing and simulation	30h00	30h00			30h00	4
EMU2.1.2				30h00	30h00	2
Practical training in a company				30h00	30h00	2
Cross-cutting EU						
UET2.1	60h00	60h00	60h00		120h00	8
Optional teaching units* (optional)	60h00	30h00	30h00		120h00	8
Total Semester S3	180h00	150h00	90h00	30h00	450h00	30

Table of course distribution: 2nd year (Semester 4)

Teaching Unit EU	Semester volume					Coefficients
	(hours)					
	Lectures	Work directed	Work practices	Other	Total	
EU Fundamental						
UEF2.2.1	50h00	15h00	40h00		105h00	7
Distributed System	30h00	15h00	15h00		60h00	4
Systems and Network Security	20h00		25h00		45h00	3
UEF2.2.2	30h00	15h00	15h00		60h00	4
Software architectures	30h00	15h00	15h00		60h00	4
UEF2.2.3	30h00	15h00	15h00		60h00	4
DBMS and Advanced Databases	30h00	15h00	15h00		60h00	4
EU Methodology						
EMU2.2.1				60h00	60h00	4
Specialty Project				60h00	60h00	4
EMU2.2.2	30h00		15h00		45h00	3
Combinatorial Optimisation	30h00		15h00		45h00	3
Cross-cutting EU						
UET2.2	60h00	30h00	30h00		120h00	8
Optional teaching units* (optional)	60h00	30h00	30h00		120h00	8
Total Semester S4	200h00	75h00	115h00	60h00	450	30

UEF 2.1.1- Advanced networks

Knowledge Area: Systems and Networks

UEF code	Title of the module	Coefficient
UEF 2.1.1	Advanced networks	4

Hourly volumes		
Lectures	TD / TP	TOTAL
30	30	60

Semester :	3
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Prerequisites	<ul style="list-style-type: none">• Networks I• Networks II
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OBJECTIVES :

- Understand the principle and implementation of dynamic routing and Internet routing
- Discover the advanced aspects of IPV6 addressing including the mobility aspect
- To make students aware of the importance of Quality of Service (QoS) in computer networks.
- To provide the student with notions relating to the management and supervision of networks
- Understand new network applications: multimedia, real-time applications based on Voice over IP.
- Understand the technologies used to build the packet transport infrastructure within the Internet and current approaches to providing high performance communications in wide area networks.
- Introduce the student to mobile networks.

Some recommendations:

- The practical exercises must be started at the same time as the course, with a reminder of the notions seen in the third year.
- During the course, IPV6 addressing must be included.

CONTENT OF THE MODULE :

I. Addressing and dynamic routing (6 h)

1. Reminders on IPV4 addressing ;
2. Multicast communication in IP networks ;
3. Dynamic routing and routing over the Internet (RIP , OSPF , BGP ;
4. Advanced study of IPV6 addressing: auto configuration mechanisms, mobility management.

TP/TD (8 h):

1. Theoretical analysis of routing protocolsdynamic (as a tutorial) ;
2. Dynamic routing configuration (RIP, OSPF and BGP) with protocol analysis.

II. Quality of Service (QoS) in IP networks (6h)

1. Definitions and issues ;

2. Mechanisms for managing Quality of Service (QoS) ;
3. QoS architectures: best effort, integrated services (IntServ), differentiated services (DiffServ); load controlled service;
4. The RSVP signalling protocol ;
5. Congestion control and flow control ;
6. IPv6 and QoS.

Practical work (8 h):

1. Implementation of a QoS mechanism on routers ;
2. Implementation and analysis of congestion control techniques.

III. Multimedia networks (6 h)

1. Multimedia and real-time data: information coding, transfer constraints (throughput, error rate, jitter, etc.);
2. Streaming audio and video data: the RTSP protocol;
3. Real-time interactive applications: RTP and RTCP protocols;
4. IP telephony: issues, standards, H.323 and SIP protocols, coding systems, equipment, QoS, call processing.

Practical work (4 h):

1. Implementation of an IP PABX (example: Asterix) and protocol analysis;
2. Implementation of a video streaming application and protocol analysis.

IV. Network monitoring and management: SNMP protocol (4h)

1. Multimedia data General presentation ;
2. The SNMP protocol ;
3. The database - MIB ;
4. Data representation ;
5. SNMP messages ;
6. A component of the development of a network management application.

Practical work (6 h):

1. Implementation of a network supervision tool (example: nagios);
2. Analysis of the SNMP protocol.

V. Wide area networks (high speed) (6h)

1. High-speed networks: architecture, techniques, switching and routing;
2. Long-distance technologies (PDH.SDH) ;
3. Optical networks (SONET/SDH): WDM, C-WDM, D-WDM multiplexing techniques;
4. Operator access: Types of interface, Level of availability, Constraints, Frame relay, ATM ;
5. MPLS and GMPLS technology: switching and signalling techniques.

Practical work (2 h):

1. Implementation of MPLS technology

VI. Introduction to mobile networks (4 h)

1. Mobile radio telecommunication networks: GSM, GPRS, UMTS.
2. Standards (3G and derived): architecture and protocols.
3. Deployment and administration of mobile phone technologies.

PERSONAL WORK

- Design project of a network (implementation of quality of service, dynamic routing, network supervision) ~15 hours ;
- Programming of a network application (SNMP, multicast) ~ 15 hours.

KNOWLEDGE TEST
<ul style="list-style-type: none">- Intermediate review : 15%- Final exam: 35%.- TP test: 30%.- Projects: 15%.- TP reports: 5%.

BIBLIOGRAPHY
<ul style="list-style-type: none">• J. Crowcroft, M. Handley, I. Wakeman, "Internetworking Multimedia", Morgan Kaufmann, 1999.• P. Ferguson, G. Huston, "Quality of Service: Delivering QoS on the Internet and in Corporate Networks", Wiley, 1998.• J.F. Kurose, K.W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Addison Wesley, 2003.• J. Raj, "The Art of Computer Systems Performance Analysis", Wiley, 1991.• A. Tanenbaum, "Réseaux: Architectures, protocoles, applications", InterEditions, 3rd edition, 1997.

UEF 2.1.2- Programming Theory

Knowledge Area: Software Engineering

UEF code	Module title	Coefficient
UEF 2.1.2	Programming theory	4

Hourly volumes		
Lectures	TD / TP	TOTAL
30	30	60

Semester :	3
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Prerequisites	<ul style="list-style-type: none">• Algorithms• Mathematical logic• Theory of programming languages and applications• Graph theory
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OBJECTIVES :

- Know the foundations and theories behind programming
- Know how to evaluate and compare the performance of algorithmic solutions
- Learning to reason about programmes
- Have an overview of programming paradigms

CONTENT OF THE MODULE :

I. Preliminary concepts

1. Landau rating
2. Graph traversal
3. Fixed point theory

II. Complexity theory

1. Introduction
2. Decision problems and languages
3. Calculation models
4. Complexity classes
5. Polynomial reductions
6. NP-Complete

III. Complexity reduction

1. Top-down method (divide and conquer)
2. Bottom-up method (Dynamic Programming)

IV. Problem solving

1. Backtracking
2. Hill-Climbing
3. Best First Search
4. Branch and Bound
5. Algorithm A*

V. Imperative programming

1. Programme schemes
2. Programme transformations

3. Formal evidence

VI. Application programming

1. Lambda-calculation
2. Lisp and higher order functions
3. Inductive evidence
4. Interpretation of functional languages

VII. Declarative programming

1. Automatic proof of theorems
2. Prolog and symbolic manipulations
3. Interpretation of logic languages

PERSONAL WORK

-Practical work (3 to 4) + lectures (1 or 2)

KNOWLEDGE TEST

-Practical work/presentations + one or more written tests + a final exam

BIBLIOGRAPHY

- M. J. Atallah, M. Blanton, "Algorithms and Theory of Computation Handbook", Second Edition, CRC Press, 2010.
- M. R. Garey, D. S. Johnson, "Computers and Intractability: A Guide to the Theory of NP-Completeness", W. H. Freeman, 1979.
- O. Goldreich, "Computational Complexity A Conceptual Perspective", Cambridge University Press, 2008.
- R. Kowalski, "Logic for Problem Solving", North Holland, 1979.
- S. L. Peyton Jones, "The Implementation of Functional Programming Languages", Prentice-Hall, 1987.
- M. L. Scott, "Programming Language Pragmatics, Second Edition, Morgan Kaufmann, 2006.
- M. Spivey, "An introduction to logic programming through Prolog", Prentice-Hall International, 1995.

UEF 2.1.2 - Compilation

Knowledge Area: Software Engineering

UEF code	Title of the module	Coefficient
UEF 2.1.2	Compilation	4

Hourly volumes		
Lectures	TD / TP	TOTAL
30	30	60

Semester :	3
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Prerequisites	<ul style="list-style-type: none">• Theory of programming languages• Theory of programming languages and applications• Programming in one of the two paradigms (Imperative Programming, Object Oriented Programming)• Operating system (assembler, processor registers, etc.)
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OBJECTIVES :

- Write a grammar of a programming language and build a parser for it using standard tools.
- Understand the formalised description of the operational semantics and static semantics of a language
- Programming a compiler from a language to a target machine

CONTENT OF THE MODULE :

I. Reminder Lexical and syntactic analysis (3H)

1. Lexical analyzer and regular expressions (Lex)
2. Parser and free context grammars (type 2)
3. YACC parser generator

II. Syntactic analysis methods (9H)

1. Top-down methods of type LL(K) :
2. Ambiguity and grammar transformation
3. LL parser construction and operation
4. LR(k) bottom-up methods
5. Contextual analysis
6. Construction of LR analyzer by the method of items
7. Error management

III. Semantic analysis and syntax-driven translation (6H)

1. Intermediate languages
2. Notion of grammar symbol attributes (synthesised and inherited attributes)
3. Translation schemes (in the case of bottom-up and top-down analyses)
4. Semantic analysis (more verification at compile time less risk at runtime)

IV. Execution environment (6H)

1. Procedures and activations
2. Organisation of the memory space
3. Access to non-local names
4. Passing parameters

5. *Generation of executable code (6h)*
6. Register machine
7. Flow control (flow graph and DAG)
8. Virtual machine

PERSONAL WORK

- **Face-to-face work**
 - Presentation of parser generation tools (YACC, JCC, the .NET class, bison...etc)
 - Top-down syntactic analysis using the tools
 - Ascending parsing using the tools
 - Semantic analysis using the tools
 - Code generation for various machines (Native code and byte code for VM)
- **Project :**
 - Individual development of a compiler: the project will be carried out and evaluated in stages during the semester
 - Deepening of course concepts through assignments and presentations.

KNOWLEDGE TEST

- Continuous monitoring by small tests after the 5 chapters
- Evaluation of the project and the 5 TPs
- Final exam of 3 hours

BIBLIOGRAPHY

- A. Aho, M. Lam, J.D. Ullman, R. Sethi, "Compilers: Principles, Techniques and Tools", 2nd edition, Pearson Education France, 2007, [ISBN 978-2-7440-7037-2](#).
- A. Aho, J. Ullman, R. Sethi. "Compilers: Principles, techniques and tools", Ed. DUNOD, 2000.
- A. Aho, J. Ullman, "Principles of compiler design", Edition: Addison Wesley, 1977.
- R. Bornat, "Understanding and Writing Compilers, A do-it-yourself guide", First published Macmillan, 1979, Internet edition 2007.
- T. Copeland, "Generating Parsers with JavaCC" Ed. Centennial Books, Alexandria, VA, 2007. ISBN: 0-9762214-3-8.
- J.E.F. Friedl, "Mastering Regular Expressions", O'Reilly, 2006, ISBN: 1-56592-257-3.
- D. Grune, "Modern Compiler Design", Ed. John Wiley & Sons, 2000. ISBN: 0 471 97697 0.
- J.E. Hopcroft, J.D. Ullman, "Introduction to Automata Theory, Languages and Computation", Ed. Addison Wesley, 1979.
- S. C. Johnson, "Yacc: Yet Another Compiler-Compiler", Computing Science Technical Report No. 32, Bell Laboratories, Murray Hill, NJ 07974.
- J. Levine, T. Mason, D. Brown, "Lex & Yacc", Ed. O'Reilly, 1992. ISBN: 1 56592 000 7
- K.C. Loudon, "Compiler Construction: Principles and Practice", Course Technology, 1997. ISBN: 0 534 93972 4.
- N. Silverio, "Réaliser un compilateur, les outils Lex et YACC", Ed. Eyrolles, 1994.

UEF2.1.3- Data Analysis and Mining

Knowledge Area: Mathematical tools

EMU Code	Title of the module	Coefficient
UEF2.1.3	Data Analysis and Mining	4

Hourly volumes		
Lectures	TD / TP	TOTAL
30	30	60

Semester :	3
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Prerequisites	<ul style="list-style-type: none">Statistics and probability, linear algebra, numerical calculation.
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The use of data analysis extends to a wide range of fields, including pattern recognition, data mining, prediction, marketing, biostatistics.....

OBJECTIVES :

- Present the techniques of multidimensional descriptions, statistical modelling and learning theory used in data mining in various fields of application: industry, marketing.... The aim is to bring out the relevant information contained in a large mass of data.

At the end of this course, students will be able to mobilise the tools to process data and interpret the results of the various measurements they encounter in the exercise of their profession.

CONTENT OF THE MODULE :

I. Reminder (1h)

9. Linear algebra, descriptive statistics, matrix derivation and optimisation of functions.

II. Factor methods (Description, Reduction, Visualisation and Interpretation of data) (14h)

10. Principal component analysis.
11. Factor analysis of correspondences.
12. Multiple correspondence factor analysis.

III. Data mining: Supervised and unsupervised classification (15h)

13. Classification and Ranking (Prediction) of data
 - Discriminant factor analysis.
 - Automatic classification.
 - Introduction to the principle of statistical learning: Presentation of some methods (SVM, K-nearest neighbours, Neural networks, Bayesian method...).
14. Modelling and forecasting
 - Simple and multiple regression.
 - Notions on Time Series and Exponential Smoothing

PERSONAL WORK

- TD to enable the student to manipulate the tools of data analysis.
- Practical work on real data using appropriate software including R, SAS and Matlab, WEKA.

KNOWLEDGE TEST
<ul style="list-style-type: none">- Written examination on the course- Continuous monitoring of the TDs

BIBLIOGRAPHY
<ul style="list-style-type: none">• R. Bourbonnais, M. Terraza, "Analyse des séries temporelles: Application à l'économie et à la gestion", Dunod, 2010.• R. O. Duda, P.E. Hart, D.G. Stork, "Pattern classification", 2nd edition, Wiley and sons, 2001.• T. Hastie, R. Tibshirani, J. Friedman, "The elements of statistical learning. Data mining, inference and prediction", Springer, 2001.• L. Lebart, A. Morineau, M. Piron, "Statistique exploratoire multidimensionnelle", Dunod, 2006.• G. Saporta, "Probabilites Analyse des Données et Statistique", 3rd edition, Technip, 2011.• Online resources: http://www.math.univ-toulouse.fr/~besse/teaching.html.

UEF2.1.3- Queues and simulation

Knowledge Area: Mathematical tools

EMU Code	Title of the module	Coefficient
UEF2.1.3	Queuing and simulation	4

Hourly volumes		
Lectures	TD / TP	TOTAL
30	30	60

Semester :	3
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Prerequisites	<ul style="list-style-type: none">Basic concepts of probability and statistics
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OBJECTIVES :

- Study different queue models and calculate performance parameters
- Learn simulation techniques

CONTENT OF THE MODULE :

- I. Recall of the concepts of probability theory (2 hours)
- II. Random (Stochastic) Processes (7H)
 15. Markov chains
 16. Poisson process
 17. Birth and death process
- III. Queuing models (10H)
 18. Markov Models: Open and Closed Systems
 19. Model M/M/1
 20. Model M/M/s
 21. Models M/M/S/L, M/M/S/S and M/M/∞
 22. Closed M/M/s model
 23. Non-Markovian model: M/G/1 model
- IV. Jackson Networks (2H)
- V. Simulation (9H)
 24. Generation of uniform random variables
 25. Generation of discrete and continuous random variables according to different laws
 26. Inverse method
 27. Rejection method
 28. Estimation of an integral by the Monte Carlo method
 29. Variance reduction techniques.
 30. Random number tests (KHI 2 test, KS test and sign test)
 31. Discrete event simulation and continuous time simulation

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PERSONAL WORK

-Lecture and MCMC methods lab.

KNOWLEDGE TEST

BIBLIOGRAPHY

- R. Faure, "Précis de la recherche opérationnelle (cours et exercices)", Dunod, 2004.
- J. F. Hêche, T. M. Liebling, D. de Werra, "Recherche opérationnelle pour ingénieurs Volume 2", Presse Polytechnique Romande, Lausanne, 2003
- L. Kleinrock, "Queuing systems volume 1 and 2", Wiley-Interscience, 1975.
- P. Le Gall, "Les systèmes avec ou sans attente et processus stochastiques Tome1", Dunod, 1962.
- J.T. Morgan, "Elements of Simulation", Chapman & Hall, 1984.
- A. Pages, M. Gondran, "Fiabilité des systèmes", collection of the Direction des études et recherche d'électricité de France, Eyrolles, 1980.
- G. Pujolle, S. Fdida: "Modèles de systèmes et de réseaux TOME 1 Performances TOME 2 Files d'attente", Eyrolles, 1989.
- A. Ruegg, "Stochastic processes with applications to expectation and reliability phenomena", Presse Polytechnique Romande, Lausanne, 1989.
- M. Sakarovitch, "Mathematical Techniques of Operations Research", V-Random Processes, ENSIMAG, 1978.

UEM2.1 - Practical training in a company

Knowledge area: Business knowledge and general training

EU Code	Title of the module	Coefficient
EMU2.1	Practical training in a company	2

Hourly volumes		
Lectures	TD / TP	TOTAL
		30

Semester :	3
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Prerequisites	
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OBJECTIVES :

The expected objective of the trainees is to participate in the study and analysis of a real problem from the professional environment and possibly propose scenarios for improvement.

- a. Learning sub-goals
 - i. Putting into practice what you have learned
 - ii. Developing analytical skills
 - iii. Developing the spirit of synthesis
- b. Sub-goals for personal development
 - i. Life experience
 - ii. Compliance with academic and professional guidelines

Target skills:

- a. Communication
- b. Observation
- c. Teamwork

CONTENTS:

- A presence in the workplace
- A written report on the internship
- A presentation to a panel of teachers
- Self-evaluation of the experience (participation in a post-course survey)

PERSONAL WORK

- A search for a subject among companies
- Negotiation of the objectives to be achieved

UEF2.2.1- Distributed Systems

Knowledge Area: Systems and Networks.

UEF code	Title of the module	Coefficient
UEF 2.2.1	Distributed Systems	4

Hourly volumes		
Lectures	TD / TP	TOTAL
30	30	60

Semester :	4
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Prerequisites	<ul style="list-style-type: none">• Operating systems (I and II)• Networks
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OBJECTIVES :

- Introduce the basic concepts of distributed systems.
- At the end of this module the student should understand the advantages that distributed systems provide over centralized systems.
- The student should be able to design distributed applications

CONTENT OF THE MODULE :

I. Introduction (3h)

- 32. Centralized systems
- 33. Multiprocessor systems
- 34. Network systems
- 35. Large-scale systems
- 36. Basics of Distributed Systems :
 - Purpose of distributed systems
 - Advantages and disadvantages of distributed systems
 - Basic functions of a distributed system
 - Characteristics of distributed algorithms :
 - Data Migration, Process Migration
 - Robustness (Fault tolerance)
 - Remote Services: Remote Procedure Calls (RPC)

II. Distributed programming models (2h)

- 37. Socket-based model (TP)
- 38. Client-server model (TP)
- 39. CPR model (TP)
- 40. RMI model (TP)
- 41. Service-based model (ST)

III. Coordination in Distributed Systems (10h)

- 42. Notion of time
 - Physical clock
 - Logic clock
- 43. Scheduling of events.
- 44. Broadcasting
 - Causal diffusion
 - Atomic scattering
 - FIFO broadcasting

<p>45. Global state of a distributed system</p> <p>46. Distributed Algorithms: Mutual Exclusion and Election Algorithms</p> <ul style="list-style-type: none"> - Centralized approach (reminder) - Fully distributed approach - Techniques based on the scheduling of events - Techniques based on token circulation. - Synchronisation and Termination Detection <p>47. Handling interlocking</p> <ul style="list-style-type: none"> - Static and dynamic prevention (schemes with and without requisition) - Detection and Healing (Centralized and Fully Distributed Approaches) <p>IV. <i>Distributed Data Management in Distributed Systems (12h)</i></p> <p>48. Space sharing: Distributed virtual memory (consistency, safety, liveness)</p> <p>49. Object Management : Location, Fragmentation, Duplication (consistency)</p> <p>50. Distributed file systems (NFS, AFS, CODA)</p> <p>V. <i>Implementation of Distributed Applications and Case Studies (3h in class and the rest to be treated in TD/TP):</i></p> <p>51. Client-Server application</p> <p>52. Amoeba</p> <p>53. Corba</p> <p>54. JAVA (RMI)</p>

PERSONAL WORK
<ul style="list-style-type: none"> - Do at least two PTs from the list of PTs below: <ul style="list-style-type: none"> – TP Socket-based model – TP Client-server model – TP CPR Model – TP RMI model – TP Service-based model – Practical work on distributed algorithms

KNOWLEDGE TEST
-At least one continuous assessment + final examination + practical work.

BIBLIOGRAPHY
<ul style="list-style-type: none"> • G. Coulouris, J. Dollimore, T. Kindberg, G. Blair "Distributed_Systems Concepts_and_Design", Addison Wesley, 2011 • S. Ghosh, "Distributed Systems: An Algorithmic Approach", Chapman & Hall/CRC, 2007. • N. A. Lynch, "Distributed Algorithms", Morgan Kaufmann Publishers, 1996. M. Raynal, J-M. Helary, "Synchronisation et contrôle des systèmes et des programmes répartis", Eyrolles, 1988. • M. Raynal, "Le problème de l'exclusion mutuelle", Eyrolles, 1987. • A. Silberschatz, P. B. Galvin, G. GAGNE, "Principles of Operating Systems", 7th edition, Addison-Wesley, 2005 • A. S. Tanenbaum, M. V. Steen, "Distributed Systems Principles and Paradigms", (2nd Edition) Prentice Hall, 2006 • A. S. Tanenbaum, "Operating Systems: Centralized Systems Distributed Systems", InterEditions, 1994.

UEF2.2.1- System and Network Security

Knowledge Area: Systems and Networks.

UEF code	Title of the module	Coefficient
UEF 2.2.1	Systems and Network Security	3

Hourly volumes		
Lectures	TD / TP	TOTAL
25	20	45

Semester :	4
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Prerequisites	<ul style="list-style-type: none">• Networks Networks I and Networks II• System I and II• Introduction to cryptography
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OBJECTIVES :

- To make the student aware of computer security issues in general and network security in particular.
- Understand the risks associated with system flaws and applications.
- Understand the need for protection in systems.
- To illustrate the different types of attacks in a computer network and the countermeasures.
- To show the importance of authentication and the use of cryptographic mechanisms to ensure it.
- Understand the secure architectures of a computer network.
- To raise awareness of the importance of filtering and access control.

CONTENT OF THE MODULE :

I. General information on system and network security (3 h)

1. Security of systems and networks (issues, statistics, software, communication, networks, access control,)
2. Ethics in computer security (laws, legislation, charter,...)
3. Need to define a security policy
4. The rules to follow and the basic elements for defining a policy
5. Recommendation for implementation of the policy

TD/TP (2 h) :

Describe a security policy for the use of a computer system (case of a company)

II. Protection and Security of Systems (15h)

A. Protection (3h)

1. Definition
2. Protective devices
 - materials
 - software: system level, application level.
3. Problems of protection :
 - Basic concepts
 - Insulation

- Global and selective sharing
- Notion of Area of Protection
- Representation of protection rules: Rights matrix
 - Representation by columns or Access Lists
 - Representation by lines or Capability Lists
- Study of typical examples of protection systems:
 - UNIX system
 - Windows system
- 4. Other problems :
 - Dynamic modification of access rights
 - Hierarchical protection
 - Protection through mutual distrust

B. Safety (6h)

1. Purpose and Objectives of Security in a System
2. Authentication and Privacy
 - By hardware and software (biometric techniques)
 - By pure software means :
 - Static, dynamic, one-time use, custom questionnaire.
 - Secure management of passwords (size, associated security rules, backup procedures in case of loss).
3. Malware: classification by category (spyware, Trojans, viruses, worms, logic bombs, trapdoors, rootkits, bots)
4. Attacks and System Intrusion
 - Attack by exploitation of vulnerabilities.
 - The system
 - Applications Examples
 - and associated countermeasures.
 - Attack by deception (social engineering, spoofing, phishing)
 - Examples and associated countermeasures.
5. Some useful security techniques and tools
 - Against data loss: periodic automatic back-up, logging of processing, redundancy).
 - Against malware: Malware detection software (AntiVirus, system hotspot protection, etc.)
 - Containment technique (SandBoxing)
 - Virtual machine technology (full system virtualisation software)

III. Network security (15h course)

A. Network vulnerabilities and attacks (3h)

1. Definition and description of a network attack (scans, vulnerability discovery, information exploitation and penetration, etc.)
2. Threat across the layers of the OSI model
 - Attacks on the IP protocol (ipspoofing, etc.)
 - Attacks on TCP (flooding, smurfing, etc.).
 - Attack on web applications (system, service, application)
 - SQL injection
 - Buffer Overflow
 - Fishing
 - Attacks and intrusion (sniffers, spoofing, flooding, denial of service,).
3. Audit, diagnostics and countermeasures .

Practical work (6 h) :

- Simulate some network attacks.
- Use diagnostic tools (audit) to detect flaws in some applications.
- Implementing some countermeasures to correct the flaws in a system.

B. Authentication in networks (3 h)

1. Problems with authentication.
2. Password authentication (PAP and CHAP protocols).
3. Authentication using a network server.
4. Use of cryptographic tools for network authentication:
 - Authentication by digital certificate (PKI concept).
 - Authentication in WIFI networks.
 - Security of WAN connections: VPN (IPsec).

Practical work (6 h) :

- Implementation and analysis of authentication protocols in WIFI
- Analyse protocols: SSH and HTTPS
- VPN (IPsec)

C. Filtering and access control (3 h)

1. Introduction and importance of filtering and access control.
2. Access List Filtering: ACL
3. Principle of a firewall (operation, filtering,).
4. Secure network architectures : DMZ
5. Proxy and content filtering (http, SMTP)
6. Intrusion Detection Systems (IDS)
7. HoneyPot and HoneyNet

Practical work (6 h) :

- Implementation of an access control system based on ACLs (example on routers)
- Setting up a firewall-based filtering system (example iptables under Linux)
- Setting up a DMZ architecture with filtering
- Setting up an IDS (example: SNORT)

PERSONAL WORK

-A problem with several possible variants (research, development, implementation of a solution,) will be proposed and the choice (study, analysis and implementation) will be left to the student's initiative.

KNOWLEDGE TEST

- Intermediate review : 15%
- Final exam: 25%.
- TP test: 40
- Projects: 15%.
- TP reports: 5%.

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UEF 2.2.2 - Software architectures

Knowledge Area: Software Engineering

UEF code	Title of the module	Coefficient
UEF 2.2.2	Software Architectures	4

Hourly volumes		
Lectures	TD / TP	TOTAL
30	30	60

Semester :	4
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Prerequisites	<ul style="list-style-type: none">• Introduction to Software Engineering I and II,
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OBJECTIVES :

The architecture of a software system defines the structure of the system, its components and the connections within the system. The architecture is a very important element resulting from the high-level design and necessary for the development of the modules of the system structure. The module is a continuation of the chapter "software architectures" of the IGL module. It addresses the notion of architecture and the main architectural styles of the moment such as N-Tier architecture or Cloud-Computing. The practical aspect is important to reinforce the theoretical knowledge acquired during the module. The objectives of this module are :

- Highlight the importance of the architectures and their impact on the final product.
- Discover the various architectures: client-server, object-oriented, components, aspects, services, etc.
- To enable the engineer to discover architectural styles such as layered architectures or multi-agent architecture
- Raising the engineer's awareness of architectures through practical workshops.

CONTENT OF THE MODULE :

- I. Introduction to software architectures.*
- II. Definition of architectural styles.*
- III. Pipes and filters.*
- IV. Component-based architectures.*
- V. Client-Server and N-Tier.*
- VI. Subscription-based architectures.*
- VII. Cloud computing.*

KNOWLEDGE TEST

- Written examination on the course
- Continuous monitoring of the TDs

BIBLIOGRAPHY

- L. Bass, P. Clements, R. Kazman, "Software architecture in practice", Addison-Wesley, 2003.
- C. Hofmeister, R. Nord, D. Soni, "Applied software architecture", Addison-Wesley, 2000.
- J. Garland, R. Anthony, "Large-scale software architecture: a practical guide using UML", Wiley, 2003.

UEF2.2.3- Advanced DBMS and Database

Knowledge Area: Information Systems

UEF code	Title of the module	Coefficient
UEF2.2.3	DBMS and Advanced Database	4

Hourly volumes		
Lectures	TD / TP	TOTAL
30	30	60

Semester :	4
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Prerequisites	<ul style="list-style-type: none">Data model, algebraic and SQL language, file structure
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OBJECTIVES :

- Deepening of knowledge on aspects related to DBMS performance improvement.
- Learn about new trends in the field of databases.

CONTENT OF THE MODULE :

- I. Query optimization*
 1. Definition
 2. Logical optimisation
 3. Physical optimisation
- II. Architecture of storage systems*
 1. Characteristics and organisation of storage media
 2. DBMS and cache management
 3. DBMS in RAM
- III. Transaction concepts and competition control issues*
 1. Transaction concepts
 2. Concurrent execution, serializability
 3. Competition management techniques
 - Two-phase locking
 - Stamping
- IV. Fault tolerance and recovery*
 1. Notion of failure
 2. Logging
 3. Disaster recovery techniques
- V. Parallel and distributed databases*
 1. Preliminary definitions and concepts
 2. Data storage
 3. Parallel processing
 4. Distributed transactions
 5. Replication
- VI. Post-relational systems*
 1. Object and Relational-object data models
 2. Deductive databases
 3. Temporal databases
 4. Spatial and spatio-temporal databases
 5. Real-time databases
- VII. Multidimensional databases*
 1. Data warehouse

<p>2. OLAP analysis</p> <p><i>VIII. Management of semi-structured data</i></p> <p>1. XPath and XQuery</p> <p>2. XML Data Storage and Indexing</p>

PERSONAL WORK
<ul style="list-style-type: none"> - TP-project using a DBMS to implement the course concepts - Literature review on new database directions

KNOWLEDGE TEST
-Two audits and a project or literature review

BIBLIOGRAPHY
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EMU 2.2.1- Combinatorial Optimisation

Knowledge Area: Mathematical tools

EMU Code	Title of the module	Coefficient
EMU2.2.1	Combinatorial Optimisation	3

Hourly volumes		
Lectures	TD / TP	TOTAL
30	15	45

Semester :	4
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Prerequisites	<ul style="list-style-type: none">Data structure, THP, ROP1
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OBJECTIVES :

- Solving combinatorial optimisation problems (exact and approximate methods)
- To show the effective applicability of the methods presented to practical problems.
- rigorous reasoning before intuition

CONTENT OF THE MODULE :

I. Introduction to combinatorial optimisation

1. The problem of combinatorial optimisation
2. Fundamental tools of combinatorial optimisation
3. Some models of combinatorial optimisation
 - Touring problem
 - Graph colouring problem
 - Scheduling problem
 - Inventory Management problem

II. Separation and evaluation methods

1. Principle of the Branch and Bound approach
2. Application to integer linear programming problems
3. Application to the backpack problem
4. Application to the travelling salesman

III. Dynamic programming

1. Introductory example: Stock management problem
2. Solving the inventory management problem using networks (Bellman algorithm)
3. Principles of the programming programming: Problems that can be justified by dynamic programming.

IV. Approximate Methods

1. Gluttonous Heuristics
2. Specific construction methods
3. Neighbourhood methods
 - Simulated annealing method
 - Taboo Research
4. Evolutionary metaheuristics :
 - Genetic Algorithms,
 - Ant colonies,

PERSONAL WORK

-1TP and 1 project

KNOWLEDGE TEST

- | |
|---|
| <ul style="list-style-type: none">- 2 written tests on the course and TD- Continuous assessment during the course and TD |
|---|

BIBLIOGRAPHY

- | |
|--|
| <ul style="list-style-type: none">• M. Bazara, C.M., Shetty, "Non Linear Programming, (Theory and Algorithms)", Wiley, 1979.• G. B. Dantzig, "Linear Programming and Extensions", Princeton University Press, 1963.• R. Diestel, "Graph Theory", Springer, Second Edition, 1999• M. Gondron, M. Minoux, "Graphs and Algorithms", Wiley, 1984.• B. Korte, J. Vygen, "Combinatorial Optimisation", Springer, 2001.• P. Lacomme, C. Prins, M. Sevaux, "Algorithmes De Graphes", Eyrolles, 2003.• M. Minoux, " Programmation Mathématique : Théorie Et Algorithmes ", Tomes 1 Et 2, Dunod, 1983• G. Nemhauser, "Introduction to Dynamic Programming", Wiley, 1966.• M. Sakarovitch, "Combinatorial Optimization", Hermann, 1984. |
|--|

UEM2.2.2- Specialty project

UEF code	Title of the module	Coefficient
EMU2.2.2	Specialty project	4

Hourly volumes		
Lectures	TD / TP	TOTAL
		60

Semester :	4
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Prerequisites	
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OBJECTIVES :

To enable students to work in project teams around a given problem and complexity.

Objectives in terms of project management

- Project life cycle experience
- Exercising the roles: project owner / project manager (client / supplier)

TARGET COMPETENCES:

- Modelling / methodology
- Functional / business
- Technical
- Project management

KNOWLEDGE TEST

Formative evaluation

- Deliverables
- Presentation
- Involvement

Final Evaluation by :

- the project manager and/or quality manager or other

Optional modules in semester 3 and semester 4

UET- Embedded Systems Architectures

Knowledge Area: Systems and Networks

ETU code	Title of the module	Coefficient
ETU	Architecture of Embedded Systems	4

Hourly volumes		
Lectures	TD / TP	TOTAL
30	30	60

Semester :	4
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Prerequisites	<ul style="list-style-type: none">• Computer architecture 1• Computer architecture 2• Computer architecture 3
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OBJECTIVES :

The objectives of this course are to familiarize the student with real-time and embedded systems:

- He/she should be familiar with the three layers of such systems: the architecture, the operating system and the application.
- he must be confronted with the constraints of real-time and embedded systems which are very different from those of the systems usually used by computer engineers.
- He/she must be able to design, develop and use: embedded software, real-time applications and embedded systems using a unified methodology.

CONTENT OF THE MODULE :

I. Integrated circuit design: (3h)

1. Evolution of integrated circuits
2. Design process
3. Design steps,
4. Manufacturing, testing and packaging

II. Real-time and embedded systems: (3h)

1. History and growth of the microprocessor market
2. General information on embedded systems
3. Examples of embedded systems
4. Characteristics of embedded systems
5. Block diagram of embedded systems
6. Architecture of embedded systems

III. Processors and circuits for embedded systems: (3h)

1. Instruction set processors
2. DSP
3. FPGA
4. ASIC

5. Socs

IV. Design methods for embedded systems: (1h)

1. Classical approach
2. Introduction of codesign

V. Different stages in the design of an embedded system: (7h)

1. Co-specification of embedded systems
2. Modelling of embedded systems
3. Partitioning and scheduling of embedded systems
4. Embedded systems synthesis
5. Verification of embedded systems
6. Testability of embedded systems

VI. Multiprocessor chips (MPSoCs): (3h)

1. Multiprocessors and the evolution of MPSoCs
2. MPSoCs applications and architectures
3. Architectures for low power real-time systems
4. Interconnection network in MPSoCs: NOCS (Network On Chip)
5. Computer-aided design and MPSoCs

VII. Platforms and operating systems for embedded systems: (4h)

1. Embedded application development platforms
2. Functionality of operating systems and their implementation on existing systems.

VIII. Fault tolerance and safety in embedded systems (2h)

IX. Examples of interlocking systems: (2h)

1. Sensor networks
2. RFID systems

PERSONAL WORK

I. Integrated circuit design :

Objective: to familiarise the student with tools to assist in the design of circuits. **I.1. Design and development of a system for hardware implementation on FPGA.**

Tools :

- 1- Software: ISE from Xilinx, Modelsim simulator.
- 2- Hardware: FPGA board.
 - **Specification**, with hardware description languages (VHDL or verilog).
 - 1- Initiation, presentation of the language.
 - 2- Example of a circuit description.
 - 3- Presentation of the Xilinx ISE tool.
 - **Synthesis**, RTL level, logic gate level.
 - **Simulation and validation**, ISE simulator or Modelsim.
 - **Mapping, floorplanning, placement and routing.**
 - **Design implementation**, FPGA programming and testing.

I.2. Drawing of Layouts :

Tool: MicroWind Simulator (MW) :

1. Presentation of circuits based on transistors, resistors and parasitic capacities.
2. The transition to different layout layers with different materials.
3. Presentation of the MW simulator, drawing rules.
4. Creation of the layout.
5. Simulation and testing.

II. Embedded system design methods:

Objective: to familiarise the student with tools to assist in the design of embedded systems.

Tools: specification in SsystemC, and KDE from Xilinx.

KNOWLEDGE TEST

- 2 scheduled written tests
- Practical note
- Individual and team projects.

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- M. Tien-Chien Lee, High-Level Test Synthesis of Digital VLSI Circuits, Artech House Publishers, ISBN: 0890069077, February 1997.

UET- Signal Processing

Knowledge Area: Mathematical Tools

ETU Code	Title of the module	Coefficient
ETU	Signal Processing	4

Hourly volumes		
Lectures	TD / TP	TOTAL
30	30	60

Semester :	3
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Prerequisites	Mathematics programme
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OBJECTIVES :

This module presents the basics of signal processing theory. It will enable them to acquire the notions necessary to master the algorithms and architectures of signal and image processing. These concepts are applied in various fields such as telecommunications, multimedia, robotics, etc.

KEYWORDS :

Fourier transforms, orthogonal functions, convolution, distributions, linear systems, discrete systems, signal, filtering. Wavelets.

CONTENT OF THE MODULE :

I. Space of continuous deterministic signals

- 55. Fourier Transform
- 56. Definition of continuous TF
- 57. Spectrum of a deterministic continuous signal
- 58. Linear and invariant systems
- 59. Convolution
- 60. Correlation
- 61. Sampling and SHANNON's theorem
- 62. Reconstruction of sampled signals

II. Discrete systems

- 1. Discrete Fourier Transform
- 2. Definition, fast algorithms of DFT calculation (FFT...)
- 3. Spectrum of periodic signals and real signals
- 4. Sampling
- 5. Z-transform
- 6. Discrete Fourier Transform

III. Filters

1. Filtering of a signal, main families of filters, transfer function, convolution, stability.
2. RIF and RII filters

IV. Orthogonal transforms

1. Discrete cosine transform (DCT)
2. Wavelet transform

V. Random signal space

1. Signal filtering, random
2. Discrete random signal
3. Spectral analysis of random signals

PERSONAL WORK

- Digitisation, decomposition of signals into fourier series, sampling and signal restitution, Filters
- Image compression by DCT and wavelets

KNOWLEDGE TEST

-Continuous assessment 15%, lectures and practical work 15% and final exam 70%.

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UET- Digital Images

Knowledge Area: Mathematical Tools

ETU Code	Title of the module	Coefficient
ETU	Digital Images	4

Hourly volumes		
Lectures	TD / TP	TOTAL
30	30	60

Semester :	4
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Prerequisites	<ul style="list-style-type: none">Signal processing
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OBJECTIVES :

- This course provides us with the essential basics of digital image processing and analysis and pattern recognition. This course also provides an introduction to the most innovative themes such as image synthesis, intelligent interactivity and virtual reality. Concrete examples will be implemented through practical work and mini projects.
- Various applications are highlighted, namely: biometrics (recognition and identification), documents, document and image restoration, 3D synthesis and virtual reality.

Key words

- Recognition, shapes, segmentation, classification, analysis, decision. compression, synthesis, virtual reality, augmented reality.

CONTENT OF THE MODULE :

I. Image processing: 20 hours

1. Definition of the image, objective of image processing...
2. Signal and frequency aspects of the image.
3. Image scanning and binarisation, Image
4. formats (bit-map, vectorised)
5. Basic image processing techniques: (histograms, point operations...)
6. Image pre-processing and filtering
7. Segmentation (study of different approaches: region, borders, etc.). of
8. Notion movement in a sequence of images.

II. Pattern recognition: 10 hours

1. Introduction to pattern recognition: (definition and scheme of a recognition system and its applications - acquisition - processing - post-processing).
2. Feature extraction.
3. Classification (Bayesian decision theory,...).
4. Recognition and interpretation

III. Introduction to image compression and watermarking: 15 hours

1. Definition,
2. Compression and decompression methods: lossy and lossless, accuracy/space/computation time trade-off, standards.
3. Different coding and quantification.

IV. Introduction to image synthesis: 15 hours

1. 2D and 3D transformations -Rasterisation and GPU programming
2. 2D and 3D display algorithms.
3. Lighting model - illumination - reflections - ray-tracing
4. Curve and surface modelling
5. Animation, Morphing, Skeletons and Reverse Kinematics
6. Virtual reality

PERSONAL WORK (Practical work)

Image processing: (digitisation, histogram display, binarisation, edge detection, median and average filters, etc.).

Classification and recognition: (-Recognition of isolated characters- Analysis of complex documents- Recognition of isolated handwritten numbers, etc.)

Image compression: Image compression using DCT, ACP, etc.

NB: for this part you can use the following software: PYTHON, Matlab and OpenCV.

Image synthesis AND Virtual Reality: use and manipulate OpenGL AND 3DS MAX for image synthesis; use and manipulate appropriate software VRJuggler, Virtools, Delta3D and VRML ; - Transforming an image into virtual reality

KNOWLEDGE TEST

- Continuous assessment 15%, lectures and practical work 20% and final exam 65%.

BIBLIOGRAPHY

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UET- Industrial Computing

Knowledge Area: Mathematical Tools

ETU code	Title of the module	Coefficient
ETU	Industrial IT	4

Hourly volumes		
Lectures	TD / TP	TOTAL
30	30	60

Semester :	4
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Prerequisites	<ul style="list-style-type: none">• Mathematics• Electricity• Electronics• Signal Processing
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OBJECTIVES :

The main objective of this course is to introduce the student to the basics of digital process control. The course is structured around the following topics:

- Understanding of the objectives and basic concepts of automation and automatic process control.
- Study of tools, methodologies and some algorithms and architectures related to digital process control.
- Introduction to the application of feedback control algorithms to computer systems.
- Familiarisation with the computerisation of the automated control of industrial processes with methods of description, functional specification and microprogramming.

CONTENT OF THE MODULE :

I. Introduction to Automation and Automatic Process Control

1. Presentation of Automation and the interests of Automation
2. General concepts of control systems

II. Digital Process Control

1. Role of the Computer in Automatic Process Control
2. Principles, Hardware and Software Aspects of Digital Control
3. Formalisms and Representations of Discrete Systems
4. Performance Analysis of Discrete Systems
5. Digital Controller Overview
6. Advanced Digital Control Architectures
7. Study of the Application of Digital Control to Computer Systems

III. Industrial IT

1. Basic structure of an automated industrial system
 - Operative part
 - Ordering section
2. Introduction to Grafcet and its Implementation.
3. Programmable Logic Controllers.

IV. Productivity element

PERSONAL WORK (Practical work)

- Simulation work to be carried out in the *Matlab* environment (*Control Toolbox*) - Simulink
- Application of numerical feedback control algorithms to improve the quality of service and performance of computer systems.
- Implementation of the grafcet.
- Programmable Logic Controllers.

KNOWLEDGE TEST

- Continuous assessment 15%, lectures and practical work 20% and final exam 65%.

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- W. Bolton, "*Les Automates Programmables Industriels*", Collection: Technique et Ingénierie, Dunod, 2010.
- K. Collins, "*The Programming of Programmable Logic Controllers*", Exposure Publishing, 2007.
- G. Blanchet, "*Commande et Temps Discret : Illustration Sous Matlab*", Hermès, 2003.
- J. H. Chow, D. K. Frederick, N. W. Chbat, "*Discrete-Time Control Problems: Using Matlab and the Control System Toolbox*", Thomson Engineering, 2003.
- M. Rivoire, J.-L. Ferrier, "*Matlab, Simulink, Stateflow*", Technip, 2000.
- A. Biran, M. Breiner, "*Matlab pour l'Ingénieur*", Pearson Education, 2009.
- "*Control Toolbox For Use with Matlab: User's Guide*", The MathWorks Inc.

UET - Geographical Information System

Knowledge Area: Information Systems

ETU code	Title of the module	Coefficient
ETU	Geographical Information System	2

Hourly volumes		
Lectures	TD / TP	TOTAL
15	15	30

Semester :	3 or 4
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Prerequisites	Basics of Databases, Probability and Statistics, Graph Theory
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OBJECTIVES :

- To clarify the concept of GIS, and then to provide a method for spatial analysis of map data.
- Study the acquisition, organisation and storage of data in databases satellite images or collected in the field.
- Modelling geo-spatial or simply geographical data in 2D and 3D for decision support

CONTENTS:

I. Introduction to GIS (2h)

1. History and development of GIS
2. Territory, geography and cartography
3. Geomatics and geodetic reference systems
4. Use and challenges of GIS (customers, finance, decision-making, human resources, etc.)
5. Comparison of GIS, CAD

II. Acquisition and analysis (4h)

1. Acquisition methodology
2. Studies of the main types of scanned or satellite images available (resolution, spectral band, swath, repetitive ...) and their distribution
3. Spatial vector analysis (multi-spectral image)
4. Spatial analysis using the raster model
5. Metadata and applicable standards
6. Study of common storage modes

III. Information processing and retrieval (7h)

1. Digital models and terrain topology
2. Architecture of geographic information systems
3. Coordinate systems and map projection
4. Transformation operations and image geo-referencing techniques
5. Digital terrain models (maps, 3D views)
6. Spatial data analysis and modelling
7. Relationship between graphic data and added alphanumeric data
8. Introduction to virtual reality and 3D scene animation

<p><i>IV. GPS system (2h)</i></p> <ol style="list-style-type: none"> 1. Presentation 2. Types of measures 3. Examples of applications
PERSONAL WORK
<ul style="list-style-type: none"> - Report following a guided tour of the INCT (National Institute of Cartography and Remote Sensing) in Hussein Dey - Discovery of ARCGIS software (visualisation and manipulation of geographical information) - Creation of a geographic database in ARCCatalog and Geodatabase in ARCGIS - Spatial analysis operations in vector and raster mode - Data representation in ARCMap and ARCVIEW - Spatial analysis micro project with ARCGIS (or Autodesk MAP 3D)
KNOWLEDGE TEST
-Continuous assessment 15%, lectures and practical work 20% and final exam 65%.
BIBLIOGRAPHY
<ul style="list-style-type: none"> • Poidevin, Didier, "La carte, moyen d'action. A practical guide to the design and production of maps" 1999 • Rodier, Xavier, "Le système d'information géographique TOTOP", Les petits cahiers d'Anatole, 4, 2000 • "Geographic Information System, Archaeology and History, History & Measurement", 2004, vol. XIX, n°3/4. • Denègre, Jean; Salgé, François, "Les systèmes d'information géographiques" coll. Que-sais-je? 3122, Paris, PUF, 1996 1st ed., 2001 2nd ed. • Longley, P. A., M. F. Goodchild, D. J. Maguire and D. W. Rhind. "Geographical informatics systems. Vol. 1 and 2. 2nd ed. New York, John Wiley, 1997. • Burroughs, P. A. "Geographical information systems for land resources assessment". Oxford, Clarendon Press 1986 • Laurini, R., and D. Thompson. "Fundamentals of spatial information systems. London, Academic Press, 1992

ETU- ICT in Organisation

Knowledge Area: Information Systems

ETU code	Title of the module	Coefficient
ETU	ICT in Organisation	3

Hourly volumes		
Lectures	TD / TP	TOTAL
30	15	45

Semester :	3
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Prerequisites	<ul style="list-style-type: none">• Analysis of organisations
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ICT (Information and Communication Technologies) play a key role in the management of companies. These technologies have become a factor of innovation and transformation of organisations.

OBJECTIVES :

- Understanding the impact of ICT on organisations
- Understanding the strategic role of ICT in organisations
- To be able to understand the functioning of ICT structures in organisations
- Understanding the basic principles of the CIO Dashboard

CONTENT OF THE MODULE :

I. ICT in Organisation: Global Analysis (4h)

1. T.I.C: clarification
2. Evolution of ICT: Technology Push & Market Pull
3. Structure of the ICT industry
4. Analysis of the role of ICT in the organisation (MIT survey results, S. Morton)

II. Strategic role of ICT in business (6 h)

1. Describe the role of information and the information system in the enterprise
2. Understanding IT strategy concepts
3. Which IT to solve which problems? Contributions of the 5 forces model of M. PORTER (rivalry between competitors, threat of new entrants, bargaining power of suppliers, bargaining power of customers, threat of substitute products and services)

III. IT in the structure of the organisation? What solutions? (10h)

1. Centralized computing
2. Disseminated computing
3. Outsourcing of IT services

IV. Internal structure of the ISD (Information Systems Department) in an Organisation (10 h)

1. Internal organisation of an IT structure in a large company
2. Role of CIOs in the organisation
3. CIO Dashboard

- Building principles
- The BSC or Balanced Scorecard applied to the ISD

RECOMMENDATIONS

TD/TP (15h) :

- TD on the application of Porter's 5 forces model to business cases.
- It is essential to invite professionals (CIOs) to speak to the students
- TD on CIO Dashboards

PERSONAL WORK

- Reading of various articles to complement the course
- Work in groups of 4 students (information gathering from CIOs)

KNOWLEDGE TEST

- 1 Written examination on the course
- 1 Continuous control of the TD (group work, participation mark, attendance mark)

BIBLIOGRAPHY

- J.F Challande, J.L Lequeux, "Le grand livre du DSI. Mettre en œuvre la direction des Système d'information 2.0", Eyrolles, 2009.
- S. Kaplan, "Tableau de bord prospectif", Editions d'Organisations, 2005.
- C. Legrenzi, P. Rosé, "Le tableau de bord du DSI, Pilotage, performance et benchmarking du système d'information", Dunod, 2007.
- S.C Morton, "The Competitive Enterprise of the Future", Editions d'Organisations, 1995.
- J.L Peaucelle, "La gestion de l'informatique", Editions d'Organisations, 1990.

ETU - Quality Assurance

Knowledge Area: Information Systems

ETU code	Title of the module	Coefficient
ETU	Quality Assurance	1

Hourly volumes		
Lectures	TD / TP	TOTAL
15		15
Semester :	3	

Prerequisites	<ul style="list-style-type: none">• Analysis and design of information systems• Project management
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To understand the interest of the "quality" approach in the field of science and technology, in order to have confidence and inspire confidence in the actions undertaken and the decisions taken for analysis, production, etc. in the context of IT projects.

OBJECTIVES :

- Knowledge of the spirit of the "quality" systems in their organisational aspects and in their technical requirements.
- The ability to insert one's action into such a system, to contribute to its establishment, life and evolution.
- Ability to accept and take into account the external regulatory elements that are required in the different fields of activity.
- Ability to participate dynamically in the continuous improvement of quality in the The meaning of induced or similar standards.

CONTENT OF THE MODULE :

I. Introduction

1. Quality assurance as a performance objective for the organisation
2. Introduction to normative standards, for "process" quality [ISO 9000], good practice standards
3. Introduction to quality auditing

II. Basic tools for quality assurance.

III. The architecture of organisational and technical quality documentation ;

IV. Principles of certification, accreditation, approval.

V. Taking into account the elements of professional, national and supranational regulation.

PERSONAL WORK

-Reading articles

KNOWLEDGE TEST

-Written examination on the course

BIBLIOGRAPHY

- J.P Huberac, Guide des méthodes de la qualité, MAXIMA, 1999
- R. Ernoul, "Le grand livre de la qualité", AFNOR,
- C. Jambart, "Assurance qualité", 3^{ème} édition, Economica, 2011
- C.Y Laporte, A. April, "Assurance qualité logicielle, Tome II", Hermès, 2011
- C. Villalonga, L'audit qualité interne, Dunod, 2003

UET - Decision Support Systems: Methods and Tools

Knowledge Area: Information Systems

ETU Code	Title of the module	Coefficient
ETU	Decision Support Systems: Methods and Tools	3

Hourly volumes		
Lectures	TD / TP	TOTAL
30	15	45

Semester :	3 or 4
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Prerequisites	<ul style="list-style-type: none">• Introduction to IS• Analysis of organisations
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OBJECTIVES :

- In-depth study of the concepts and models underlying decision support information systems. Particular emphasis will be placed on the development of methods for the design of DIS.
- In-depth study of the main decision support tools, including dashboards, SIAD, data warehouses and datamining.

CONTENT OF THE MODULE :

I. Introduction

II. Decision-making (6h)

1. Basic concepts (the decision maker, the decision)
2. Decision-making
 - The cognitive process of the decision maker
 - Typology of decision-making processes
 - The IDC model
 - The decision situation
 - Decision-making and work organisation
 - a. Structuring of decisions
 - b. Steering modes
 - Types of decision situations
 - a. Operational decisions
 - b. Adaptation decisions
 - c. Strategic decisions
3. Cooperative decision making

III. Decision support (9 h)

1. Definition
2. Introduction to multi-criteria decision support
3. Method and tools for individual decision support
 - Individual decision support tools
 - SIAD
 - Executive Information System (EIS)
 - Expert Systems (ES)
 - Query languages (SQL, QBE,...)

- DM
- Individual decision support methods
 - AMS method for dashboards
 - ROMC method
- 4. Method and tools for group decision support
 - Group decision support tools
 - GDSS
 - Workflow tools, Groupware tools (will be seen in the Cooperative IS course)
- 5. Method and tools for decision support at the organisational level
 - ODSS
 - OLAP tools, Data Warehouse (will be seen in the Advanced DB course)

PERSONAL WORK

- Creation of a dashboard
- Development of SIAD

KNOWLEDGE TEST

- Written examination on the course
- Continuous monitoring of the TDs

BIBLIOGRAPHY

- F. Adam, P. Humphreys, "Encyclopedia of Decision Making and Decision Support Technologies", Information Science Reference, 2008.
- E.D. Carlson, R.H. Sprague, "Building Effective Decision Support Systems", Prentice Hall, 1982.
- C.W. Holsapple, A.B. Whinston, "Decision Support Systems - A Knowledge Based Approach", West Publishing Company, 1996.
- P.G. Keen, M.S. Scott Morton, "Decision Support Systems", Addison Wesley, 1978.
- S. Kaplan, "Tableau de bord prospectif", Editions d'organisations, 2005.
- J.L. Le Moigne, "Les Systèmes de Décision", Éditions d'Organisation, 1973.
- J. Mélése, "Analyse Modulaire des Systèmes", Éditions d'Organisation, 1972.
- H. Mintzberg, "Structure et Fonctionnement des Organisations", Éditions d'Organisation, 1982.
- A. Newell, H.A. Simon, "Human problem solving, Prentice Hall", 1972.

UET - Human-Computer Interaction (HCI)

Knowledge Area: Software Engineering

ETU code	Title of the module	Coefficient
ETU	Human-Computer Interaction (HCI)	2

Hourly volumes		
Lectures	TD / TP	TOTAL
15	15	30

Semester :	3
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Prerequisites	<ul style="list-style-type: none">Object-oriented programming
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OBJECTIVES :

- Introduce the basic concepts of Human-Computer Interaction and give a complete overview of all aspects related to Human-Computer Interaction
- Mastering HMI design, from task modelling to design, development and evaluation of human-machine interfaces.
- Acquire the necessary skills for the development of Human-Computer Interface.

CONTENTS :

I. Basic HMI concepts (9 h)

1. Problems, objectives of the HMI
2. Notion of task
3. Task analysis models
4. Software architectures
5. Ergonomics of human-machine interfaces

II. HMI modelling (12 h)

1. Interaction models
2. Human Machine Interface Models
 - 1st generation interfaces
 - WYSIWYG interfaces
 - WYMP interfaces

III. Tools for the development and evaluation of HMIs (9h)

1. Toolboxes
2. Application skeleton
3. Interface generator
4. Web/mobile interfaces (adaptability, plasticity, multi-modality)
5. Evaluation of HMIs

KNOWLEDGE TEST

- Written examination on the course
- Continuous monitoring of the TDs

BIBLIOGRAPHY

- Ludovic Cinquin, Erika Duriot, Eric Groise, Olivier Mallassi, André Nedelcoux, David Rousselie, Vanessa Vimond " Les dossiers de l'écran : Utilisabilité et technologies IHM Editons OCTO, technologist 2010
- G. Calvary, "Human-computer interaction engineering: retrospective and perspectives, Interaction homme-machine et recherche d'information " Traité des Sciences et Techniques de l'Information, Lavoisier, Hermès, 2002, pp 19-63
- J. Coutaz, "Interface Homme-Ordinateur" Dunod, 1990.
- C. Kolski, "Analyse et conception de l'IHM, Interaction homme-machine pour les Systèmes d'Information" Editions Hermès, May 2001
- C.Kolski " Advanced Environments and HMI Evaluation, Interaction for Systèmes d'Information " Editions Hermès, May 2001
- J.F. Nogier " De l'ergonomie du logiciel au design des sites Web ", Dunod 2001.
- D. Norman "The Psychology of Everyday Things", Basic Books, 1988.
- J. Preece, "Computer Human Interaction", Addison Wesley.
- Dan Olsen, "Developing User Interfaces
- JefRaskin, "The Humane Interface
- Card, Moran, Newell, "Psychology Of Human Computer Interaction".

UET - Web Technologies and Development

Knowledge Area: Software Engineering

ETU Code	Title of the module	Coefficient
ETU	Technology and web development	4

Hourly volumes		
Lectures	TD / TP	TOTAL
15	45	60

Semester :	3
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Prerequisites	Software engineering
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OBJECTIVES :

Design and develop web applications.

- Assimilate the concepts related to the management of a Web-oriented project.
- Know and learn to select with justification the technologies and Web architectures to be used in a Web-oriented project (J2EE, XML, scripting languages, AJAX, Web services, etc.)
- Learn to use the tools that support web-oriented development.

CONTENTS

I. Static web

1. Introduction to HTML
2. Defining style and layout with CSS
3. Javascript programming

II. Dynamic web

1. History (CGI, DLL, scripting languages, JAVA applet, etc.)
2. Introduction to AJAX
3. Boosting websites with JQuery
4. What's new in HTML5
5. Multimedia with HTML5

III. Semantic Web

1. Metadata and search engines
2. The semantic web with HTML5

IV. Tools to support the creation of websites

1. Website creation with CMS
2. other

PERSONAL WORK
-

KNOWLEDGE TEST
<ul style="list-style-type: none">- Written examination on the course- Continuous monitoring of the TDs- TD exam

BIBLIOGRAPHY
<ul style="list-style-type: none">• Melancon, B., A. Micka, A. Scavarda, B. Doherty, B. Somers, K. Negyesi, J. Rodriguez, M. Weitzman, R. Scholten, and R. Szrama. 2011. The Definitive Guide to Drupal 7: Apress.• David M. 2010. HTML5: Designing Rich Internet Applications: Elsevier Science & Technology.• Lancker, L.V. 2009. jQuery: The JavaScript framework for Web 2.0: Editions ENI.• Guérin, B.A. 2007. PHP 5, MySQL 5, AJAX: train yourself to create professional applications: Editions ENI.• Ullman, L.E. 2003. PHP and MySQL for dynamic Web sites: Peachpit Press.

UET - Software Quality (QL)

Knowledge Area: Software Engineering

EU Code	Title of the module		Coefficient
ETU	Software quality (QL)		4
Hourly volumes			
Lectures		TD / TP	TOTAL
30		30	60
Semester :	4		
Prerequisites	<ul style="list-style-type: none">Introduction to Software Engineering		

OBJECTIVES :

- Definition of software quality, verification and validation.
- Distinguish between the different types of tests (unit, integration, acceptance)
- To enable the student to understand and apply the different types of tests
- To enable the student to audit processes and products related to software engineering activities
- Introduce the different metrics and methodologies for measuring reliability.

CONTENTS :

- I. Introduction to software quality and reliability
- II. Software prediction and sizing
- III. Size and effort prediction and measurement
- IV. Calculation model (COCOMO, COCOMO II)
- V. Measurement of external product attributes
- VI. Reliability models
- VII. Tests: types, tools and methods
- VIII. Validation of the development process

KNOWLEDGE TEST

- Written examination on the course
- Continuous monitoring of the TDs

BIBLIOGRAPHY

- Stephen H.Kan, Metrics and Models in Software Quality Engineering (2nd Edition), 2010, Addison-Wesley Professional, ISBN-10: 0201729156
- Linda Westfall, The Certified Software Quality Engineer Handbook, 2009, Quality Press, ISBN-10: 0873897307
- MuraliChemuturi, Mastering Software Quality Assurance: Best Practices, Tools and Techniques for Software Developers, 2010, J. Ross Publishing, ISBN-10: 1604270322

UET - Mobile Technology and Development 1 (TDM1)

Knowledge Area: Software Engineering

EU Code	Title of the module	Coefficient
UEF 2.2.1	Mobile Technology and Development (MTD)	2

Hourly volumes		
Lectures	TD / TP	TOTAL
15	15	30

Semester :	4
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Prerequisites	<ul style="list-style-type: none">• Object-oriented programming• Introduction to Software Engineering
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OBJECTIVES :

- Enable the engineer to assimilate the special constraints concerning the development of mobile applications
- Presentation of the essential techniques used for the complete design of a mobile system
- Discovering the different software and hardware components needed to build mobile systems
- Analysis and evaluation of the technical choices proposed by the major market players on the different software platforms they offer
- Development of test applications on different targets as a practical exercise.
- Using Android as the default target for mobile development

CONTENTS :

I. Introduction to mobile computing

- History
- Main mobile systems

II. Introduction to Android development

- Setting up the development environment
- Anatomy of an android application
- Creating applications on virtual devices
- Creation of applications on real devices

III. Android mobile application development

- Creation of user interfaces
- Activities and fragments

- Resources
- Views
- Menus and Dialogues
- Intentions

IV. Seminar on Mobile Application Development on Windows Phone

KNOWLEDGE TEST

- Practical examination on the course
- Continuous monitoring of the TDs

BIBLIOGRAPHY

- Djidel, D., and R. Meier. 2010. Developing business applications with Android 2: Pearson.
- SatyaKomatineni (Author), Dave MacLean (Author), Pro Android 4, 2012, APress, 2012, ISBN-10: 1430239301
- Reto Meier, Professional Android 4 Application Development, 2012, Jon Wiley & Sons

UET - Mobile Technology and Development 2 (TDM2)

Knowledge Area: Software Engineering

EU Code	Title of the module	Coefficient
ETU	Mobile Technology and Development (MTD)	2

Hourly volumes		
Lectures	TD / TP	TOTAL
15	15	30

Semester :	4
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Prerequisites	<ul style="list-style-type: none">• Object-oriented programming• Introduction to Engineering L• CT 1
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OBJECTIVES :

- Acquire more advanced knowledge of mobile application development in Android
- See through a seminar on alternative systems such as Windows Phone

CONTENTS :

I. Mobile data management

- Status and preferences
- Content providers
- SQLite databases

II. Background applications

- Services
- Threads
- Alarms

III. Sensors & Networks

- Physical and virtual sensors
- Movement & Orientation
- Maps & Geolocation
- Barometer
- Bluetooth & Wifi & NFC

IV. Advanced aspects

- Telephony & SMS
- Creating widgets
- Audio, video & camera

V. Deployment
VI. Seminar on Mobile Application Development on Windows Phone

KNOWLEDGE TEST
- Practical examination
- Continuous monitoring of the TDs

BIBLIOGRAPHY
<ul style="list-style-type: none">• Djidel, D., and R. Meier. 2010. Developing business applications with Android 2: Pearson.• SatyaKomatineni (Author), Dave MacLean (Author), Pro Android 4, 2012, APress, 2012, ISBN-10: 1430239301• Reto Meier, Professional Android 4 Application Development, 2012, Jon Wiley & Sons

UET -Engineering of secure protocols and software(ILPS)

ETU Code	Title of the module	Coefficient
ETU	Engineering of secure protocols and software	4

Hourly volumes		
Lectures	TD / TP	TOTAL
30	30	60

Semester :	3 or 4
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Prerequisites	SYS1, SYS2, RES1, RES2, Introduction to Computer Security, Software Engineering
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OBJECTIVES :

- Analyse security flaws in software architecture, communication protocols, programs, and Information Systems in general.
- Introducing safety into the software engineering life cycle
- Know how to use tools to check the security of software and communication protocols
- Design and implement secure IT applications in various domains (Web, E-commerce)

CONTENT OF THE MODULE :

Vulnerability and Security of Information Infrastructures

- Application and network vulnerability analysis
- Tools to defend against cyber-attacks
- Design of secure information system architectures

Specification and Validation of Secure Internet Protocols and Applications

- Analysis of security protocols: key agreement, authentication, identification,
- Analysis of attacks on communication protocols: replay, identity theft, session interleaving, integrity violations, etc.
- Specification and automatic verification of the security of Internet protocols and applications

Modelling and Design of Secure Software

- Security software vulnerability analysis
- Introducing safety into the software development life cycle
- Safety by design: Safe software design patterns
- Checking the security of the software :
 - static analysis of software safety
 - dynamic analysis of programme execution

Applications

- Security of e-commerce applications
- Web Application Security (OWASP)

Practical work

- Specification, Verification and Development of Internet Protocols and Applications
- Analysis of security flaws in programs (C, Java, etc.)
- Static program verification (secure software development)
- Implementing OWASP for secure web application development

PERSONAL WORK

Mini-project of your choice :

- Risk analysis and development of a security plan for an information system
- Development of Secure Web Services
- Design and specification of secure Internet protocols and applications with AVISPA

KNOWLEDGE TEST

Personal work 30%,

TP 40%,

Examination 30%.

BIBLIOGRAPHY

- Gildas Avoine, Pascal Junod, Philippe Oechslin " Sécurité Informatique : cours et exercices corrigés", Vuibert, 2010.
- Eduardo Fernandez-Buglioni, "Security Patterns in Practice: Designing Secure Architectures Using Software Patterns", Wiley, ISBN: 978-1-119-99894-5, April 2013.
- Brian Chess, Jacob West, "Secure Programming with Static Analysis", Addison Wesley, ISBN: 0-321-42477-8, 2007.
- AVISPA Project, "Automated Validation of Internet Security Protocols and Applications", User Manual, June 2006.
- AVISPA Project, "A Beginner's Guide to Modelling and Analysing Internet Security Protocols", June 2006

ETU - Watch

Knowledge area: General training and knowledge Enterprise

EU Code	Title of the module	Coefficient
ETU	Watch	2

Hourly volumes		
Lectures	TD / TP	TOTAL
15	15	30

Semester :	3 or 4
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Prerequisites	no
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OBJECTIVE

- What are the tools and means of information monitoring?

CONTENTS

1 - General presentation

- General & Definitions
- Types of monitoring
- Methods and tools

2 - Principles and methodology

- Monitoring process
- Collection and sourcing
- Analysis, synthesis and processing
- Sharing and dissemination

3 - Information sources

- Research methodology
- Internet search
- Search by field and intuitive search

4 - Search engines

- Evolution of the web
- Search engines
- Types of engines: linear, graphic, cluster, visual, multimedia
- Research practices

- Custom search
- Social, real time, reverse search
- Semantic, predictive and conversational search

5 - RSS feeds

- Definitions and standards
- Types of content
- RSS Feed Aggregators
- Types of aggregators (Netvibes, ...)
- Generate an RSS feed
- Benefits of RSS feeds

6 - Monitoring agents and tools

- Intelligent agents (Cybion, Digimind, ...)
- Structure and functioning of agents
- Monitoring agents (Webwatcher, ...)
- Conversational agents

7 - Processing and use of information

- Analysis, filtering and curation of information
- Information processing tools
- Dissemination of information
- Evaluation and improvements of the monitoring process

8 - Business intelligence

- Strategy and information
- Business intelligence & monitoring
- Strategic intelligence
- Business intelligence practice (in SMEs)
- Extending the use of business intelligence
- Economic intelligence in Algeria

KNOWLEDGE TEST
<ul style="list-style-type: none"> - 1 written exam - presentation

UET - MANAGEMENT (MNG)

Knowledge area: Business knowledge and general training

EU Code	Title of the module	Coefficient
ETU	Management (MNG)	2

Hourly volumes		
Lectures	TD / TP	TOTAL
30	0	30

Semester :	3 or 4
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Prerequisites	
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OBJECTIVES :

- Introduction to the principles of management.

CONTENTS :

1. Introduction and general principles of

management The company

The business concept

- Evolution of company organisations
- The main functions of companies

2. The Manager

Introduction to the Manager concept

- The qualities of the Manager
- Forms of Management

3. Manager's tools

- TDBs
- Business plan and pricing
- Tools for managing work teams
 - Motivational tools
 - Assessment tools

4. Non-specialty tools

- Finance for non-financial people
- Marketing for non-marketers
- HR for non-HR

PERSONAL WORK

- TBD

KNOWLEDGE TEST

ETU - Ethics and Professional Conduct (ECP)

Knowledge area: Business knowledge and general training

EU Code	Module title	Coef/Credits
ETU	Ethics and Professional Conduct (ECP)	2

Hourly volumes		
Lectures	TD / TP	TOTAL
30	0	30

Semester :	3 or 4
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Prerequisites	No
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OBJECTIVES :

- Preparing the engineer with a moral code and ethical principles
- To instil principles of professional conduct within an organisation.

CONTENTS :

- I. Responsibilities towards the company and the company
- II. Models of professionalism
- III. Ethics and practice

KNOWLEDGE TEST

- Written examination on the course
- Continuous monitoring of the TDs

BIBLIOGRAPHY

- Brennan, L.L., and V.E. Johnson. 2004. Social, ethical and policy implications of information technology: Information Science Pub.
- Bott, F. 1996. Professional issues in software engineering: UCL Press.