



Option Quality, innovation and reliability engineering

Syllabus

Option Quality,
innovation and
reliability engineering

Syllabus for semester 5

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|--|-----------------|--|
|  QIF | <i>English</i> |  UE 5-1 General courses |
| | 3A / Semester 5 | |
| | 28 h TD | |

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Level B2 from the CEFR

Objectives:

- Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of international environment

Organization of Language proficiency levels from a mock TOEIC test.

Validating a minimum score is a requirement in the final year to graduate as an Engineer.

Program:

Oral and written communication skills

Looking for a mandatory training experience abroad, writing a cover letter, a CV

Communication skills in companies (letters, memos, emails, phone conversations, interviews etc.)

Political, economic and social news

Delivering speeches.

Evaluation:

100% Continuous assessment



Learning outcomes:

The student can write a cover letter and a CV.

The student can speak for a few minutes on a topical issue or a topic of personal interest.

The student can take part in a conversation on simple topics that can be related to his/her personal interests.

The student can read an article or listen to a programme in a standard language and comment on it.

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|  QIF | <i>German / Spanish/French</i> |  | |
| | 3A / Semester 5 | | UE 5-1 |
| | 14 h TD | | General courses |

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Basic oral and written communication skills

Objectives:

- Strengthening the five skills to the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of international environment

Organization of Language proficiency levels

The target for the advanced group is CEFR B2 or C1 ; A2 or B1 for the intermediate group

A certification in Spanish is recommended for advanced students in final year

Program:

Oral and written communication skills

Looking for a training experience abroad, writing a cover letter, a CV, an abstract



Communication skills in Companies (letters, memos, emails, etc.)

Political, economic and social news

Evaluation:

100% Continuous assessment

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|---|-------------------------|---|-----------------|
|  | <i>Economics</i> |  | |
| | 3A / Semester 5 | | UE 5-1 |
| | 12 h TD | | General courses |

Keywords: economic growth, unemployment, wages, inflation, taxation, debt, market, economic liberalism, economic interventionism

Prerequisite: none

Objectives:

- To understand the economic environment
- To know more about the issues of economic debates

Program:



- Team challenges: « what do you know about economics”?»
- Understand the figures for the economy
- The general functioning of the market
- Schools of thought in economy
- Economic news

Evaluation:

100% Continuous assessment.

Learning outcomes:

The student must be able to understand the current economic situation (figures and mechanisms), to correctly use the notions addressed, to identify liberalism versus interventionism in economic policy.

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|  | <i>Sport</i> |  | |
| | 3A / Semester 5 | | UE 5-1 |
| | 12h TD | | General courses |

Keywords: Physical and Sports Education.

Prerequisites: None

Objectives:

Sports education courses help train future engineers by promoting physical and psychological development, by facilitating their integration, and by strengthening the team spirit and dynamics of the school.

Having the ability to work as part of a team, to communicate effectively, to build relationships of trust, be healthy and to withstand stress, are all qualities required of future engineers.

The sports activities proposed involve the acquisition of new motor skills, the implementation of individual and collective strategies, the resolution of problematic situations, while simultaneously requiring a constant adaptation of one's effort.

All of these elements contribute to the development of the engineers in the making and will be additional advantages for their training and their socio-professional integration.

Program:

The program of physical sports and artistic activities is built over the first four years of study at the school. Each engineering student must choose a different activity per semester from the five individual and team sports offered.

Evaluation:

100% Final assessment.

Learning outcomes:

Each student is expected to participate actively. This requires serious commitment, both physically by “doing” and also reflectively by demonstrating “know how”, with a cultural understanding of the activity. Physical investment will be carried out via the management of one's own physical and psychological integrity, and those of others (with adapted muscular, joint and cardio-respiratory warm-ups, and also respect of basic safety precautions).

The student will also have to demonstrate his / her ability to acquire skills specific to each sporting and artistic activity that he / she chooses. These teaching contents are grouped into three types of General Competences:



C1: To progress technically, tactically and / or behaviorally on one's individual and initial level.

C2: Achieve a performance in an enabling context.

C3: Produce the best possible result in a reference situation.

References:

Site UA Moodle: <http://moodle.univ-angers.fr/course/view.php?id=2687>

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|  | <i>School challenge integration</i> |  | |
| | 3A / Semester 5 | | UE 5-1 |
| | 26h TD | | General courses |

Keywords: Integration, project, challenge.

Prerequisite: none.

Objectives:

The challenge is aimed at students and is the simulation of a product development as it could be carried out in a company. The purpose of this project is to provide a basis for various courses in 3rd year. These courses can be introduced thanks to concrete situations/problems that the contestants faced during the week.

Program:

The challenge takes place over a whole week from Monday to Friday during the third week of September. Students are split into teams of 5. On Monday, Tuesday and Wednesday the robot will be designed, built and programmed. Thursday is free in order to let students attend “Campus Day” organized by the University of Angers. The qualification phases of the challenge take place on Friday morning. The finals of the challenge will be held on Friday afternoon. Sponsorship promoting EI3 then starts. During this week, students will also attend some specific “integration activities”:

- Theatrical Team Presentation
- Promotional poster
- Cooking contest
- Integration Quizz



Evaluation:

100% Continuous assessment

Learning outcomes:

The student will know the environment of the engineering school in which he will spend his next three academic years: places (two sites), rooms, schedules, teachers and especially his fellows. The student will evolve in projects groups quite numerous, to carry out a project with multiple competences.

References:

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|  QIF | <i>Applied Statistics</i> |  POLYTECH ANGERS | |
| | 3A / Semester 5 | | UE 5-2 |
| | 1,33h CM / 18,67h TD | | Applied Science |

Keywords: ANOVA, Linear regression, Kruskal-Wallis test, Friedman test, T, Tinn-R, Rcommander

Prerequisites: notions of courses Estimation and Tests (EI2 ISTIA) and Statistics and Probability (EI1 ISTIA)

Objectives: Introduce various exploratory statistical approaches that can be used depending on the nature of the available data. The illustration of the different statistical concepts discussed is performed using the R software (<https://www.r-project.org/>). The focus is on the interpretation of results and not on deepening theoretical concepts inherent in different approaches.



Contents:

- The R software (read and record data; simple functions; graphics; Tinn-R; Rcommander package)
- Analysis of vector-type data structures (statistical description of data, graphical data visualization)
- Analysis of variance (ANOVA)
- Kruskal-Wallis test (non-parametric equivalent of the ANOVA 1 factor)
- Friedman test (non-parametric equivalent of the ANOVA 2 matched factors)
- Linear regression

Evaluation: CC (100%)

Bibliography:

Vincent Goulet - Introduction à la programmation en R, ISBN 978-2-9811416-6-8, Bibliothèque et Archives Canada, 2016

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|--|-----------------------------|--|
|  QIF | <i>Dependability</i> |  UE 5-2 Applied Science |
| | 3A / Semester 5 | |
| | 5,33h CM / 18,67h TD | |

Keywords: Probability distributions, Reliability metrics, mortality models, Weibull paper, Qualitative Risk Assessment methods, Reliability Block Diagram

Prerequisites: Basic notions of Statistics and Probability (E11 ISTIA)



Objectives:

- To introduce the basic concepts and metrics of system reliability.
- To know how to use the various probability distributions.
- To address mortality models.
- To know how to use Weibull paper.
- To handle a reliable experience feedback.
- To assess and improve the reliability of a complex system for

Contents:

- Dependability characteristics (Reliability, maintainability, availability, safety)
- Reliability characteristics (Characteristic times, failure rate)
- Reliability Assessment (Predicted, experimental, operational)
- Probability distributions (discrete and continuous)
- Mortality Models (Research of distributions by mean of graphical methods)
- How to perform a reliability analysis
- Reliability Block Diagram

Evaluation: CC (100%)

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|  QIF | Optimization |  POLYTECH ANGERS | |
| | 3A / Semester 5 | | UE 5-2 |
| | 12h CM / 20h TD | | Applied Science |

Keywords: Optimization, Decision making, Linear Programming, Graph Theory, Random Phenomena, Gaming Theory

Prerequisites: Linear Algebra, Statistics

Objectives: Studying solving methods for combinatorial optimization problems, in deterministic and in random environments

Contents:

Introduction to linear programming

Geometrical solving

Simplex algorithm

Dual problem

Elements of graph theory

Notions used in graph theory

Critical paths; application: planning and scheduling problems

Maximum flow problems; application: allocation problems

Minimal value trees; application: transportation problems

Optimally valued Hamiltonian circuits; application: travelling salesman problem

Stochastic process

Stochastic process definition; Birth-death process; Poisson process

Forecasting

Renewal problem; preventive maintenance

Queuing theory

Inventory management: deterministic and step-by-step models

Introduction to Gaming Theory

Decision methods in random environment

Combined strategies and enterprise games

Evaluation: CC (100%)

Bibliography:

« Précis de recherche opérationnelle », R. Faure, Dunod, 1996

« Chemins, flots, ordonnancements », R. Faure, C. Roucairol, J. Tolla, Gauthier-Villars, 1976



« Méthodes d'optimisation combinatoire », I. Charon, A. Germa, O. Hudry, Masson, 1996

« Programmation linéaire », C. Guéret, C. Prins, M. Sevaux, Eyrolles, 2000

« Fiabilité et renouvellement des équipements », R. Faure, JL.Laurière, Gauthier-Villars, 1974

« Processus stochastiques, leurs graphes, leurs usages », Ph. Chrétienne, R. Faure, Gauthier-Villars, 1974

« Eléments de programmation dynamique », R. Faure, JL Laurière, Gauthier-Villars, 1979

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|  | <i>Mechanical Engineering I</i> |  | |
| | 3A / Semester 5 | | UE 5-3 |
| | 16h TD / 12h TP | | Engineering science |

Keywords: Engineering, components , CAD, applied mechanics

Prerequisites: None

Objectives: To give the basics of mechanical technology

Contents: -

Part 1: Mechanical Technology

: Ensure bases : Technical drawing / knowledge of mechanical components (bearing / gear / etc) / linking piece / kinematic - goal : understand a mechanism

Part 2: CAD

: Ensure CAD bases : design and / or use the digital model of a mechanism



Part 3: Applied Mechanics

: Ensure bases of applied Mechanics: force , torque, wrench , Equilibrium equations, mechanical calculation (speed , power, energy , etc.)

Evaluation: 100% CC

Bibliography:

- « Système mécanique : Théorie et dimensionnement », M. Aublin et co , Edition DUNOD
- « Guide des sciences et technologies industrielles » , JL. Fanchon,
- Site WEB : <http://www.aae.ens-cachan.fr/>
- Tutoriels Solidworks, disponibles à partir du logiciel

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|  QIF | Computer engineering I |  POLYTECH ANGERS | |
| | 3A / Semester 5 | | UE 5-3 |
| | 6,67h CM / 4h TD / 21,33h TP | | Engineering science |

Keywords: Algorithmics. Programmatic trees, problems of decomposition into sub-problems. successive refining processes. control structures. Imperative programming. C language

Prerequisites: Basics of algorithms, logic bases

Objectives: Knowledge and understanding of structured programming in imperative language (C) through a methodology (problem solving approach) for the construction algorithms by successive refining processes emphasizing aspects:

- algorithmic
- decomposition of problems into sub-problems (successive refinings)
- graphic design using programmatic trees / flow charts
- control structures (structuring algorithms)
- sub-programs (sub-problem is addressed via a subroutine itself refined through control structures)

With this training, students will be able to analyze a computer problem, propose a solution implementation through a modeling technique (programmatic trees / flow chart / control graph) & to realize it in a programming language related software . More generally, students will gain the "computational thinking" being able to make adequate abstractions to a problem, and combine theory with practice with the computer as a support.

Contents: -

Presentation of the problem-solving approach: decomposition into sub-problems and issues reminder sue algorithmic



- Introduction to Computer
- Construction of an algorithm
- Overview of the C language
- Modular programming
- Pointers
- Data Types
- Structure of a C program
- Standard Libraries

Evaluation: continuous assessment (100%)

Bibliography:

D. Gries - Science of programming - Springer-Verlag, 1981.

B.-W. Kernighan, D.-M. Ritchie - Langage C, Norme ANSI – 2e édition, Dunod, 20

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|  QIF | <i>Electronics</i> |  POLYTECH ANGERS | |
| | 3A / Semester 5 | | UE 5-3 |
| | 8h CM / 12h TD / 12h TP | | Engineering science |

Keywords: Analog electronics, operating regimes, diodes, transistors, amplifiers, filters, combinational logic circuits, digital circuit technology.

Prerequisites: Electronics basics

Objectives: This course of Electrical Engineering aims to provide solid knowledge of electronics field to students who will be able to design electrical circuits, to understand the principle of existing circuits, to predict their behavior and to check their good functioning. This course encompasses analog and digital electronics and it aims to give skills that help our students to interact with industrials in different domains such as automotive / aerospace.

Contents:

- **Foundations:** Components, electrical networks, linearity, notion of duality, generators (voltage / current sources), association of dipoles, instrumentation and measurement elements.
- **Methods and theorems**
 - Conventions, Kirchhoff equations, methods of voltage/current divider
 - Thevenin theorem
 - Norton's Theorem
 - Equivalent Thevenin-Norton
 - Superposition theorem
 - Millmann theorem
- **Operating regimes**
 - Steady regime
 - harmonic regime
 - Cissoidal regime
 - The notion of energy
- **Diodes (description and applications)**
 - Electrical characteristic of the diode
 - Modeling of diodes
 - Polarization of diodes
 - Applications of diodes (with a description of the alternator principle)
- **Transistors (description and applications)**
 - Working principle
 - Types of transistors
 - Electrical characteristic of transistors PNP/NPN
 - Polarization of a transistor
 - Determination of the conduction state of a transistor (applications)
- **Operational amplifiers**
 - Caractéristiques
 - Working principle
 - Adders and subtractors

- Advanced circuits (from theory to practice)
- **Combinatorial logic circuits**
 - Logical functions
 - Design of combutational circuits
 - Simplification of logic functions
 - Multiplexers/demultiplexers,
 - Encoders/decodeurs
 - Comparatos/adders/substractors
- **Overview on digital circuits technology**
 - TTL and CMOS circuits
 - PLD circuits
 - FPGA circuits

Evaluation : CC (100%).

Bibliography:

L'électronique en pratique, Charles Platt, 2013.



Comprendre l'électronique: de l'électricité jusqu'au numérique, Jean Herben, 2012.

Électronique. Systèmes bouclés, de communication et numériques: cours & exercices corrigés, Thierry Gervais, 2013.

Systèmes électroniques embarqués et transports, Philippe Louvel, Pierre Ezerzere, Philippe Jourdes. Auteur : Philippe Louve, 2015.

Conception de systèmes avec FPGA : bonnes pratiques pour le développement collaboratif, Philip Simpson (trad. de l'anglais par Daniel Etienne), 2014.

Logique combinatoire et composants numériques: Cours et exercices corrigés / Mouloud Sbaï, 2013.

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|  QIF | <i>Manufacturing Processes & Materials</i> |  UE 5-3 Engineering science |
| | 3A / Semester 5 | |
| | 8h CM / 20h TD / 4h TP | |

Keywords: Materials, Formatting, Manufacturing Processes

Prerequisites: Bases of the structure of the material and technical drawing

Objectives:



- Have an overview of conventional and new materials properties and behavior.
- Develop a choice of materials according to the needs and design constraints.
- To report the performance attributes and methods of the universe.
- Open to the diversity of industrial production.
- Being able to provide a manufacturing method for producing a part according to the material used

Contents:

- Introduction (1:20 CM): Overview of a panorama of the materials used in industrial engineering, different behaviors, properties and mechanical tests.
- Metals (2:40 and 5:33 CM TD): Steel / cast iron and aluminum
- Properties were writing, structures and functions.
- Collection and shaping (casting / machining / shaping / sintering / etc ...).
- Plastics (CM 2h40 and 5h33 TD): Synthetic Polymers
- Presentation polymers families, properties, structures, modes of production.
- Collection and shaping (extrusion / injection / blow / etc ...)
- New materials (CM 1:20 and 5:33 TD) Advanced Materials
- Introducing new materials and new related technologies (composites, nanomaterials, biomaterials, etc ...)
- Formatting and introduction to micro-mechanical analysis of composite materials.

- Rapid Prototyping (4h TP): a TP session to achieve rapid prototypes using different techniques available in the technology hall of ISTIA (3D printers, vacuum casting).
- Assembly technology (4h TD) processes and assembly lines (mechanical and electronic).

Evaluation: continuous assessment (100%)

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|  QIF | <i>Information retrieval and Patent Documentation</i> |  |
| | 3A / Semester 5 | UE 5-4 |
| | 12h CM / 16h TP | Quality and innovation methods |

Keywords : Technology watch-environmental monitoring, Patent search

Prerequisites: no prerequisites

Objectives: Mastering technology and concurential watch on a given subject

program:

Technology and concurential watch on the internet, M. Samier (8hCM + 8hTD)

1. INTRODUCTION

- 1.1. The Technology Watch, Competitive and Commercial
- 1.2. Some figures on the Eve
- 1.3. Examples of positive and negative impacts of technology

2. TECHNOLOGICAL

- 2.1. Definition of the company's business
- 2.2. The company markets
- 2.3. Alternative strategies

3. AND TECHNOLOGICAL INNOVATION

- 3.1. Notion of value and differentiation
- 3.2. How to pass the FCS lines of research?
- 3.3. The tree functions / principle / Technology

4. ORGANIZATION OF TECHNOLOGICAL

- 4.1. Networking and organization
- 4.2. operating a network
- 4.3. The program sheets

5. CASE STUDY

Patent search methodologie (M. Delamarre, 4hCM + 8hTD):

Industrial property introduction

- law definition and industrial property positioning
- industrial property concept definition (patent, trademark, registred design)

Patent : an ingeneer tool

- introducing industrial property title and its place in an ingeneer lifecycle
- patentability criterion
- patent document structure and informations included
- using patent in industrial engineering

Industrial property strategy : enterprise case studies

- trademark strategy
- registred design strategy
- patent strategy

Patent information retrieval

- patent information sources

preparing the patent search
method and technic to reach patent databases
mapping and exploitation of patent results

Tutorial classes agenda :

The tutorial classes aims to build up a technologic state of the art on a technic subject. The objectives of the tutorial is to realise a technical brief on a subject that the student doesn't know ex ante. The tutorial classes task are :



Tutorial explanation and organisation and first information seeking
group constitution (three students), subject affectation and tutorial explanation
general seeking information in french ingeneer technical sources

Seeking formalisation
building keywords tab (french - english)
keywords, strategy : synonym seeking
using IPC (international patent classification)
Mapping of the technical state of the art

Patent seeking strategy : Espacenet examination
Espacenet fonctionnality
Espacenet request
tab results
results analysis to bring exhaustive search
patent synthesis

Compilation of a technical report

Assessment: Continuous monitoring 100%

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|  | <i>Product lifecycle and Value engineering</i> |  |
| | 3A / Semester 5 | |
| | 8h CM / 12h TD / 4h TP | Quality and innovation methods |

Keys Words : System Engineering, Functional Analysis, Specification Deployment, Model of Design Organization

Prerequisites: Dessin industriel and CAO

Goals: To know the advanced tools of product development, ie deploy the functional specification, developing the ability to manage projects of disruptive innovation and technological innovation (C.IDI1)

Programme :

Lecture:

1. Design Theories
2. Model of Design organization
3. Model of Product Design Process
4. System Engineering
5. improvement of New product design Process
6. Product design and Need specification
7. External function analysis
8. Internal function analysis

Tutorials Practice:



1. choice of the system under study, determination of sub-systems and concurrent engineering organization;
2. analysis of need and information retrieval
3. functional review
4. Multivariate analysis of supply
5. Writing of Functional Specifications
6. decomposition of subsystems in technical functions and positioning of innovations
7. Composition of Functional Block Diagrams and propose areas for improvement;
8. Build two QFD matrices (Need / Requirements and Specifications / Design parameters) and evaluation of innovations

Assessment: 100% CC

Bibliography :

- « Méthodes de conception de produits nouveaux », DUCHAMP, Edition Hermès
- « Conception de produits mécaniques : méthodes, modèles et outils », TOLLENAERE, Edition hermès
- « Maîtriser l'innovation technologique : Méthodes et outils pour concevoir des produits nouveaux », Maurice Reyne, Edition Dunod
- YANNOU Bernard, ROBIN Vincent, CAMARGO Mauricio, MICHAËLLI Jean-Pierre, ROUCOULES Lionel, La conception industrielle de produits, Vol.2 – Spécifications, déploiement et maîtrise des performances, Hermes Sciences Lavoisier 2008, 251p., ISBN 978-2-7462-1922-9

YANNOU Bernard, CHRISTOFOL Hervé, JOLLY Daniel, TROUSSIER Nadège, La conception industrielle de produits, Vol.3 – Ingénierie de l'évaluation et de la décision, série Productique, Hermes Sciences Lavoisier 2008, 321p., ISBN 978-2-7462-1920-4

| | | |
|---|--|---|
|  | <i>Introduction to Quality and Innovation</i> |  |
| | 3A / Semester 5 | |
| | 4h CM / 20h TD | Quality and innovation methods |

Keywords: Quality approach, innovation process approach

Prerequisites: no prerequisites

Objectives: to teach the innovation process and the quality approach to give a global view of these processes to the students. to allow students to understand the position of the methodological courses in a global process.

Contents: The course is divided in 2 parts : 12hTD describing the innovation process and 4h CM +8h TD describing the Quality approach. -

The agenda of the innovation process is divided in courses of 1h20 like this :

3 courses of introduction of innovation :

Definitions ;

Risk of innovation : the degree, the nature et intensity of innovation ;

Panorama of innovation approaches : from project to open innovation

The innovation organisation : from start-up to innovation cell

Managing innovation portfolio

6 courses of working group on designing a product by a innovation process

First course : thématic choice and brainstorming

Second course : organise your ideas with the mindmapping

Third course : Formalise your ideas with idea sheet and review them

Fourth course : Evaluate your ideas with the radar method

Fifth course : Build you prototype or model (CAD, photomontage)

sixth course : Build your marketing speech to sell your idea

The quality program is as follows:

- Presentation of the World of Quality
- 8 principles of quality management
- Main Standards
- Approach Process and Quality Indicators
- Introduction to the 6 Sigma method
- Introduction to quality control, statistical control of processes

Evaluation: CC (100%)

Bibliography:

Boly Vincent, Camargo Mauricio, Morel Laure, ingénierie de l'innovation, Hermès science publications-Lavoisier, 2016, 288p.

Cap Gemini, *l'innovation, dernier des processus sauvages*, Edition cap gemini, 2013



Corsi Patrick, Neau Erwann, *les dynamiques de l'innovation*, Hermès science publications-Lavoisier, 2011, 231p.

Delamarre Anthony, *Contribution de la conception d'un produit concept à l'organisation des phases préliminaires du processus de conception – Application dans la société Rossignol S.A. dans le cadre de la mise en place d'une cellule d'innovation*, Thèse de doctorat soutenue le 11 décembre 2006

ISO 9001, ISO 10018, ISO 10006 ISO 14001, ISO 9100, ISO 18001, ISO 5725

Option Quality,
innovation and
reliability engineering

Syllabus for semester 6

| | | |
|---|-----------------|---|
|  | <i>English</i> |  |
| | 3A / Semester 6 | |
| | 20 h TD | General courses |

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Level B2 from the CEFR

Objectives:

- Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of international environment

The language proficiency levels are reviewed following a mock TOEIC test scheduled at the end of term 5.

Validating a minimum score is a requirement in the final year to graduate as an Engineer.

Programme:

Oral and written communication skills

Communication skills in companies (letters, memos, emails, phone conversations, interviews etc.)

Political, economic and social news

Writing abstracts;

Delivering speeches.

Regular practise of pronunciation and word stress.

Continuous assessment

The student can speak and give his/her opinion on a topical issue or a topic of personal interest.

The student can read a rather long article or listen to a radio/tv programme in a standard language and comment on it.

The student can make a professional oral presentation (presenting a company or a professional experience for example).

The student can comprehend a placement test.

The student can identify learning needs and correct them.

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|  QIF | <i>German/Spanish/French</i> |  |
| | 3A / Semester 6 | |
| | 14 h TD | General courses |

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Basic oral and written communication skills

Objectives:

- Strengthening the five skills to the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of international environment

Organization of Language proficiency levels

The target for the advanced group is CEFR B2 or C1; A2 or B1 for the intermediate group
A certification in Spanish is recommended for advanced students in final year.

Program:

Oral and written communication skills



Looking for a training experience abroad, writing a cover letter, a CV, an abstract

Communication skills in Companies (letters, memos, emails, etc.)

Political, economic and social news

Evaluation:

100% Continuous assessment.

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|  QIF | <i>Communication</i> |  | |
| | 3A / Semester 6 | | UE 6-1 |
| | 24h TD | | General courses |

Keywords: presentation, Internship report, poster

Prerequisites: none

Objectives:

- Present a synthetic work experience
- Write an internship report
- Create a poster
- Stakes of the intercultural

Program:

"Communicating with Effective Tools"

Know how to present an internship experience in a synthetic way:

- Identify the key elements to highlight
- Speak and captivate audiences and manage time
- Evaluate its performance and reflect on its areas for improvement

Design and write an internship report:

- Observe good internship reports, identify and synthesize the effectiveness criteria
- From less successful reports in previous years: reformulation of a problem, searching for information, rebalancing a plan, recalling recurring spelling mistakes, revising the rules of grammar and reintroducing the rules of presentation
- Present a team work from a power point

Designing and creating a poster:

- Observe, record and synthesize the effectiveness criteria of good posters
- Identifying the defects of posters
- Design a poster
- Create a poster
- Make a defense by using a poster as a communication medium

Knowing the stakes of intercultural in the company and abroad

Examination:



100% Continuous assessment: oral presentation and poster.

Learning outcomes:

The student will be able to present in a synthetic way a professional experience, to conceive and to write an internship report, to problematize a subject.

References:

- L. Bellenger, *Etre constructif dans les négociations et les discussions*, Entreprise Moderne d'Édition, 1984.
- A. Da-Silva, *Savoir se présenter efficacement*, Kindle, 2012.
- M.I. Laborde, *Ecrire un rapport de stage*, Mémo 122, Seuil, 2012.
- B. Lebel, *L'art des présentations power point*, Broché, 2012.
- P. Morin, *Organisation et motivations*, les éditions d'organisation, 1989.
- P. Oléron, *L'argumentation*, Presses universitaires de France, 1987.
- W. Ury, *Négocier avec des gens difficiles*, Paris, Le Seuil, 1990.

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|  | <i>Management and accounting</i> |  |
| | 3A / Semester 6 | |
| | 24h TD | General courses |

Management :

Keywords: organizational behavior, social influence, corporate structures, corporate culture.
Accounting

Prerequisites: none

Objectives:

- To understand the human behavior in the organizations.
- To meet the requirements to act more effectively in a professional situation.

Program:

Introduction to Organizational Behavior

- I- Individual characteristics and behavior
 - a. The diversity of individuals in organizations
 - b. Individual determinants of organizational behavior

- II- Groups
 - a. Group pressure or conformism
 - b. Standards in a group
 - c. Group decision-making

- III- The impact of the organizational context on behavior
 - a. Corporate structure and behaviors
 - b. Corporate culture

Evaluation:

100% Continuous assessment.

Learning outcomes:

Students must be able to analyze human behavior in organizational situations, to consider all possible determinants. Students must have understood the interest and limits of experiments in social psychology.

Bibliographie

Alexandre-Bailly F. (coll.) : « Comportements humains et management » Ed. Pearson Education, 2006
 Crozier M. et Friedberg E: « L'acteur et le système » Ed. Seuil, 1977
 Doise W. , Deschamps J-C. , Mugny G.: « Psychologie sociale expérimentale » Ed. Colin, 1991
 Robbins S. et Judge T.: « Comportements organisationnels. »: Ed Pearson, 2011
 Schermerhorn JR. Et al. (collectif): « Comportements humains et organisation » Ed ERPI, 2010

Accounting :

Keywords:

Financial analysis, functional assessment, working capital requirement, intermediate balances, net working capital, treasury

Prerequisites:

Knowledge in accounting.

Objectives:

- being able to understand the functioning of the elements of the balance sheet and the income statement
- to be able interact with accounting logic and the financial logic.

Program:

Chapter 1: Objectives of accounting

1. Objectives of accounting
2. The means of accounting
3. Recording
4. Accounts and « plan comptable général »
5. The principals of « partie double »
6. Rules of recording
7. The main documents of accounting

Chapter 2: Balance sheet and consequences on management

1. Liabilities and equity:
 - a. Equity
 - b. Resources from third party
 - c. Objects of resources
2. The main equilibrium of the balance sheet:
 - a. Measuring treasury
 - b. The main elements of the balance sheet
 - c. The main financial equilibriums
3. Analyzing balance sheet :
 - a. Forward cash planning
 - b. Variation of the net working capital
 - c. Variation of the working capital requirement
 - d. Methodology to calculate various variations

Chapter 3: income statement

1. Analyzing expenses and incomes:
 - a. Incomes
 - b. Expenses
 - c. Non cash incomes and expenses
 - d. Synthesis : relationship between treasury and net operating income
2. Intermediates balances;
3. Presentation of the intermediates balances;

4. Ratios

Evaluation:



50% Continuous assessment + 50% Final assessment.

Learning outcomes:

The student will be able to analyze the various elements of a balance sheet and the income statement.

References:

Colasse B., General Accounting, Economica, 2000.

| | | |
|---|----------------------------|---|
|  QIF | <i>Sport</i> |  |
| | 3A / Semester 6 12 h TD | |

Keywords: Physical and Sports Education.

Prerequisites: None

Objectives:

Sports education courses help train future engineers by promoting physical and psychological development, by facilitating their integration, and by strengthening the team spirit and dynamics of the school.

Having the ability to work as part of a team, to communicate effectively, to build relationships of trust, be healthy and to withstand stress, are all qualities required of future engineers.

The sports activities proposed involve the acquisition of new motor skills, the implementation of individual and collective strategies, the resolution of problematic situations, while simultaneously requiring a constant adaptation of one's effort.

All of these elements contribute to the development of the engineers in the making and will be additional advantages for their training and their socio-professional integration.

Program:

The program of physical sports and artistic activities is built over the first four years of study at the school. Each engineering student must choose a different activity per semester from the five individual and team sports offered.

Evaluation:

100% Final assessment.

Learning outcomes:

Each student is expected to participate actively. This requires serious commitment, both physically by "doing" and also reflectively by demonstrating "know how", with a cultural understanding of the activity. Physical investment will be carried out via the management of one's own physical and psychological integrity, and those of others (with adapted muscular, joint and cardio-respiratory warm-ups, and also respect of basic safety precautions).

The student will also have to demonstrate his / her ability to acquire skills specific to each sporting and artistic activity that he / she chooses. These teaching contents are grouped into three types of General Competences:



C1: To progress technically, tactically and / or behaviorally on one's individual and initial level.

C2: Achieve a performance in an enabling context.

C3: Produce the best possible result in a reference situation.

References:

Site UA Moodle: <http://moodle.univ-angers.fr/course/view.php?id=2687>

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|---|--------------------------------|---|
|  | <i>Entrepreneurship</i> |  |
| | 3A / Semester 6 | |
| | 12 h TD | General courses |

Keywords : Entrepreneurship, intellectual property,

Pré requis : none

Objectifs :

Discern the entrepreneurial spirit, the passion of entrepreneurs, their needs to create and innovate and their orientation towards action

Propose entrepreneurial projects

Establish creativity and monitoring methods

Build a CANVAS business model

Programme :

This introductory course in entrepreneurship aims to develop students' sense of initiative and entrepreneurship, in order to make them discover and exploit their full entrepreneurial potential. The program sweeps the entrepreneurial process. Students are introduced to the process of business creation: from idea creation to marketing. This course integrates the concepts of industrial property: brands, model and patent. The concepts are approached through the construction of a virtual business that the students will build on the basis of creativity methods, construction of CANVAS business model through the creation of the identity and values of the business to be built..

Evaluation :

100 % continuous assessment.

Acquis d'apprentissage :

The student is expected to identify the stages of business creation and be able to organize a process from the idea to the realization of his entrepreneurial project. The student must understand the issues of intellectual protection and know the broad outlines of the rules of law that govern all activity in society

Bibliographie :



BODELL, Richard W., Garry RABBIOR et Larry W. SMITH, *Entrepreneuriat - L'esprit d'aventure*, Montréal, Les Éditions de la Chenelière, 1994, 35 p. *

BODELL, Richard W., Garry GASSE, Yvon, et al., *PME - Posséder mon entreprise*, Vanier, Centre franco-ontarien de ressources pédagogiques, 1998, 281 p.* GASSE, Yvon, et al., *PME - Posséder mon entreprise*, (Guide de l'étudiant et guide pour réaliser le plan d'affaires),

JOHNSON, M. W. CHRISTENSEN C.M., KAGERMANN H. *Reinventing Your Business Model*. Harvard Business Review, Dec 2008

LE LOARNE, S. BLANCO, S. et al., *Management de l'Innovation*, Ed. Pearson, 2e édition, 2012

RIES E., *Lean startup*, ed Pearson, 2015, 319p

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|---|---|---|
|  QIF | <i>Mechanical Engineering II</i> |  |
| | 3A / Semester 6 | |
| | 4h CM / 28h TP | Engineering Science |

Keywords: Design of mechanical systems (components and materials), gear-wheels, rolling bearing, static indeterminacy, shaft coupling, power transmission

Prerequisites: Mechanical Engineering I

Objectives: To be able:

- To calculate the degree of static indeterminacy of a mechanism
- To choose component adapted to solicitations

Contents: -

Study of the degree of static indeterminacy of a mechanical system

Study and design of rotary guide elements

Study and design of power transmission:

Energy principles and efficiency



Kinematic simulation

Digital model

Evaluation: 100% CC

Bibliography:

- « Système mécanique : Théorie et dimensionnement », M. Aublin et co , Edition DUNOD
- « Guide des sciences et technologies industrielles » , JL. Fanchon,
- Site WEB : <http://www.aae.ens-cachan.fr/>
- Tutoriels Solidworks, disponibles à partir du logiciel

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|  QIF | <i>Industrial Engineering</i> |  POLYTECH ANGERS |
| | 3A / Semester 6 | |
| | 1.33h CM / 18.67h TP | Engineering Science |

Keywords: information system, Inventory management, Cost of production, Supply, Scheduling, Kanban, Physical distribution, Detailed production planning, Reverse logistics

Prerequisites: None

Objectives: To give students a global view of industrial management

Contents: -

Following an introductory session, the course is organized in 5 different times for the students.

4h TP: the Kanban (game)

4h TP: the PERT chart (game)

4h TP: Reversed class part 1: the students (in groups of 3) prepare a mini-course (1 page A4 recto-verso + 1 presentation of 15 minutes) on one of the following topics: Stock, Production cost, Supply, Scheduling, Kanban, Physical distribution, Detailed production planning, Reverse logistics

4h TP: Reversed class part 2: the students (in groups) present their courses to the other students



2.67h TP: Reversed Class Part 3: Students assessed their knowledge through a board game type questions / answers (questions / answers are done by each group during the Reverse Classroom Part 1 session)

Evaluation: 100% CC

Bibliography:

« Manuel d'organisation appliquée : Reconcevoir les processus et coordonner les activités ». Jacques Herard, Edition Dunod

Techniques de l'ingénieur : section Génie industriel/Management industriel

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|  QIF | <i>Computer engineering II</i> |  |
| | 3A / Semester 6 | |
| | 4h CM / 5.33hTD / 6.67h TP | Engineering Science |

Keywords: MERISE, RDBMS, ACCESS, model entity association, CDM, LDM, SAT

Prerequisites: None

Objectives:

Know how to apply the method MERISE design & realization of an information system. Knowing how to use Access (relational DBMS Windows). Know how to design & produce an Information System with Access MERISE applying the method on a concrete example

Contents:

-

A mix of theoretical and practical activities

- Principle of the method MERISE
- Conceptual Data Model
- Conceptual Model of Treatment
- Organizational Model Treatments
- Organizational Data Model
- Logical Data Model
- Treatments of Logic Model
- Data Model & Physical Treatments
- Design & develop an RDBMS in Access



project:

The aim of this project is to apply the MERISE design method on a concrete example and become familiar with Relational Database Management System in Windows environment (ACCESS). This work is done in groups of 2 students.

Evaluation: continuous assessment (100%)

Bibliography: Comprendre Merise : Outils conceptuels et organisationnels de Jean-Patrick Matheron

Exercices et cas pour comprendre MERISE de Jean-Patrick Matheron

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|  | <i>Automation</i> |  |
| | 3A / Semester 6 | |
| | 4h TD / 12h TP | Engineering Science |

Keywords:

Prerequisites:

Objectives: This course aims to provide basic principles of programmable logic controllers (PLC) to student who will be able to understand the architecture of a PLC, to configure it and to program sequential digital systems using different programming languages (SFC, LADDER, LIST). Thus, students will be able to interact with different services of industry especially the industrial automation service.

Contents:



Foundations of Programmable Logic controllers

- **Sequential digital systems**
- **Sequential function chart (SFC) language**
 - o Definition, structure and constitutive elements
 - o Applications
- **LADDER (LD) programming**
 - o Basic instructions
 - o Comparison instructions
 - o Mathematical instructions
 - o Data management instructions
 - o Instructions for subprograms
 - o Counting instructions
 - o Transforming SFC into LD program
 - o Applications
- **LIST programming**
 - o Basic instructions
 - o Comparison instructions
 - o Mathematical instructions
 - o Data management instructions
 - o Instructions for subprograms
 - o Counting instructions
 - o Transforming SFC into LIST program
 - o Applications

Evaluation: 100% CC

Bibliography:

Automates programmables industriels / William Bolton ; traduction de Hervé Soulard, 2015.
 Langages de programmation pour systèmes automatisés : norme CEI 61131-3, Nicolas Jouvray, Techniques de l'ingénieur, 2008.
 Le GRAFCET (Texte imprimé) : conception, implantation dans les automates programmables industriels, Simon Moreno, 2009.

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|---|--|---|
|  QIF | <i>Process : optimization and control</i> |  |
| | 3A / Semester 6 | |
| | 16h CM / 16hTD / 8h TP | Industrial production |

Keywords: design of experiments, analysis of variance, control chart, capability

Prerequisites: statistics, linear algebra

Objectives: Design and use experiments, monitor process stability

Contents:

Bases of industrial process optimization

Experiment principles

Comparison statistical tests and Analysis of variance

Test for distributional adequacy

Two-level factorial experiments

Taguchi experiments (design and interpretation)

Capability



Control chart for continuous data

Control chart for discrete data

Evaluation: 100% CC ? Half-term exam ?

References:

- « La méthode des plans d'expériences », J. Goupy, Dunod, 1988
- « Conception de la qualité : les plans d'expériences », R.H. Lochner, J.E. Matar, AFNOR, 1992
- « Pratique industrielle de la méthode Taguchi », J. Alexis, AFNOR, 1995
- « Les plans d'expériences », G. Sado, MC. Sado, AFNOR, 1991
- « Design and analysis of experiments », D. C. Montgomery, Wiley, 2001
- « Design and analysis of experiments », A. Dean, D. Voss, Springer, 1999
- Les livres de Gérald Baillargeon.
- Les livres de Maurice Pillet
 - *Six Sigma, comment l'appliquer*, 2013,
 - *Appliquer la maîtrise statistique des processus SPC/MSP*, 2005,
 - *Les plans d'expériences par la méthode Taguchi*, 1997,

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|---|--------------------------------------|---|
|  | <i>Metrology and Quality Control</i> |  |
| | 3A / Semester 6 | |
| | 9.33h CM / 18.67h TD / 12h TP | Industrial production |

Part 1 (Abdérafi CHARKI)

(4h CM / 5.33h TD / 8h TP)

Mots-clés : Traceability, connection, verification, calibration, measuring chain, measurement uncertainties, GUM

Pré requis : Basic Statistics, Instrumentation and Sensors

Objectifs :

Knowing the basic concepts of metrology (all disciplines).

Understand that a measure is still affected by uncertainty and learn to express it.

Programme :

- Organization of industrial metrology, legal and scientific
- Terms of the International Vocabulary of Metrology (VIM)
- Accreditation, calibration, verification, EMT, connection, reference standard and work, etc. ?
- Management System of Measurement (ISO 10012) in a company
- Ensure traceability of measurement
- Different sources of uncertainty of a measurement chain or a measurement process and methods of propagation of uncertainties
- Reminders on differential calculus
- Applications (1) of the conventional method for estimating uncertainty from physical models.
- Applications (1) of the measurement uncertainty estimation method of the GUM (methods of types A and B standard uncertainty, expanded uncertainty)
- (2) Applications for the measurement of electrical quantities, metrology temperatures, volumes and masses.

Evaluation : continuous assessment (100%)

References :

ISO 10012, GUM, VIM

Incertitudes de mesure - Tome 2, Applications concrètes pour les essais, EDP Sciences, A. Charki

Incertitudes de mesure - Tome 1, Applications concrètes pour les étalonnages, EDP Sciences, A. Charki

Part 2 (Teodor TIPLICA)

(1.33h CM / 6.67h TD)

Keywords: standard measurement method, capability, Accuracy, Precision, repeatability, reproducibility, ISO5725

Prerequisites: notions presented in Estimation and Tests (EI2 ISTIA) and Statistics and Probability (EI1 ISTIA)

Objectives: Show how to evaluate the accuracy of a standard measurement method by inter-laboratory comparisons. Show how to evaluate the capability of a measurement system according to the standard Ford.

Contents:

- Accuracy of results and measurement methods (definitions; statistical model to estimate the accuracy; planning experience of estimating accuracy; estimation of the precision of a measurement method; estimation of the correctness of a measurement method).
- Evaluation of the capability of a measurement system (steps of an R & R study, capability coefficients; relations between capability coefficients; how to plan a R & R study; what should we do when bad results?)

Evaluation: 100% CC

Bibliography:

- BARRENTINE Larry B., Concepts for R&R studies – 2nd ed., ASQ Quality Press, 2003
- QUEVAUVILLER Philippe, Métrologie en chimie de l'environnement, Editions Technique et Documentation, 2001
- Measurement Systems Analysis – Reference Manual – Chrysler Corporation, Ford Motor Company, General Motors Corporation, 1995
- Méthodes statistiques, tome 5 – Traitement des résultats de mesure, 7ème édition, Qualité et Efficacité des Organisations, AFNOR, 1996
- NF ISO 5725-1 : Exactitude (justesse et fidélité) des résultats et méthodes de mesure ; partie 1 – principes généraux et définitions, AFNOR, 1994
- NF ISO 5725-2 : Exactitude (justesse et fidélité) des résultats et méthodes de mesure ; partie 2 – méthode de base pour la détermination de la répétabilité et de la reproductibilité d'une méthode de mesure normalisée, AFNOR, 1994
- NF ISO 5725-4 : Exactitude (justesse et fidélité) des résultats et méthodes de mesure ; partie 4 – méthodes de base pour la détermination de la justesse d'une méthode de mesure normalisée, AFNOR, 1994

Part 3 (Sylvain VERRON)

(1.33h CM / 6.67h TD / 4hTP)

Keywords : Statistical control, sampling efficiency curve, probability laws

Prerequisites : Statistics and Probability

Objectives : Develop a sampling plan for control at reception

Program :

Statistical control, sampling, efficiency curve

Normalized sampling plan for attributes characteristics:

Single plans

Double plans

Multiple plans



Progressive plans

Normalized sampling plan for continuous characteristics:

Examination : 100% continuous assessment

Bibliography

« Méthodes statistiques : contrôle statistique d'acceptation », AFNOR, 1996

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|  QIF | <i>Problem solving</i> |  UE 6-4 Industrial design |
| | 3A / Semester 6 | |
| | 8h CM / 16h TD | |

Part 1 (Michel Kermorvant)

(4h CM / 8h TD)

Keywords: dysfunction, non-conformities, corrective actions, preventive actions

Prerequisites: None

Objectives: To understand the improvement approaches based on the use of a structured problem-solving approach

Contents:

Concept of structure
The functioning of a structure
Concept of dysfunction
Realized products and services
Concept of compliance and non-compliance

nonconformities treatment device

Need to solve recurring problems. Corrective Action Concept
nonconformities analysis and dysfunction encountered
Prioritization (Pareto Law)

known causes, possible immediate actions, opening an action plan
Cause unknown
Constitution of a working group
The causes (of experience brainstorming-Plan)
Ranking 5M detected causes (Ishikawa)
Search exploitable causes (why 5)
Opening an action plan
monitoring of action plans
Closing action plans
Generalization capitalization. Preventive Action Concept

related procedures
Management of problem solving activity
Variations and modifications of the method (PDCA, Kaizen, Hoshin, 8D)

Evaluation: continuous assessment 100%

Bibliography: Résolution de problèmes Crépin/Pernin/Robin édition Eyrolles
PDCA et performance durable : Chardonnet édition Eyrolles

Part 2 (Pascal Crubleau)

(4h CM / 8h TD)

Keywords: Principles inventive, Problem Solving, Innovation, TRIZ

Prerequisites: None

Objectives: Formulate a problem as a contradiction, Know how to use a DB principles of resolution

Program :

1. The TRIZ theory

- Causal Modeling a multifactorial problem situation
- The degree of inventiveness
- Notions of useful features and harmful functions
- Expression and resolution of a technical contradiction
- Application of generic principles of resolution



2. Method Substance-Field

- causal mico Modeling a problematic situation
- Application generic standard resolution

Evaluation: continuous assessment 100%

References:

- « Découvrir et appliquer les outils de TRIZ », Denis CHOULIER, Edition CHANTIERS, Université Technologique de Belfort-Montbelliard.
- « And Suddenly the Inventor Appeared », Genrich ALTSHULLER, Technical Innovation Center, INC.

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|---|---------------------------------|--|
|  QIF | <i>Innovation method</i> |  UE 6-4 Industrial design |
| | 3A / Semester 6 | |
| | 8h CM / 6.67h TD / 25.33h TP | |

Keys Words : System Engineering, Functional Analysis, Specification Deployment, Model of Design Organisation

Prerequisites: UE Mécatronique, Dessin industriel et CAO

Goals : To know the advanced tools of product development, ie deploy the functional specification, developing the ability to manage projects of disruptive innovation and technological innovation (C.IDI1)

Programme :

Lecture :

1. Innovation theories
2. Design Theories
3. Model of Design organisation
4. Model of Product Design Process
5. System Engineering
6. improvement of New product design Process
7. Product design and Need specification
8. External function analysis
9. Internal function analysis
10. Ecodesign



Tutorials Practice :

1. choice of the system under study, détermination of sub-systems and coucourent engineering organization;
2. analysis of need and information retrieval
3. functional review
4. Multivariate analysis of supply
5. Writing of Functional Specifications
6. decomposition of subsystems in technical functions and positioning of innovations
7. Composition of Functional Block Diagrams and propose areas for improvement;
8. Build two QFD matrices (Need / Requirements and Specifications / Design parameters) and evaluation of innovations
9. Tools for ecodesign

Assessment: continuous assessment through tutorials

Bibliography :

- « Méthodes de conception de produits nouveaux », DUCHAMP, Edition Hermès
 - « Conception de produits mécaniques : méthodes, modèles et outils », TOLLENAERE, Edition hermès
- « Maîtriser l'innovation technologique : Méthodes et outils pour concevoir des produits nouveaux », Maurice Reyne, Edition Dunod

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|--|----------------------------|---|
|  QIF | Engineering Project |  UE 6-4 |
| | 3A / Semester 6 | |
| | 12h TP | Industrial design |

Keywords: project management, collaborative engineering, collaborative design, project organisation

Prerequisites: *Introduction to Quality and Innovation, Mechanical engineering*

Objectives:

Implement a team project of more than six people in a limited time

Know how to manage the project organization to make the deliverables on time

Manage internal and external communication in synchronous and asynchronous mode

Contents:

The sequence is divided into three sessions of four hours to design an automatic coffee machine per percolation. The input of the system is the coffee beans and the output must be an espresso. One group works on the Water subsystem and the other on the coffee subsystem, all of the two groups must provide the plans of the complete machine. The project is carried out as follows:

First session (4 hours)

Breakdown into two groups in two separate project rooms
Discovery of the teams of design and implementation of the organization, distribution of tasks, and choice of collaborative tool (google drive, mail, chat ...)

- Work group water system

Functional analysis system water tank and coffee bean and grain mill

Specifications and preparation of the exchange of specifications between group A and group B

Development of Ideas

- Work group coffee bean Functional analysis system manufacturing and removal of ground coffee pellets

Specifications and preparation of the exchange of specifications between group A and group B

Development of Ideas

Second session (4 hours)

Development of ideas sheets

Objective: to obtain a CAD of the subsystem to be designed

Third session (4 hours)

Integration of solutions and design of a common housing

Writing a common account with a personal part written by each student.

Feedback on design and collaboration is requested.

Evaluation: CC (100%)

Bibliography:

Conception collaborative des systèmes et composants mécaniques, Pierre DEVALAN, Jean-Charles DELPLACE , technique de l'ingénieur, 2010



L'ingénierie concourante- Un nouveau professionnalisme, Christophe GOBIN,technique de l'ingénieur, 2015

Modélisation des processus d'innovation en PME, Hervé Christofol, Patrick Corsi, Pascal Crubleau, Anthony Delamarre, Henri Samier, archive ouverte de l'université d'angers, 2016

La conception industrielle de produits,Volume 3 ingénierie de l'évaluation et de la décision, Paris : Hermes science : Lavoisier, impr. 2008

Option Quality,
innovation and
reliability engineering

Syllabus for semester 7

| | | |
|---|-----------------|---|
|  QIF | English |  |
| | 4A / Semestre 7 | |
| | 28 h TD | General course |

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Level B2 from the CEFR

Objectives:

- Validating TOEIC minimum score to graduate as an Engineer.
- Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of international environment

Organising a mock TOEIC at the beginning of term 7 for setting up language proficiency groups.

Programme:

- Practising oral and written communication skills.
- Strengthening grammar skills.
- Regular practise of pronunciation and word stress.
- Communication skills in companies.
- Political, economic and social news
- Delivering speeches.

Evaluation:

Continuous assessment (100%)

Learning outcomes :

- The student can speak about a technical issue related to his/her field of expertise.
- The student can infer and understand gist, purpose and details in a spoken document related to a general or technical topic.
- The student can infer and understand gist, purpose and details in a written document related to a general or technical topic.
- The student can speak and write in a clear and fairly complex language.

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|--|----------------------------------|---|
|  QIF | <i>German / Spanish / French</i> |  UE 7-1 General course |
| | 4A / Semestre 7 | |
| | 14 h TD | |

Keywords: Communication skills, Cross-cultural skills

Required: Basic oral and written communication skills

Objectives:

- Strengthening the five skills to the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of international environment

Organization of Language proficiency levels

The target for the advanced group is CEFR B2; A2 or B1 for the intermediate group

A certification in Spanish is recommended for advanced students in final year



Programme:

- Oral and written communication skills
- Communication skills in Companies (letters, memos, emails, etc.)
- Political, economic and social news
- Delivering speeches

Evaluation:

Continuous assessment

Learning outcomes :

| | | | |
|---|--|---|----------------|
|  | Global responsibility et prevention of occupational risks |  | |
| | 4A / Semestre 7 | | UE 7-1 |
| | 12h TD | | General course |

Keywords: occupational health and safety, occupational risks, ergonomic, occupational psychology, musculo skeltal disorder, psychosocial risks, single document

Prerequisites: Business organization, rules and regulation

Objectives :

This module is constructed on the base of the referential BES&ST «Bases Essentielles en Santé et Sécurité au Travail» formalised in 2005 (Inrs). It is intended to give to any future engineer essential skills in order to integrate occupational hygiene within all of his/her professional activities.

✓ **Identify in any working organization the human, social, economic and legal issues of occupational hygiene**

Regulatory and normative context, responsibilities
Internal and external actors of occupational hygiene
Occupational hygiene indicators and sources of information

✓ **Integrate occupational hygiene in the management of its activities and projects**

Vocabulary and definitions - Identify hazardous situations
Take into account the human factor at work including physical, physiological, cognitive and psychological dimensions, and the working reality
Identify et assess risks: a priori and a posteriori
Ergonomics, tools and methods
« Unique document » for risks assessment: methods and issue
Risks prevention – Prevention principles

✓ **Contribute to occupational hygiene management**

Occupational hygiene management and integrated management system, management commitment
Safety culture - Reflection on Lean Management: which issue for health at work?

Programme : Tutorials

- ✓ Practice and study on concrete cases based on videos, photos and if possible role-playing
- ✓ Calculation, analyses and interpretation of occupational hygiene indicators
- ✓ Analysis of the different dimensions of an occupational accident : causal tree method
- ✓ Identification and risks assessment : « unique document » construction and action plan

Evaluation :

100% Continuous assessment

Learning outcomes :



Integration of occupational hygiene in its professional activity

Bibliographie :

Sources d'information en santé et sécurité au travail, L. Laborde, B. Berlioz, M. Ferreira, *Techniques de l'ingénieur, collection Sante et sécurité au poste de travail, article se3950*, octobre 2008.

- Le guide de la sécurité au travail - Les outils du responsable, B. Péribère, *Ed. AFNOR*, 218 p., 2013.

- www.inrs.fr; www.anact.fr; www.travail-et-securite.fr

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|  QIF | <i>Sport</i> |  |
| | 4A / Semestre 7 12 h TD | |

Keywords: Physical and Sports Education

Prerequisites: None

Objectives:

Sports education courses help train future engineers by promoting physical and psychological development, by facilitating their integration, and by strengthening the team spirit and dynamics of the school.

Having the ability to work as part of a team, to communicate effectively, to build relationships of trust, be healthy and to withstand stress, are all qualities required of future engineers.

The sports activities proposed involve the acquisition of new motor skills, the implementation of individual and collective strategies, the resolution of problematic situations, while simultaneously requiring a constant adaptation of one's effort.

All of these elements contribute to the development of the engineers in the making and will be additional advantages for their training and their socio-professional integration.

Program:

The program of physical sports and artistic activities is built over the first four years of study at the school. Each engineering student must choose a different activity per semester from the five individual and team sports offered.

Evaluation:

100% Continuous assessment

Learning outcomes:

Each student is expected to participate actively. This requires serious commitment, both physically by "doing" and also reflectively by demonstrating "know how", with a cultural understanding of the activity. Physical investment will be carried out via the management of one's own physical and psychological integrity, and those of others (with adapted muscular, joint and cardio-respiratory warm-ups, and also respect of basic safety precautions).

The student will also have to demonstrate his / her ability to acquire skills specific to each sporting and artistic activity that he / she chooses. These teaching contents are grouped into three types of General Competences:



C1: To progress technically, tactically and / or behaviorally on one's individual and initial level.

C2: Achieve a performance in an enabling context.

C3: Produce the best possible result in a reference situation.

References:

Site UA Moodle : <http://moodle.univ-angers.fr/course/view.php?id=2687>

| | | | |
|---|--|---|----------------|
|  QIF | <i>Professional Communication</i> |  | |
| | 4A / Semestre 7 | | UE 7-1 |
| | 20 h TD | | General course |

Keywords : Professional project, curriculum vitae, cover letter, meeting animation

Prerequisites : French language written and spoken

Objectives :

- Preparing for job search
- Meeting and group animation

Programme : « Become an operational strategist »

- I. Preparation to appraisal meeting
 - Enhancing the professional project and motivations
 - The curriculum vitae
 - Decrypt a traineeship/job offer
 - Cover letter writing
 - To be efficient during the appraisal meeting

- II. Meeting animation
 - Organization of a meeting
 - Animation of a meeting
 - The knowledge and the appropriate choice of the animations technics
 - How to react against
 - How to deal with the other participants of the meeting

Evaluation :

- Oral checks (50%)
- Written tests (50%)

Learning outcomes :

Bibliographie :

- L. Bellenger, *Etre constructif dans les négociations et les discussions*, Entreprise Moderne d'Édition, 1984.
- V. Billaudeau, *Le recrutement : quelles pratiques actuelles ?*, Julhiet Editions, 2012.
- M.J Chalvin, *Prévenir conflit et violence*, Paris, Nathan, 1996.
- S. Milgram, *Soumission à l'autorité*, Calman Lévy, 1974.
- R. Mucchielli, *La conduite des réunions: Les fondamentaux du travail en groupe*, ESF éditeur, réédité, janvier 2016.
- P. Morin, *Organisation et motivations*, les éditions d'organisation, 1989.
- P. Oléron, *L'argumentation*, Presses universitaires de France, 1987.
- C.Papetti, B. Dogor Di Nuzzo, *Un CV réussi !*, Ellipses, 2016.
- D. Pérez, *Le guide du CV et de la lettre de motivation*, Solar, 2014.
- W. Ury, *Négocier avec des gens difficiles*, Paris, Le Seuil, 1990.

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|  QIF | <i>Systems engineering & Mechatronic</i> <i>(Multiphysical modeling, simulation)</i> <i>(Software & Hardware)</i> |  |
| | 4A / Semestre 7 | |
| | 8h CM / 30h TP | Science and technologies |

Keywords: Mechatronics, Integrated design, Bond Graphs, Simulation, Dynamic Modeling, Automatic control

Prerequisites: Mechanical engineering, electronic engineering, physical modeling, programming

Objectives:

- Acquiring multidisciplinary skills on dynamic modeling of Engineering systems independently of their physical nature
- Systematic approach for global analysis of complex multiphysical systems
- Finding innovative engineering solutions
- Deduction in systematic way state equations and their simulation of industrial systems
- Training with new software's tools for integrated design and simulation of industrial systems



Contents:

- Introduction to mechatronics systems
- Methodology for testing in industry
- Introduction to Bond Graph methodology
- Integrated design for multiphysical systems
- Causality and systematic generation of behavioural equations
- Mathematical modeling and structural analysis
- Embedded diagnosis approaches
- Conclusion

Evaluation: 50% CC+50%Labs

Bibliography:

- D. Karnopp, R. Rosenberg "Systems dynamics : a unified approach", John Wiley & sons, 1975, 1991 (2nde édition)
- R. Rosenberg, D. Karnopp "Introduction to physical system dynamics", series in mechanical engineering, Mac Graw Hill, 1983
- J. Thoma "Introduction to bond graphs and their applications", Pergamon Press, 1975
- N. Chatti et al. "Model-based approach for fault diagnosis using set-membership formulation" International journal of Engineering Applications of Artificial Intelligence, pages 307-319, vol. 55, 2016.
- N. Chatti et al. "Signed Bond Graph for multiple faults diagnosis", International journal of Engineering Applications of Artificial Intelligence, pages 134-147, 2014.
- B. Ould-Bouamama, N. Chatti and A.-L. Gehin "SBG for health Monitoring of Fuel Cell System" ICREGA'14-Renewable Energy: Generation and Applications, Springer International Publishing, pages 73-85, 2014.

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|  QIF | <i>Industrial optimization (DoE, SPC)</i> |  UE 7-2 |
| | 4A / Semestre 7 | |
| | 16h CM / 16h TD | Science and technologies |

Keywords: design of experiments, analysis of variance, complex process, control charts

Required: probability and statistics, linear algebra, design of experiments, MSP

Objectives: industrial process optimization, design and use experiments, monitoring, control and supervision of complex industrial processes, in order to reduce variability

Contents:

Signal/noise ration and robust engineering
Two level fractional experiments
Optimal design of experiments
Nonstandard Taguchi arrays
Limits of Taguchi arrays



SPC and other tools (R&R, DoE)
SPC, Six sigma and robust engineering
Control charts for complex processes
EWMA, CUSUM, FIR, small series control chart, pre-inspection chart
Non Gaussian distribution processes
The folded normal distribution
Process capability index calculation

Evaluation:

Continuous assessment

References:

- « La méthode des plans d'expériences », J. Goupy, Dunod, 1988
- « Conception de la qualité : les plans d'expériences », R.H. Lochner, J.E. Matar, AFNOR, 1992
- « Pratique industrielle de la méthode Taguchi », J. Alexis, AFNOR, 1995
- « Les plans d'expériences », G. Sado, MC. Sado, AFNOR, 1991
- « Design and analysis of experiments », D. C. Montgomery, Wiley, 2001
- « Design and analysis of experiments », A. Dean, D. Voss, Springer, 1999
- « Appliquer la maîtrise statistique des procédés MSP-SPC », M. Pillet, Editions d'Organisation, 2000
- « Six Sigma : comment l'appliquer », M. Pillet, Eyrolles, 2013

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|---|----------------------------------|---|
|  QIF | Computer Engineering (OO) |  |
| | 4A / Semestre 7 | |
| | 4h CM / 12h TP | Science and technologies |

Keywords: Spreadsheets, VBA, Statistical tools, solver

Prerequisites: COO, POO, UML, classes, objects, messages, inheritance, class diagrams

Objectives: As opposed to procedural programming seen in the 3rd year, Object programming is a very different way of thinking, architecting and developing its application. This course aims to teach the principles of object-oriented programming (encapsulation, inheritance, polymorphism ...) with emphasis on object-oriented design using UML modeling. The aim of this teaching is twofold:

- on the one hand, to teach students how to break down a large-scale problem into functional elements ("objects"), in the formal framework of the Unified Modeling Language (UML).
- on the other hand, allow them to apply the concepts of object modeling through a programming language

Contents:

Concept of object, message, class, inheritance, method, instance. Programming methodology with an object-oriented language. Object Modeling / UML: Modeling the development process (from needs expression to implementation), System Description (Components, Functionalities and Dynamic Behavior), Logical, Functional and Physical Models. Graphical representation through case diagrams, sequences, components, states, objects and collaborations.



Evaluation: 100% CC

Bibliography:

Grady Booch, James Rumbaugh, and Ivar Jacobson. **Le guide de l'utilisateur UML**. Eyrolles, 2003

Franck Barbier, UML 2 et MDE, **Ingénierie des modèles avec études de cas**, 2009

Pascal Roques. **UML2 par la pratique (étude de cas et exercices corrigés)**. Eyrolles, 5^e édition, 2006

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|---|--|---|--------------------------|
|  | <i>Reliability models and Statistical methods for reliability</i> |  | |
| | 4A / Semestre 7 | | UE 7-2 |
| | 18.67h CM / 21.33h TD | | Science and technologies |

Keywords: previsional reliability, reliability block diagram, failure tree, reliability databases, operational reliability, statistical methods, Reliability data analysis

Required: dependability, bases of reliability, reliability engineering, Statistics

Objectives: Forecasting the reliability of a system in the design phase; studying dependability in design phase; estimating the reliability metrics of a product in the operating phase; verifying the validity of the reliability design specifications

Contents:

Introduction : previsional dependability

Reliability block diagrams (RBD)

Series and parallel RBD, series/parallel and parallel/series RBD, complex RBD

Failure trees

Representation, Construction rules, Boolean expression, Quantitative analysis

Reliability postmortem (feedback) databases

Databases for electronic parts, for non-electronic parts, other reliability databases

Statistical methods for reliability data

Complete and censored reliability estimation methods

Estimation of the reliability metrics in case of weak information

Degradation-based reliability model estimation

How to assess the reliability metrics in various mission profiles

Evaluation:

100 % continuous assessment

References:



« Sûreté de fonctionnement des systèmes industriels », A. Villemeur, Eyrolles, 1988

« System Reliability Theory », A. Hoyland et M. Rausand, Wiley, 1994

« Arbres de défaillance », N. Limnios, Hermes, 1991

« Processus stochastiques », A. Ruegg, Presses Polytechniques Romandes, 1989

« Statistical Methods for Reliability Data », W. Meeker et L. Escobar, Wiley, 1998

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|---|-------------------------------------|---|
|  QIF | <i>Risk analysis methods</i> |  UE 7-3 Quality, Innovation, reliability Methodology |
| | 4A / Semestre 7 | |
| | 4h CM / 16h TD | |

Keywords : Preliminary Risk Analysis (APR), FMEA (Analysis of Failure Modes, Effects and Criticality), AdD (Failure Tree)

Prerequisite : fonctional analysis

Objectives : Master practical risk assessment methods

Program :



Introduction to risks (product risks, risks of use, ...)

Presentation of the different methodologies: APR, FMEA (Product, Process, Machine), AdD.
Industrial applications

Assesment : Mini project of 4 h

Bibliography :

Méthodes d'analyse des risques, REF : 42155210, technique de l'ingénieur

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|  QIF | <i>Numerical Tools for Engineers</i> |  |
| | 4A / Semestre 7 | |
| | 24h TP | Quality, Innovation, reliability Methodology |

Keywords: Spreadsheets, VBA, Statistical tools, solver

Prerequisites: Excel Basics, Statistics and Probabilities

Objectives: The general objective is that the student knows how to use the Excel spreadsheet to carry out advanced processing / calculations (involving in particular statistical calculations), to design and realize a software development in Excel with VBA (interaction with spreadsheets) Applying a structured approach.

Contents:



Discovery of basic and advanced statistical functions for a Quality / SDF engineer: use of the "Analysis Utility" tool, including Descriptive Statistics, Histogram, Analysis of variances.
 Discovery and labor price "Tables and dynamic cross-media graphics"
 Use of Excel for the modeling of physical phenomena (notion of model, calculation by regression method): Function "Droitereg", "calculus matriciel", "Solveur"
 Estimation by Maximum likelihood of statistical law parameters, based on the solver.
 VBA under Excel: Reminders / Initiation on VB language - Reminders of Excel (basic functions, Data processing) - VBA programming under Excel (Programming environment, Sheets, Controls, Event management, Excel-specific functions, Working method)

Evaluation: 100% CC

Bibliography:

VBA Excel 2016 maîtrisez la programmation sous Excel , Théorie et TP corrigés. 36 H de mise en pratique. Michèle Amelot et Claude Duigou, St Herblain : Éditions ENI, cop. 2016

Travaux pratiques avec Excel 2007 et 2010, Saisie et mise en forme, formules et exploitation des données, courbes et graphiques. Lemainque, Fabrice. Paris : Dunod, 2011

| | | |
|---|--|---|
|  QIF | <i>Design Engineering (strength of materials, Application simulation)</i> |  |
| | 4A / Semestre 7 10h TD / 28h TP | UE 7-3 Quality, Innovation, reliability Methodology |

Keywords:

Design of mechanical systems, theories and laws of the resistance of materials applied to the Structural engineering design.

Required:

Resistance of materials

Objectives:

Allow students:

- To understand the results of mechanical finite element simulations and perform the reports for design teams;
- To realize the structural design studies, to define the specifications and to consult the suppliers;
- To be initiated to calculation codes and software such as SOLIDWORKS.



Program:

Reminders of material strength and mechanical tests;
Finite element methods;
The stress-resistance method;
Case studies.

Evaluation:

Continuous assessment and reports.

References

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|  QIF | Management system and – ISO approach (QHSE) |  |
| | 4A / Semestre 7 12h CM / 12h TD | UE 7-3 Quality, Innovation, reliability Methodology |

Keywords: Continuous improvement, organization, processus improvement , documentation, internal audits, management review, management system

Prerequisites: None

Objectives: Introduce and explain the building and the functioning of a management system based on QHSE continuous improvement approach previously implemented.

Program :



- Organisms and activities
- Customers, suppliers, products and services,
- Quality, Environment, Safety considerations
- Continuous improvement (Measures, objectives and action plan)
- Improvement management – System approach
- The system organization
- Organization charts and personal instructions
- Processus approach
- Processus description
- Management system documentation
- Internal audits activities
- Management review activity
- Management system certification
- The ISO standards (9001, 14001, 45001...)
- High Level Structure of the standards
- Requirement items
- Detailed requirements of the ISO standards

Examination:

Examination including theoretic acquisition and practical capacities

Bibliography:

International standards about management systems

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|  | <i>Customer and supplier survey (survey technics)</i> |  |
| | 4A / Semestre 7 6.67h CM / 17.33h TD | |

Customer satisfaction survey

Valérie Billaudeau
5h20 CM et 5h20 TD

Keywords: Specifications, customer satisfaction, survey, qualitative individual study, individual and collective interview, quantitative study, questionnaire, results communication

Prerequisites: None

Objectives: Introduce the customer satisfaction surveys to student's perspective. Adapt services or products Company to the market needs and improve their quality

Program:

- Why to realize satisfaction surveys?
- How to formalize and validate a specification?
- Which method of inquiry to choose?
- How to design and organize the two great guides of a customer satisfaction survey?
- Conducting an investigation
- How to process data?
- Analysis of results and communication of results
- Taking a step back and teaching the approach

Examination:

Results presentation of a real survey by group in front of a feigned "Executive committee"

Bibliography:

Les outils de la satisfaction client, Afnor, Août 2011, ISBN: **978-2-12-216831-8**

Engineering for customers

Michel Kermorvant
6h67 CM et 6h67 TD

Keywords: Marketing, products, services, customers needs, customers requirements, engineering, functional analysis, functional specification, FMEA, value analysis, CEM method..

Prerequisites: None

Objectives: Introduce the engineering of services and products based on the customer needs and requirements. Practice the methods used to be sure that the engineering activity is really based on them

Program :

- Quality management
- Engineering activities
- Engineering process
- Requirements and needs statement
- Functional analysis and functional spécification
- Hazard analysis of a new product or service (technical and financial)
- New needs and requirement detection

Examination:

Examination including an analysis on a new product



Bibliography:

International standards about engineering, functional analysis and functional specification, value analysis, FMEA...

Expression du besoin et cahier des charges fonctionnel. Jacques Bernard Bouissières
Edition AFNOR : ISBN 2-12-465135-1

Aide à l'élaboration du cahier des charges fonctionnel. Jacques Bernard Bouissières
Edition AFNOR : ISBN 2-12-465048-3

La conception à l'écoute du marché. Shoji Shiba
ISBN 2-901-323-63-4

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|---|--|---|
|  QIF | <i>Veille, créativité et prospective dont méthodes de recherche et d'analyse d'articles scientifiques</i> |  |
| | 4A / Semestre 7 | UE 7-3 |
| | 12h CM / 16h TD / 4h TP | Quality, Innovation, reliability Methodology |

Veille : Henri SAMIER, 12 H/E : 4 H Cours/ 8 H TD

Keywords: Internet - Monitoring - Monitoring, Web 2.0

Prerequisites: No

Objectives:

- Know different types of search tools.
- Optimize information retrieval on the Internet.
- How to find information faster?

Program:

Robots and intelligent agents (A.I.)

- Definitions, characteristics and types of intelligent agents: mobile agent research, vacuum agents, autonomous agents
- Use of each type of agent

The automatic search

- Definition of the process automatic standby
- Automatic monitoring of the internet
- Objectives of such a method: build a base of relevant knowledge, gains in productivity in research, information processing ...
- The various functions to control: searching, indexing, filtering, presentation, distribution, decision support

- Characteristics and critical analysis tools

Methods for automatic search

- Problems
- Development and implementation of methods
- 10 Tips for monitoring the Internet

Assessment: Continuous monitoring

Bibliography :

SAMIER H., SANDOVAL V., La recherche d'information sur le Web 2.0, Hermes Sciences, Lavoisier, Paris, à Paraître 2008.

SAMIER H., SANDOVAL V., La veille stratégique sur l'internet, éditions Hermes, Paris, 2002.

REVELLI C., l'Intelligence Stratégique, éditions Dunod, Paris, 1998.

ANDRIEU O., Trouver l'information sur internet, les éditions d'organisation, Paris, 1998.

Ziegler C.N., (2012), Mining for Strategic Competitive Intelligence, Springer Ed. 206 p.

Fuld L.M., (2010) The Secret Language of Competitive Intelligence, Dog Ear Publishing, 326 p.

Sharp S., (2009) Competitive intelligence advantage, Wiley & Sons Ed., 304p.

Gilad B., (2003), Early Warning, Using Competitive Intelligence to Anticipate Market Shifts, Control Risk, and Create Powerful

Metcalf Carr M., (2003) Super Searchers on Competitive Intelligence, cyber age book, 339p.

Créativité 4CM + 4TD

Mots-clés : créativité – cognitive psychology – creativity method

Prerequisite : none

Objectives : The lessons provided make it possible to understand the cognitive processes of creativity and to provide the theoretical framework for the application of brainstorming type creativity sessions..

Program :

Theoretical elements

- - Creativity methods (Braiwriting, 6 hats, etc.)
- - Creative processes and mechanisms;
- - Creativity session (preparation, development, analysis);
- - Application exercises;
- - Debriefing and analysis of the sessions;
- - Reduction of designer / user distances;
- - Personalization of mass production;
- - Writing idea sheets.
- - Watch over the idea sheets

Practical elements

- - Implementation of 2 collaborative and associative methods;
- - Writing idea sheets.
- - Watch over the idea sheets
- - Organization of idea sheets in functional categories.
- session facilitation training
- Coaching the implementation of two collaborative and associative creativity methods;

Evaluation : continuous assessment :

Bibliographie :

- BOLY, Vincent, Ingénierie de l'innovation : organisation et méthodologies des entreprises innovantes, Paris : Hermes Sciences Publications 2004, 188 p.
- BOTTON, Marcel, *La Créativité appliquée en 50 fiches*, Paris : Editions d'Organisation 1995, 130 p.
- DE BONO, Edward ; NICOLAÏEFF, Laurence, *La Boîte à outils de la créativité*, Paris : Editions d'Organisation 2004, 452 p.
- DE BRABANDERE, Luc, *Le Management des idées : de la créativité à l'innovation* Paris : Dunod 2002, XII-243.
- FUSTIER Michel et Bernadette, *Exercices pratiques de créativité à l'usage du formateur*, Edition d'organisation, 2001.

- GUTERN G., *Les 7 règles d'or de la créativité*, Maxima Laurent du Mesnil Editions, Paris, 1999.
- HAQUET, Charles-Emmanuel ; BOUYSSOU, Julien ; MIEL, Morgane, *Comment être plus créatif ?* Management 2005, Janvier 2005, n° 116, p. 36-[59].
- HSIAO Shih Wen, HOU Tyh Rong, (2004), *a creativity based design design process for innovative product design*, International journal of industrial ergonomics, volume 34, issue 5, 421-443.
- KAO, John ; PAVILLET, Marie-France, *Organiser la créativité : l'Esprit du jazz*, Paris : Village Mondial 1998, 192 p.
- LITTNER, Thierry, *La Créativité dans tous ses états : comment favoriser le potentiel créatif de vos équipes*, Paris : Editions d'Organisation 2002, XVIII-123 p.
- TORTOCHOT, Eric ; ALT, Gérard ; BOUÏSSAGUET, Boris ; CHAPON, Dominique, *Design(s) : De la conception à la diffusion*, Paris : Bréal 2004, 219 p.

foresight :, 4CM + 4TD

Keywords : foresight - futur –innovation – long terms

Prerequisite: none

Objectives : Foresight is a discipline of anticipation and innovation. The objective of this course is to learn to adopt a long-term view of the future (prospective), in particular by using macrohistory as a discipline to study long-term transformations.

The emphasis is on foresight as the foundation (breakthrough innovation; upside-down) and goal of innovation (innovate for the benefit of the Transition)

Program :

| Course | Directed work (continuous assessment) |
|--|---|
| 1. Transition study in progress: ABCs of development | 1. complete the ABCDaire by identifying a given trend and its impacts 2. implementation of some prospective methods on the theme of Transition |
| 2. Prospective: history, concepts and metemethod | 3. application of the prospective meta-method to a given subject to produce an innovation |

Evaluation : continuous assesment

Bibliographie :

Capra Fritjof, *Le Temps du changement : science, société et nouvelle culture*, Éditions du Rocher, 1983, p. 17.

Diamond Jared, *Collapse : How Societies Choose to Fail or Succeed*, Viking Adult, 2004 ; *Effondrement. Comment les sociétés décident de leur disparition ou de leur survie*, Gallimard, NRF essais, 2006 ;

Laszlo Ervin, *The Chaos Point : the world at the crossroads*, Charlottesville (VA), Hampton Roads, 2006 ; *Virage global*, Paris, Éditions de l'Homme, 2002 ;

Garreau Joel, *Radical Evolution*, New York, Doubleday, 2005.

Held, David, Anthony McGrew, David Goldblatt, and Jonathan Perraton, *Global Transformations: Politics, Economics, and Culture*. 1st edition. Stanford University Press. 1999

sur la Prospective

BARBIERI MASINI Eleonora, *Penser le futur. L'essentiel de la prospective et de ses méthodes*. Paris : Dunod, 2000, 172 pages.

CAZES Bernard, *Histoire des futurs. Les Figures de l'avenir de saint Augustin au XXI^e siècle*. [Seghers, 1986, 475 pages], ré-édité, L'Harmattan, 2008.

GAUDIN Thierry, *La Prospective*, Paris: PUF, Que Sais-Je n°3737, 126 pages, 2005

GOUX-BAUDIMENT Fabienne, SOULET Ghislaine, DE COURSON Jacques, *Quiz pour conduire un exercice de prospective territoriale*, Lyon : CERTU, 2008.

Méthodes de recherche et d'analyse d'articles scientifiques : 4hTP

Mots-clés: bibliographic analysis

Prerequisite: English

Objectives :

- Read a scientific article and make a reading sheet
- Be able to quickly identify relevant bibliographic references

Program:

1st session (2h40):

- o Presentation of good bibliographic research practices and writing a reading sheet and a state of the art (1h20),
- o Individual reading of an identical article for the group of students (40') and writing of a reading sheet (40').

Between 1st and 2nd sessions: teacher □ proofreading of reading cards and work of comparing cards between them.

• 2nd session (1h20):

- o Resumption of files and comments on their relevance,
- o Modification of the first reading sheet according to the comments made during the s

Evaluation :



Continuous assesment : evaluation of the two versions of the reading sheet.

Acquis d'apprentissage:

- The student knows how to do a bibliographic search by keywords
- The student can quickly identify the interest of an article (written in French or English)
- The student can summarize a scientific or technical article

Bibliography :

- La recherche d'information et le travail documentaire, M.M. Castellanos, F. Delacroix-Tessereau, V. Delarue, P. Pouliquen, Ed. Nathan, collection *Repères Pratiques*, 2012, 144 p.

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|  QIF | <i>Industrial property</i> |  |
| | 4A / Semestre 7 | |
| | 12h CM | Quality, Innovation, reliability Methodology |

keywords : industrial property, patent, R&D strategy

Prerequisite : None

Objectives : Provide the essential legal background for intellectual property.
Allow the future professional to be able to protect his creations and avoid counterfeits.

Programme :

Introduction to Industrial Property

Definition of the law and positioning of industrial property

Definition of concepts of industrial property (patents, trademarks, models)

A technical engineer's tool: the patent

Introduction to industrial property and its place in the life of engineers

Criterion of patentability

Structure of the patent document and information contained in the patent

Patent Uses in Industrial Engineering (Patent Life Cycle, Corporate Use)

The industrial property strategies (business case study)

The brand strategy

The model strategy

Cases studies

Evaluation : terminal examination (100%)

Bibliographie :



MARX, Bernard. La Propriété industrielle : sources et ressources d'informations. ADBS - Nathan, 2000

DE KERMADEC, Yann. Innover grâce aux brevets. INSEP, 1999

BREESE, Pierre, KERMADEC, Yann de : La propriété intellectuelle au service de l'innovation. Nathan, 2004

BREESE, Pierre : Stratégies de propriété industrielle : guide des entreprises innovantes en action. Dunod, 2002

VAJOU, Michel. Le brevet, un vecteur de valorisation et de veille. Ministère de la Recherche – INPI, 2000

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|---|---------------------------|---|
|  QIF | <i>Marketing I</i> |  |
| | 4A / Semestre 7 | |
| | 12h TD | Quality, Innovation, reliability Methodology |

keywords : Marketing, Segmentation, targeting, Positioning, Design and Marketing

Prerequisite : management and accounting, data analysis

Objectives :

Allow students:

- to understand the issues and the interest of positioning Marketing as a competitive advantage;
- Programming the various stages of strategic marketing in line with the concept of product portfolio;
- better understanding of competitive responses to innovation

contents :

The course of Strategic Marketing is in a more general methodology called Marketing Management, it makes it possible to make apprehend the students the notions of marketing : Segmentation, targeting and positioning.

In addition, students are studying on a real marketing positioning case.

Lesson Plan :

- Strategic marketing in the marketing management process: a brief history; Concepts and vocabulary; Workflow and work plan;
- The notion of segmentation, targeting and positioning;
- Innovation, Design and Marketing; Study of the dissemination process.

TD:

- Constitution of student teams;
- Choice of a sector of activity and an innovative product;
- Analysis and presentation of positioning.

Evaluation :

100 % continuous control by the evaluation of the report drafted by the members of each team and gathering the minutes of the TD

Bibliography :

KOTLER Philip et DUBOIS Bernard, Marketing Management, 11ème Edition, Pearson Education France, 2004. Marketing, n°3, volume IV, 53-75.

Beane T. P. et Ennis D. M. (1989), “La segmentation des marchés : une revue de la littérature”, Recherche et Applications en Marketing, n°3, volume IV, 25-52.

Behaeghel J. (1991), Brand packaging, the permanent medium, London, Architecture Design and Technology Press.

Borja de Mozota B. (1995), Design et management, Paris, éditions d’organisation.

Cova B. (1994), “Design, marketing et R&D dans l’industrie européenne”, Décisions Marketing, n°1, Janvier-Avril, 47-54.

Fayolle C. (1998), Le design, éditions Scala.

Gaillard J.M. (1997), Marketing et gestion de la recherche et Développement, Paris, Économica.

Mahieux F. (1990), “L’audit design-management”, Revue Française de Gestion, n°80, septembre-octobre, 73-77.

Millier P. (1995), Développer les marchés industriels — Principes de segmentation, Paris, Dunod.

Millier P. (1997), Stratégie et marketing de l’innovation technologique — Lancer avec succès des produits qui n’existent pas sur des marchés qui n’existent pas encore, Paris, Dunod.

Pras B., Roux E. et Evrard Y., « Market », Nathan, 1998.

Quarante D. (1990), “Former au design les gestionnaires et les ingénieurs”, Revue Française de Gestion, n° 80, septembre-octobre, 89-93.



U2: 'Geoffrey Moore: Crossing the chasm'

JP.MATHIEU, G.REOHRICH, Les trois représentations du Marketing , Revue Française de Marketing, 205-4/5, 39-55, 2005

JP MATHIEU, Ouvrage collectif de recherche « Design et Marketing : Fondements et Méthodes », Editions L'Harmattan sous la direction de J-P MATHIEU, Volume 4 de la collection "Recherches en Gestion", série "Marketing et Design", 2006

Option Quality,
innovation and
reliability engineering

Syllabus for semester 8

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|---|-----------------|---|----------------|
|  | <i>English</i> |  | |
| | 4A / Semester 8 | | UE 8-1 |
| | 24 h TD | | General course |

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Level B2 from the CEFR

Objectives: - Validating TOEIC minimum score to graduate as an Engineer.
 - Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
 - Cross-cultural skills: knowledge of international environment

Reorganising language proficiency groups according to the TOEIC scores.

Programme:

- Practising oral and written communication skills.
- Strengthening grammar skills.
- Regular practise of pronunciation and word stress.
- Communication skills in companies.
- Political, economic and social news
- Presenting industrial projects.

Evaluation:

Continuous assessment

Learning outcomes :

- The student can speak about a technical issue related to his/her field of expertise.
- The student can infer and understand gist, purpose and details in a spoken document related to a general or technical topic.
- The student can infer and understand gist, purpose and details in a written document related to a general or technical topic.
- The student can speak and write in a clear and fairly complex language.

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|  | <i>German / Spanish / French</i> |  | |
| | 4A / Semester 8 | | UE 8-1 |
| | 14 h TD | | General course |

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Required: Basic oral and written communication skills

Objectives:

- Strengthening the five skills to the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of international environment

Organization of Language proficiency levels

The target for the advanced group is CEFR B2 or C1, and B1 for the intermediate group Bulats test in Spanish is recommended for advanced students in final year.



Programme:

- Oral and written communication skills
- Communication skills in Companies (letters, memos, emails, etc.)
- Political, economic and social news
- Delivering speeches

Evaluation:

Continuous assessment

Learning outcomes :

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|---|-----------------------------|---|
|  QIF | <i>Business game</i> |  |
| | 4A / Semester 8 | |
| | 24 h TD | General course |

Keywords:

Challenges, Financial balance, Treasury, profitability, Teams, multidisciplinary

Prerequisites:

Fundamentals in management, marketing, human resources, R&D, business strategy, inventory management, project management and corporate finance.

Objectives:

In the continuity of the financial analysis course, develop an understanding of the operational and financial management of an international group in a competitive environment that is constantly evolving through the practice of a serious game.

Evaluation:

Continuous monitoring via enterprise game challenges



The performance of participants is measured and compared by both operational and financial indicators, including net income, market shares, return on capital, earnings per share, capacity utilization rates and employee productivity.

The overall performance of the teams is measured by the return to shareholders, which consolidates all the key success factors into a synthetic indicator that can be used to compare the teams.

Oral presentation

Sources

Cesim Global Challenges

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|---|---|---|----------------|
|  | <i>Planification opérationnelle des projets & Management des équipes</i> |  | |
| | 4A / Semester 8 | | UE 8-1 |
| | 28 h TD | | General course |

Keywords:

- Team management - Leadership
- Project management, needs analysis, planning, project management and management, project closure and evaluation

Prerequisites: Knowledge of a company

Objectives:

Team management: Understand the challenges of «team management». Acquire the relational fundamentals within a team.

Know and develop leadership skills.

Project planning: The objective of this module is to make students aware of the concepts and tools of project management through scenarios, ongoing exchanges with the teacher from the definition and framing of a project, its planning and management until the project is completed and evaluated.

Program:

Team management:

- Leadership - Role of the manager - Mission- Objectives - Values.
- Human and managerial skills of the manager - Styles and types of authority
- Motivation - Assertiveness.
- Conflict management.

Project planning:



- Session 1: General
- Session 2: Preparation phase – needs analysis and project launch
- Session 3: Build and Plan – Project Preparation and Task and Activity Planning Phase
- Session 4: Driving and Piloting – Project Delivery and Project Team Facilitation Phase
- Session 5: Close and evaluate – Finalization phase of the experience capitalization project

Examination : 100% during classes - situational assessments

Bibliography :

- « Le guide du manager d'équipe » - Jean Louis VIARGUES - Ed. d'Organisation – 2001.
- « Encadrer et motiver une équipe » - Arthur PELL - Ed. les Echos – 2000.
- « Autodiagnostic des styles de management » - Dominique CHALVIN - Ed. ESF-EME - 1990.
- « Management situationnel » - Dominique TISSIER - Ed. INSEP – 2011.
- « Motiver ses collaborateurs » - Anne BRUCE, James S.PEPITONE - Ed. Maxima – 2002.
- « La dynamique des équipes » - Olivier DEVILLARD - Ed. d'Organisation – 2000.
- « Les responsables porteurs de sens » - Vincent LEENHARDT - Ed. INSEP – 1992.
- « Le kit du manager opérationnel » - Pierre THEPAUT - Ed. d'Organisation – 1998.

- « Le manager est un psy » - Eric ALBERT, Jean Luc EMERY - Ed. d'Organisation – 1998.
- « Comment manager son équipe » - Denis RIBIERRE - Ed. Masson – 2002.
- « L'essentiel de la gestion de projet » – Aim, Roger (Gualino 2016).

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|  QIF | <i>Sport</i> |  | |
| | 4A / Semester 8 | | UE 8-1 |
| | 12 h TD | | General course |

Keywords: Physical and Sports Education

Prerequisites: None

Objectives:

Sports education courses help train future engineers by promoting physical and psychological development, by facilitating their integration, and by strengthening the team spirit and dynamics of the school.

Having the ability to work as part of a team, to communicate effectively, to build relationships of trust, be healthy and to withstand stress, are all qualities required of future engineers.

The sports activities proposed involve the acquisition of new motor skills, the implementation of individual and collective strategies, the resolution of problematic situations, while simultaneously requiring a constant adaptation of one's effort.

All of these elements contribute to the development of the engineers in the making and will be additional advantages for their training and their socio-professional integration.

Program:

The program of physical sports and artistic activities is built over the first four years of study at the school. Each engineering student must choose a different activity per semester from the five individual and team sports offered.

Evaluation:

100% Continuous assessment

Learning outcomes:

Each student is expected to participate actively. This requires serious commitment, both physically by "doing" and also reflectively by demonstrating "know how", with a cultural understanding of the activity. Physical investment will be carried out via the management of one's own physical and psychological integrity, and those of others (with adapted muscular, joint and cardio-respiratory warm-ups, and also respect of basic safety precautions).

The student will also have to demonstrate his / her ability to acquire skills specific to each sporting and artistic activity that he / she chooses. These teaching contents are grouped into three types of General Competences:



C1: To progress technically, tactically and / or behaviorally on one's individual and initial level.

C2: Achieve a performance in an enabling context.

C3: Produce the best possible result in a reference situation.

References:

Site UA Moodle : <http://moodle.univ-angers.fr/course/view.php?id=2687>

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|---|---------------------------|---|
|  | <i>Aplicative Project</i> |  |
| | 4A / Semester 8 | |
| | 40 h TD | Aplicative project |

Keywords : pedagogical project, Professional application.

Prerequisites: All the courses of the semesters 1,2,3,4,5,6 and 7

Objective:

This project is carried out in groups of 2 to 4 students.



The pedagogical team offers project-oriented project topics that allow students to apply the knowledge introduced during the course and to appropriate the techniques of project management followed throughout their course.

The projects are pedagogically constructed and intermediate results are requested to apply the notions and methods seen in progress.

For example, on the innovation trades, the objective of the project is the filing of a patent starting from a blank sheet, the entire innovation process is applied until the transmission of a technical document To a patent office and the filing of the patent.

Evaluation

Written / oral presentation / report notes of pedagogical tutor

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|---|---------------------------|---|
|  | <i>Enterprise Project</i> |  |
| | 4A / Semester 8 | |
| | 80 h TD | Enterprise project |

Keywords : industrial project

Prerequisites: All the courses of the semesters 1,2,3,4,5,6 and 7

Objective:

This project is carried out in groups of 2 or 3 students.

Companies, often local, offer cross-cutting technical subjects that allow students to apply the knowledge introduced during the course and to appropriate the techniques of project management followed throughout their course.



Projects vary depending on years and contacts with companies.

The objective is to open the students to the professional world and the first realization of a project with an industrial stake.

The results are in the order of the preliminary draft, the pre - study, a state of the art with recommendation ...

Evaluation

Written / oral presentation / report notes tutor business

| | | |
|---|---|---|
|  | <i>Management of global performance</i> |  |
| | 4A / Semester 8 | |
| | 1,33 h TD / 8 TP | Performance management |

Keywords : performance evaluation system

Pré requis : management systems, innovation methods

Objectives :

Enabling the learner to build a global performance evaluation system
 Piloting the Performance Evaluation System

Contents :

Definition and specification of the performance concept
 The architecture of a performance evaluation system and its design
 Qualitative methods of evaluation
 Quantitative methods of evaluation
 Limited rationality (human factor) in performance evaluation systems



The course takes place through a role-play to demonstrate contradictions and managerial problems related to the definition of performance at local and global level. A multifunctional product design is made with objectives to be achieved for each role (performance objective with divergent interest). The performance management models are thus set up by the role play and its feedback.

Evaluation :

100% continuous control

Bibliography :

Lorino, P. (2003). *Méthodes et Pratiques de la Performance*. Paris, Editions d'Organisations.
 Yannou B. (2006). *Evaluation et décision dans le processus de conception*, Hermes Science Publications
 Sénéchal, O. (2004). *Pilotage des systèmes de production vers la performance globale*. valenciennes, université de valenciennes.
 Mathe J.C., C. V. (1999). "L'intention stratégique et les divers types de performance de l'entreprise." *Revue française de Gestion*.

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|  QIF | <i>Sustainable Development</i> |  |
| | 4A / Semester 8 | |
| | 6CM / 9 h TD / 3 TP | Performance management |

Keywords: Energy, consumption, energy efficiency, Life cycle, ecobalance, impact, cradle-to-grave analysis, LCA

Prerequisites: Process Engineering EI2

Objectives:

- study of the consumption of all the energy sources used as part an activity or a given production;
- be able to define the function and the functional unit of a product;
- be able to define a system and its limits;
- be able to build the life cycle of a product or a service;
- be able to use LCA software.



Program:

Presentation of energy sources (electricity, Fuel, Industrial gases, water)
 Analyze of energy consumption
 Identify the potential fields of reduction of the consumption
 Propose more effective solutions in term of energy
 Thermal simulation
 LCA principles (origin, method, etc.)
 Application of LCA
 Force and weakness of LCA
 Goal and scope definition
 Life cycle inventory (emission and extraction)
 Environmental impact assessment
 LCA interpretation
 LCA and reduction of product environmental impact
 Environmental product profile

Assessment: continuous assessment (100%)

Bibliography:

BOBIN Jean-Louis (2001) L'énergie dans le monde : bilan et perspectives.
 GRISSEL Laurent, OSSET Philippe (2004) L'Analyse du cycle de vie d'un produit ou d'un service : applications et mise en pratique.
 JOLLIET Olivier, SAADE Myriam, CRETZAZ Pierre (2005) Analyse du cycle de vie : comprendre et réaliser un écobilan
 ROUCOULES Lionel, YANNOU Bernard, EYNARD Benoît (2006) Ingénierie de la conception et cycle de vie des produits.
 ROULET Claude-Alain (1987) Énergétique du bâtiment. 2. Prestations du bâtiment, bilan énergétique global.
 SACADURA Jean-François (2015), Transferts thermiques.

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|---|--|---|------------------------|
|  | <i>Maturity of companies management system</i> |  | |
| | 4A / Semester 8 | | UE 8-4 |
| | 12 h TD | | Performance management |

Keywords Maturity of process maturity assessment, CMMI, ISO 15504 - SPICE, ISO 12207

Prerequisites: Introduction to quality management, quality assurance, quality control, software quality

Objectives: To provide a note of pragmatism quality approach by presenting students with reference to the evaluation and improvement of the production process of software and systems integration software. Give students the methodological tools related to the implementation of these approaches.

Contents:



Reminders on software quality and cost of non-quality
Quality strategy, continuous improvement, ISO 9000 series, specific software
Concept of ability, maturity, performance
Process models, ISO 12207, CMMI, ISO 15504 SPICE
Quality improvement with CMMI
Structure and representations; different levels and process areas
Best practices of five levels of maturity and implementation of evidence-CMMI
Principles and conduct evaluation
SPICE process improvement reference model, model evaluation, valuation method
The process dimension, process characterization, process categories, activities
Evaluation process: requirements, steps, eg

Evaluation: Terminal (100%) with QCM on

- The structure of CMMI
- The constellation CMMI DEV V1.3
- The ACQ constellation CMMI V1.3

Bibliography: •

- CMMI ® for Acquisition, Version 1.3, CMU/SEI-2010-TR-032
- CMMI ® for Development, Version 1.3, CMU/SEI-2010-TR-033
- CMMI ® for Services, Version 1.3, CMU/SEI-2010-TR-034
- CMMI for example, François DUFAY, Eyrolles, 2010
- ISO 15504
- ISO 9000 Version 2008
- ITIL V3 2011, TSO
- Automotive SPICE ®, Process Reference Model, automotivesig \ prm \ v4.5
- Automotive SPICE ®, Process Assessment Model, automotivesig \ pam \ v2.5

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|  QIF | <i>Physics of failure</i> |  | |
| | 4A / Semester 8 | | UE 8-5 |
| | 8CM / 8 h TD | | Product life cycle management |

Physics of failure and RAMS in automotive

Keywords: Automotive, Electronics, Reliability, embedded ECUs,

Prerequisites: Basics of Electrical & Electronics

Objectives:

Acquire general knowledge of electronics, the areas covered and the main functions supported.

Acquire a knowledge of first level of technology embedded computers in automotive, their environment and the main types of failures.

Program:

Module 1 * 2 1/2 days:

- Reminder of basic electronic - Components,
- Mechanisms of failure
- Digital Applications - Overview of techniques to improve the reliability

Module 1 a day to have a complete overview of electronics and technologies that make it up.

The main chapters are:

- Embedded electronics and areas covered,
- Design Hardware + sensors / actuators
- Software Design
- Dependability applied to electronic systems
- Diagnostic, maintainability and workshop.

Rating:

- Overall evaluation of late-type modules MCQ Questions & courses.

Bibliography:

Guide dependability (LIS - JC Laprie, Ed Cépaduès)



Support training Supelec "Reliable Electronic components" - G. Deleuze,

Practical Reliability Engineering - P. O'Connoc - Ed Wiley,

Automotive Electronics Reliability HandBook - SAE AE-9

FIDES Guide.

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|  QIF | <i>PLM (maintenabilité)</i> |  | |
| | 4A / Semester 8 | | UE 8-5 |
| | 24 TP | | Product life cycle management |

Keywords : Management of BOMs, product life cycle, manufacturing, configuration evolution, project management, collaborative engineering

Prerequisite : Mechanical engineering basis, CAD

Objectives : The objective of this course is to provide the methodological bases for understanding and implementing the key processes of a Product Lifecycle Management type approach in the design and modification phase of new systems. This course will briefly review development cycles, industrial organizations and associated project management as well as PLM information tools. Emphasis will be placed on the application of PLM in a context of manufacturing and evolution of technological products by integrating the collaborative dimension of such a process.

Program :

The training is mainly oriented on the application of the PLM approach.

The 24-hour lab will give the foundations, concepts and challenges. This course will aim to return to the organization of a collaborative product design project and to address the difficulties of deploying such an approach. A point on IT solutions will be given.

The practical application (24h of practical work) consists of 2 phases:



- Getting started with the IT tool (a PLM Teamcenter solution from Siemens Industries Software is expected)
- Sessions on collaborative projects allowing learners to grasp all of the roles in the manufacturing phase and the effects in terms of managing the evolutions of a product during its life cycle.

Assessment :

Continuous assessment

Option Quality, innovation and reliability engineering

Syllabus for Innovation, semester 9

| | | |
|---|-----------------|---|
|  | <i>English</i> |  |
| | 5A / Semester 9 | |
| | 16 h TD | General course |

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Required: TOEIC validation

Objectives:

- Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of international environment
- Good command of oral techniques

Programme:

- Team working.
- Practising on the oral presentation of the final industrial projects (focusing on pronunciation, fluency of speech, using idioms, etc...)
- Practising on job/internship interview.

Evaluation:



Continuous assessment

Learning outcomes:

The student can carry out a job/internship interview.

The student can make a professional oral presentation on a long-term project (5th year industrial project)

The student can write a professional report, an abstract, a professional e-mail and a personal profile.

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|  | <i>German / Spanish</i> |  | |
| | 5A / Semester 9 | | UE 9-1 |
| | 12 h TD | | General course |

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: B2 level on listening and comprehension skills

Objectives:

- Meeting the requirements of the CEFRL (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of German/Spanish-speaking countries
- Preparation to an external certification

Programme:



Team working
 Training placement tests
 Professional writing (abstract, report, e-mail)
 Advanced grammar review

Evaluation:

Self-assessment with placement tests

Learning outcomes:

The student is able to run meetings
 The student has advanced grammar skills

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|---|-----------------------------|---|----------------|
|  QIF | <i>Employability</i> |  | |
| | 5A / Semester 9 | | UE 9-1 |
| | 16 h TD | | General course |

Keywords: job, employability, hiring, integration, professional watch

Prerequisites: None

Objectives:

- Give the keys to facilitate the integration of students leaving training
- Provide opportunities to share perspectives of students and their professional experiences with those of various structures (industry, consulting firms, recruitment ...)

Programme:



- 1 - "The key to integration in a team and individual skills evaluation from the internship experiences in the second year of engineering school"
 - ➔ Exchanges between students and professionals
- 2- "Professional watch as a driver of inclusion"
 - ➔ Presentation prepared
- 3- "Job interview skills focus"
 - ➔ Workshops from the areas for improvement identified in the preceding

Evaluation:

Evaluation: 100 % continuous assessment (work in group and individual)

References:

- [Jean-François Giret](#), **Pour une économie de l'insertion professionnelle des jeunes**, CNRS Editions (décembre 2000), Cnrs Economie, CNRS Editions, décembre 2000.
- [Michel Arliaud](#) (Sous la direction de), [Henri Eckert](#) (Sous la direction de), **Quand les jeunes entrent dan l'emploi, Broché**, juin 2002.
- [Philippe Labbé](#), **Les bricoleurs de l'indicible, tome 2 : De l'insertion en général, des missions locales en particulier**, Broché, avril 2004.
- [Florian Sala](#), **Bilan personnel et insertion professionnelle**, L'Harmattan, octobre 2000.

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|---|-----------------------|---|----------------|
|  | <i>Employment law</i> |  | |
| | 5A / Semester 9 | | UE 9-1 |
| | 12 h TD | | General course |

Keywords: Labour code, employment contract, Collective Agreements, justice

Prerequisites: None

Objectives:

- Knowing labour law is essential; either you are worker or employer. Nobody can ignore it.
- Labour legislation is in constant discussion. It is therefore important to understand the legal, economic and social issues

Programme:

- Introduction
- Representation of employees and collective bargaining
- Hiring and contract
- Remuneration and working time
- Termination of the employment contract
- Court decisions

Evaluation:



Continuous assessment (100%): understanding the law, analyzing judgments

Learning outcomes:

The student has understood the meaning of law and is able to read and understand a court decision

References:

- Code du travail , ed.Dalloz
- RAY Jean-Emmanuel, « Droit du travail, Droit vivant 2017 », Ed Liaisons, 25^{ème} édition 2016

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|  QIF | <i>Project costs mastering</i> |  POLYTECH ANGERS |
| | 5A / Semester 9 | |
| | 12 h TD | General course |

Keywords :

Prerequisite :

Objectives :



Be able to calculate the financial profitability of an industrial project and to monitor and control the costs of this project.

Programme :

- Introduction
- Chapter 1: from the business plan to the forecast profit and loss account
- Market analysis
- Technical and operational analysis
- Financial plan
- Projected income statement
- Chapter 2: Choosing Investment
- decision criteria without updating
- Decision criteria with updating
- Decision in complex environment
- Chapter 3: costtenance
- Initial budget
- Budget to date
- Estimated cost
- Budget / cost comparison
- Treatment of inflation
- Currency processing
- Control of revenue and results
- Control of engineering costs
- Control of supply costs
- Control of construction costs
- Cost Control Tools
- Data Consolidation
- Inter-service relations

Evaluation :

Terminal examination 100%

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|  | <i>Practice analysis and co-development</i> |  | |
| | 5A / Semester 9 | | UE 9-1 |
| | 12 h TD | | General course |

Mots-clés : practise analysis, co-development

Pré requis : fourth year training period

Objectifs :

To work methodically the practices of internship of fourth year in order to make benefit the whole of the promotion of the experiences lived. Beyond the sharing of experience, it is the methods of analysis of practice and co-development that are learned through this course



Programme :

Reflecting on reflexive work, these devices always aim to better understand what practice is, to overcome the difficulties encountered on the ground and to consolidate the skills that are built up during the first experiments. Methods and techniques often quite different from one device to another, refer to those used in research on social practices, thus reflecting the theoretical references that are attached to them.

Workshops are being organized to implement these practices in a reflective way.

Evaluation :

Continuous assessment 100%

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|---|-------------------------|---|----------------|
|  | <i>entrepreneurship</i> |  | |
| | 5A / Semester 9 | | UE 9-1 |
| | 12 h TD | | General course |

Keywords: entrepreneurship, business creation

Prerequisite: economics

Objectives: Entrepreneurs are key players in today's Business world. This course will give a very concrete and operational approach of these people, their profile, the tools they are using and the main Entrepreneurial processes. The approach will be international, very practical and project oriented.

The ultimate goal will be to find a couple of "starting-up" potential real Businesses in France or abroad...

Programme:

- 1- The start : Who are the Entrepreneurs ? Where do the ideas come from ? What are the skills required ?
 - How to succeed and find the good idea ?
 - Psychological profile of various Entrepreneurs (real examples)
 - Introduction of some mandatory skills
- 2- Entrepreneurial Development : Tools and methods
 - The Start-up Business Plan
 - The different check-lists
 - The first Managerial steps
- 3- Money, money, money...
 - Financial sources
 - Selling your project
 - Find the right money at the right time !



Entrepreneurial project : To find a feasible idea with a team and understand how from this idea a potential Business could emerge...

Assessment: Continuous assessment (100%):

Bibliography :

Robert J. Calvin (2001) "Entrepreneurial Management". The McGraw-Hill Executive MBA Series.

SABONNADIÈRE Jean-Claude, BLANCO Sylvie (2005) La Création d'entreprises innovantes : l'entrepreneur innovateur – Hermes Science Publications.

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|---|-----------------------------|---|
|  | <i>Incubation in duping</i> |  |
| | 5A / Semester 9 | |
| | 28 h TD | Undertake through innovation |

Keywords: Incubation, project mode

Requirement: Entrepreneurship, economics, introduction to innovation and quality

Objectives: Create a fictitious start-up and simulate its incubation

Contents :

This teaching will be based on a tool developed in the technopoles to incubate start-ups:

- Lean start up

- Canvas model

- Business plan



- Accompanying intellectual property

- Accompaniment to the corporate event (legal status)

Students must set up their business and validate their business plan with a jury

Evaluation :

100 % Continuous assessment

| | | |
|---|--|---|
|  QIF | <i>Communication and Innovation</i> |  |
| | 5A / Semester 9 | |
| | 14 h TD | Undertake through innovation |

Keywords:

Communication, verbal and written expression

Requirement:

Bases of oral and written expression.

Objectives:

Allow the learner to master the main levers of understanding, acceptance and commercial success of an innovation.



Contents :

This teaching will articulate around the following themes:

- Control of the verbal expression
- Control of the not verbal expression
- Psychology of the innovation

Evaluation :

100 % Continuous assessment

| | | |
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|  QIF | <i>Business model, Marketing and innovation financing</i> |  |
| | 5A / Semester 9 18 h CM / 3 h TD | UE 9-3 Undertake through innovation |

Keywords:

Business model, CIR, Innovation, Market study

Requirement:

Accounting, financial Management, Data analyzes.

Objectives:

Allow the learner to master main tools of economic management and the marketing of systems.



Contents :

This teaching will articulate around the following themes:

- Control of the value of a system in an economic, social and cultural environment
- Obtaining CIR
- Looks for elaboration of a business model associated with the diverse possibilities of financing of the innovation as well as the apprenticeship

Evaluation :

100 % Continuous assessment

| | | |
|--|--|---|
|  QIF | <i>History, Innovation theory and prospective</i> |  POLYTECH ANGERS |
| | 5A / Semester 9 | |
| | 15 h CM / 6 h TD | Design thinking innovative design |

Keywords:

Innovation, History, Future

Requirement:

/

Objectives:

To give to the learner of the chronological marks, allows him to study technical, scientific, economic and social causes which accelerate the development of the world.



Contents:

These teachings will articulate around the following three themes:

- Innovation history
- Innovation theory
- Prospective

Evaluation:

100 % Continuous assessment

| | | |
|---|--|---|
|  QIF | <i>Design thinking, of service, Living Lab & User Driven innovation</i> |  |
| | 5A / Semester 9 | UE 9-4 |
| | 15 h CM / 7 h TD | Design thinking innovative design |

Keywords:

Innovation, Experiment, Design thinking, Living lab

Requirement: innovation courses of third and fourth year

Objectives: Know and apply user-oriented methods of innovation

Contents:

These lessons will focus on the following three themes:

- Design thinking
- Service design and living lab
- User driven innovation



All these methods make it possible to center the innovation on the end-user and the ability of the designer to empathize with his end-user (s).

The design is defined there and it sees its material inclination (design thinking) or intangible (service design)

Living labs are explained and show the importance of experimentation in the innovation process

Evaluation:

100 % Continuous assessment

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|  QIF | <i>Methodological approaches (ARIZ, C-K, Juggad, ...)</i> |  POLYTECH ANGERS |
| | 5A / Semester 9 | UE 9-4 |
| | 9 h CM / 12 h TD | Design thinking innovative design |

Keywords:

Innovation, Design, TRIZ

Requirement:

Fonctional analysis, Value analysis

Objectives:

Allow the learner to discover and to arrest original processes of creativity strengthening the customer satisfaction final



Contents:

This teaching will handle main methodological approaches allowing of manager the creativ-
Methodological approaches:

- ARIZ,
- C-K,
- Juggad
- ...

Evaluation:

100 % Continuous assessment

| | | | |
|---|---------------------------------|---|-----------------------|
|  | <i>Competitive intelligence</i> |  | |
| | 5A / Semester 9 | | UE 9-5 |
| | 7 h CM / 7 h TD | | Innovation management |

Keywords : Economic intelligence – Survey – territorial policy – network of excellence – competitiveness pole

Prerequisite : strategic survey knowledge, prospective course

Objectives :

- Understand economic intelligence.
- Control survey method.
- Be able to complete economic intelligence report
- Control and enroll its industrial activity in its territory

Programme :

ECONOMIC INTELLIGENCE

1. INTRODUCTION

- 1.1. Economic intelligence and strategic survey technic.
- 1.2 Factor of influence.
- 1.3. Enterprise impacts.

2. ECONOMIC AND STRATEGIC INTELLIGENCE

- 2.1. Enterprise trade definition.
- 2.2. Enterprise markets.
- 2.3. The differents possible strategies.
- 2.4. The critical factors of success.
- 2.5. The concurential positioning of enterprise.

3. INNOVATION AND ECONOMIC INTELLIGENCE

- 3.1. Value and differentiation concept.
- 3.2. How transform critical factor of success in research axis ?
- 3.3. The arborescence fonctions/principle/technology.
- 3.4. Links between IE and value analysis.

4. IMPLEMENTATION OF AN ECONOMIC INTELLIGENCE STRUCTURE

- 4.1. Enterprise technology mapping.
- 4.2. Constitution and operating of networking.
- 4.3. The program sheet.
- 4.4. The human factors in Economic intelligence.

5. THE INFORMATION SOURCES

- 5.1. Internet survey.
- 5.2. Echelon and Frechelon.
- 5.3. Economic information sources
- 5.4. Internet and databases.

6. THE DATA MINING

- 6.1. Fonctionnal data mining.
- 6.2. The typology and attributes of information.
- 6.3. The constitution of report of selected data.
- 6.4. The synthesis report with mindmapping.
- 6.5. The writing of economic intelligence report.

CASE STUDY

1. CASE PRESENTATION

- 1.1. Issues, Objectives and needs of network.
- 1.2. Constitution et organization of an IE network.
- 1.3. Coordination of network and responsibilities affectation.
- 1.4. Strategic analysis Market/Technology.
- 1.5. Definitions of program sheets.

2. INFORMATION RESEARCH

- 2.1. Definition of axis and research plan.
- 2.2. Research methods on internet.
- 2.3. Writing profile sheets.
- 2.4. Manual research on internet.
- 2.5. First analysis of informations
- 2.6. Optimisation of research
- 2.7. Launching semi automatic research.

3. ANALYSE AND PROCESS OF INFORMATION

- 3.1. Analysis of found information.
- 3.2. Building of scoreborad.
- 3.3. Building of technology sheets.
- 3.4. Building of market sheets.
- 3.5. Construction of concurent sheet.

4. SYNTHESIS

- 4.1. Writing synthesis sheet.
- 4.2. Writing synthesis with mindmapping.
- 4.3. Final writing of scoreboard .
- 4.4. Writing of IE report.

5. CAPITALISATION AND MANAGING OF KNOWLEDGE

- 5.1. Managing and updating of information.
- 5.2. Survey protocol.
- 5.3. EDM interface, Intranet et Groupware.

6 CONCLUSION

- 6.1. Case synthesis
- 6.2. Operating optimisation
- 6.3. the ten rules of Economic intelligence.

Evaluation : continuous assessment 100%

Bibliography :

- BAUMARD P., Stratégie et surveillance des environnements concurrentiels, Paris, 1991.
- BERTACCHINI, Yann. Intelligence territoriale – volet 2 – « mesurer la distance, penser la durée, mémoriser le virtuel ». Collection Les E.T.I.C, Presses Technologiques, 2004.
- BESSON B. et POSSIN J.C., Du Renseignement à l'intelligence économique, Paris, Ed. Dunod, 1996.
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- GENEREUX, Jacques. La dissociété. Editions du Seuil. 555 pages. 2006.

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JAKOBIAK F., l'Intelligence Economique en pratique, les éditions d'organisation, Paris, 1998.

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MARTINET B. et MARTI Y.M., L'intelligence économique : les yeux et les oreilles de l'entreprise, Paris, Les éditions d'organisation, 1995.

MARTRE H., Intelligence économique et stratégie des entreprises. Rapport du groupe présidé par Henri Martre, Commissariat général du Plan, La Documentation Française, 1995.

SALMON R., L'intelligence compétitive, Ed. Economica, 1998.

SAMIER H., SANDOVAL V., "La veille Stratégique sur l'internet", Les éditions Hermes Sciences, Paris, 2002.

TETU, Jean François. « L'espace public et ses médiations. », HERMES, n° 17, pages 287-298, Paris, Editions du CNRS, 1995.

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|---|------------------------------|---|
|  | <i>Creativity management</i> |  |
| | 5A / Semester 9 | |
| | 12 h TD | Innovation management |

Keywords:

Management, Créativité, Inventive

Requirement:

Creativity techniques, Industrial organization

Objectives:

Allow the learner to master the fundamental of the innovation management

Contents:

This teaching will aim at improving the inventiveness of the members of an organization by the use of tools, allowing to increase the creativity of a person or a working group.

The program is as follows:

- Understand and promote novelty

Understand creativity and be able to disseminate it to a group of collaborators

- The creative process

Give benchmarks to drive the innovation process

- Innovation and users

Putting the end user (collaborator and client) at the center of the process

- Design and innovation: formalizing the approach

Understand the importance of the design process for the concrete realization of innovation

- Motivate to innovate

Understand the motivations to better manage its innovation team

- Innovation promoter's missions

The role of facilitator

Human Network Manager

Knowledge Manager

The accelerator of the innovation process

- Innovative developer tools

To know the tool of the promoter to carry out his missions (Network tool (CSR, knowledge of experts, knowledge of internal and external human potential), Agile method, Creativity methods how to choose?, Monitoring tools, Third places: FABLAB , CREATIVLAB, XLAB).

Evaluation:

100% continuous control

Bibliography :

Thomas J. Allen, Managing the Flow of Technology, MIT Press, Cambridge, MA

Luc de Brabandere & Anne Mikolajczak, Le plaisir des idées, Dunod 2002

François Jolivet, Manager l'entreprise par projets, les métarègles du management par projet, Éditions management & société, 2003

Christophe Midler, L'auto qui n'existait pas, management des projets et transformation de l'entreprise, Interéditions, Paris, 1993.

Jean-Claude Moisdon et Benoît Weil, Capitaliser les savoirs dans une organisation par projets, Annales de l'École de Paris du management, volume IV, 1998



Vesselina Tossan, L'action d'un service central Innovation dans un Groupe de services décentralisé: le cas Suez. Quelle instrumentation sous-jacente ? Thèse de doctorat de l'École des Mines.

Thierry Weil (a), La valorisation du patrimoine technologique, ANRT, Paris, mars 2000.

Thierry Weil (b), Innovation as Creative Recombination and Integration of Existing Components of Knowledge, Conference on Knowledge and Innovation, Helsinki, 25 mai 2000.

Thierry Weil (c), Le management de l'innovation en réseau, ANRT, Paris, mars 2000.

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|---|---|---|
|  QIF | <i>Agile management, Open innovation and change management</i> |  |
| | 5A / Semester 9 | |
| | 12 h CM | Innovation management |

Keywords:

Managerial suppleness, Créativité, Innovation

Requirement:

Creativity techniques, Industrial organization

Objectives:

Allow the learner to master all the operations to be made within an organization to allow him to adapt itself with suppleness to the change and to the evolution of the environment. These developments will be made by the use of modes of innovation based on division, collaboration.



Contents:

These teachings will articulate around following themes:

- Agile management
- Open innovation
- Change management

Evaluation:

100% continuous control

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|  QIF | <i>industrial conferences</i> |  |
| | 5A / Semester 9 | |
| | 30 h TD | Innovation management |

Keywords: case studies, industrial conferences

Requirement: none



Objectives: Confront the students with the short-term themes of the companies and Acquire the vocabulary and the trends of the professions of the innovation

Contents:

These lessons will be organized around professional conferences (innovation director, innovation manager, etc.), whose aim is to bring together the representations that students make of innovation and the reality of the field. Business trends must be able to be expressed at these conferences.

Evaluation:

100% continuous control

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|  QIF | <i>Innovative Design by patents</i> |  |
| | 5A / Semester 9 | |
| | 6 h CM / 10 h TD | Innovative product design and knowledge management |

Keywords:

Patent, Créativité, Innovation, TRIZ

Requirements:

Techniques of creativity, bases of industrial property

Objectives:

- Be capable of identifying the major creative principle of a patent
- Reconstruct the genesis of the creation of a product
- Express a technical contradiction
- Use creative principles

Contents:

This teaching will articulate around the following themes:



- Analysis of the blocking patent
- Identification of new creative principles
- Generation of ideas

Evaluation:

100% continuous control

Bibliography:

- " Discover and apply the tools of TRIZ ", Denis Choulier, Edition(Publishing) CONSTRUCTION SITES(WORKS), Technological University of Belfort-Montbelliard.
- "And Suddenly the Inventor Appeared", Genrich Altshuller, Technical Innovation Center, INC.

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|  | Stylistic survey |  |
| | 5A / Semester 9 | |
| | 7 h CM / 7 h TD | Innovative product design and knowledge management |

Keys Words : sensorial design, Survey and anticipation, user centred design, design of sensorial and semantical attributes, color, trends

Prerequisites:

Objectives : Know the issues and ways to anticipate consumer expectations concerning our stylistic attributes, develop the capacity to innovate (C.11) and the ability to identify and address strategic information (C.IDI2)

Program :

Lecture :

1. Interest and foundation of the stylistic survey
2. analogical reasoning,
3. Determining the influential sectors
4. Chaining Value / Function / Attribute
5. Iconical Content analysis
6. Mounting trends boards
7. Applications in different sectors



Tutorial:

1. Choosing a product design
2. Supply analysis: collection of illustrations of competing products
3. Qualitative assessment of products and segmentation of the two axes provides meaningful
4. Segment analysis and determination of influential sectors
5. Search illustration of innovative systems representative of influential sectors
6. Categorization of illustrations
7. Mounting boards and description of trends

Assessment : continuous assessment through tutorials

Bibliographie :

- CHRISTOFOL Hervé, BOUCHARD Carole, Introduction aux méthodes d'évaluation sensorielle et sémantique, in La conception industrielle de produits, Vol.3 – ingénierie de l'évaluation et de la décision, série Productique, Hermes Sciences Lavoisier 2008, 3p.
- CHRISTOFOL Hervé, SAMIER Henry, Analyse stratégique et veille stylistique, Chap 5.3, 18p, in MATHIEU Jean-Pierre, sous la direction de , Design et Marketing – Fondements et Méthodes, L'Harmattan 2006, 436p.
- BOUCHARD C., CHRISTOFOL H., LIM D., Integration of Stylistics and Uses : Trends in Innovation Process, Chapter 9, pp175-195, in CHRISTOFOL H., CORSI P., RICHIR S., SAMIER H., « Innovation Engineering», ISTE, Hermes Sciences 2006
- CHRISTOFOL H., « L'innovation stylistique et les tendances », in CHRISTOFOL &Al, « l'innovation à l'ère des réseaux », Hermes Sciences Lavoisier 2004, pp.203-224
- H. CHRISTOFOL, « L'analyse de contenu iconique, un outils du concepteur de la coloration du produit », in Design Recherche N°8, 1996

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|  QIF | <i>Design for manufacturing and assembly (DFMA)</i> |  |
| | 5A / Semester 9 | |
| | 16 h TD | Innovative product design and knowledge management |

Keywords : CAD – CAM – DFM - DFMA

Prerequisite : technology basis, manufacturing courses, technical drawing, design processes

Objectives :

To enable students to understand the relationship between customer requirements, product design and communication, material selection and manufacturing operation. To provide students with in-depth understanding of different manufacturing processes available in modern industries by introducing students to basic casting and joining processes, different forming and machining operations, and dynamics of metal cutting processes.

The learning objectives are:

- * Students will gain an understanding of the major manufacturing processes, including machining, casting, forming, assembly, surface treatment, plastics processing, and inspection.
- * Students will develop the ability to use 3D computer-aided design (CAD) software, Pro/Engineer, and create part models, assemblies, and drawings.
- * Students will understand computer numerical control, how to write NC programs, and how to create NC programs with CAD/CAM software.
- * Students will understand CAD/CAM technologies and create physical parts.
- * Students will understand engineering graphics principles and how designs are communicated in industry. They will develop the ability to interpret engineering drawings.
- * Students will understand the relationships between customer desires, project materials, product design, and manufacturing process selection. They will develop an appreciation of product design and manufacturing process trade-offs.
- * Students will be able to look at products and determine how they were manufactured and why?

Agenda :

This course is designed to teach student the fundamentals manufacturing technology and the interrelationship between design and manufacturing processes. The course covers the essential manufacturing processes including casting, forming, machining, and joining processes. It exposes students to modern Computer-Aided Design and Computer Aided Manufacturing (CAD/CAM) techniques. It also covers basic engineering design and graphics. Emphasis is placed on the interrelationship between product design and its manufacturing processes.

Course agenda :

Manufacturing Systems and Customer Demand

Design for Manufacturing and Assembly

Product Families and Product Platforms

Definitions and Approaches to Product Family Design

Designing Mass Customized Goods and Product Families

- Manufacturing Considerations during Product Family Design
- Design for Mass Customization

Tutorial agenda :

The tutorial is a product design with manufacturing specification. The optimization of the system design is also part of the tutorial. The steps are :

Functional analysis and specification guideline

Creativity and design of the system

Manufacturing design

Product and its manufacturing definition

Oral system presentation

Evaluation : 100% TD/TP

Bibliographie :

Manufacturing Engineering and Technology, S. Kalpakjian and S.R. Schmid, 5th Edition, Prentice Hall, Upper Saddle River, NJ, Copyright 2006. ISBN-10: 0131489658

Pro/Engineer Wildfire3.0 Tutorial, Roger Toogood and Jack Zecher, SDC Publications, 2006. ISBN-10: 1585033073 (This is the green textbook).

M.F.Ashby and K.Johnson, Materials and Design – the art and science of material selection in product design, Butterworth-Heinemann, 2003.

G.E.Dieter, Engineering Design – a materials and processing approach, McGraw Hill, NY, 2000.

T.H.Courtney, Mechanical Behavior of Materials, McGraw Hill, NY, 2000.



M.F.Ashby, Material Selection in Mechanical Design, Butterworth-Heinemann, 1999.

K.G.Swift and J.D.Booker, Process selection: from design to manufacture, London:Arnold, 1997.

S.S.Rao, Engineering Optimization: theory and practice, John Wiley, NY, 1996.

Boothroyd, G., Dewhurst, P and Knight, W, Product design for manufacture and assembly, New York : Marcel Dekkar, 1994.

J.G.Bralla, Handbook of Product Design for Manufacture, McGraw Hill, NY, 1988.

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|  QIF | Digital transformatione |  |
| | 5A / Semester 9 | |
| | 12 h CM | Innovative product design and knowledge management |

Mots-clés : Knowledge – knowledge management– digitalisation – *change management*

Pré requis : survey watch (4th year)

Objectifs : Knowledge management is a multidisciplinary managerial approach that brings together all the initiatives, methods and techniques used to perceive, identify, analyze, organize, memorize and share the knowledge of the members of an organization - The knowledge created by the company itself (marketing, research and development) or acquired from the outside (economic intelligence) - in order to achieve a fixed objective.



The aim of this course is to introduce students to the notion of digital transformation (digital / digital), to show the stakes (visualization, synthesis, critical thinking, man-machine substitution) (Knowledge, data, knowledge, knowledge, IS, BDD, categorization / grid of reading) but also the knowledge of the latest digital tools in this field.

Program :

| Course |
|-----------------------------------|
| 1. from numéric to digital |
| 2. from information to knowledges |
| 3. from data mining to IS |
| 4. from data to vizualisation |
| 5. synthesis art |
| 6. digital tool |

Assessment : Continuous assessment: the pedagogy of this course is an Anglo-Saxon approach; It is to understand more than to learn and to prove that one has understood.

Bibliography : <http://sites.google.com/site/coursfgb/home>

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|  QIF | Plurial Intelligences |  |
| | 5A / Semester 9 | |
| | 6 h CM | Innovative product design and knowledge management |

keywords : Multiple Intelligence, Self-Knowledge, worldview

Prerequisite : aucun

Objectives : Plural intelligence is defined as the ability to identify, link and exploit all the resources available to us, be they emotional, rational, sensory, imaginative or sensitive. Confronting complexity, innovating: it is also in these terms that we often speak of collective intelligence and cooperation. As we all know, in order to function, a team must have a shared vision and project, common methods and values. Developing its plural intelligence is a powerful prerequisite for deeply sharing and acting constructively within a collective. This course aims to help students to become aware of the plurality of modes of operation of their intelligence.

Program :

| Course |
|---|
| 1. Self knowledge |
| 2. 7. Knowledge and openness to others (collective project) |
| 3. Emotional Intelligence |
| 4. Visual Intelligence (infography) |
| 5. Notion and exemples de <i>worldview</i> |


Assessment : Continuous assessment: the pedagogy of this course is an Anglo-Saxon approach; It is to understand more than to learn and to prove that one has understood.

Bibliography : voir le site web dédié à ce cours : <http://sites.google.com/site/coursfgb/home>

- GARREAU Joel, *Radical Evolution*, New York, Doubleday, 2005.
- DWECK, Carol, *Mindset: The New Psychology of Success*. 1ST edition. Random House, 2006
- BELL, Daniel, *The Coming of Post-Industrial Society*. Basic Books, 2008
- MACFARLANE, Alan. *Letters To Lily: On how the world works*. New Ed. London: Profile Books, 2010.
- BERNARD, Fabienne. *L'intelligence plurielle : Comment inventer demain tous les jours*. Paris: Vuibert, 2007.
- .

Option Quality, innovation and reliability engineering

Syllabus for Quality, semester 9

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|  QIF | English |  POLYTECH ANGERS |
| | 5A / Semestre 9 | |
| | 16 h TD | General course |

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Required: TOEIC validation

Objectives:

- Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of international environment
- Good command of oral techniques

Programme:

- Team working.
- Practising on the oral presentation of the final industrial projects (focusing on pronunciation, fluency of speech, using idioms, etc...)
- Practising on job/internship interview.

Evaluation:



Continuous assessment

Learning outcomes:

The student can carry out a job/internship interview.

The student can make a professional oral presentation on a long-term project (5th year industrial project)

The student can write a professional report, an abstract, a professional e-mail and a personal profile.

| | | | |
|---|-------------------------|---|----------------|
|  | <i>German / Spanish</i> |  | |
| | 5A / Semestre 9 | | UE 9-1 |
| | 12 h TD | | General course |

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: B2 level on listening and comprehension skills

Objectives:

- Meeting the requirements of the CEFRL (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of German/Spanish-speaking countries
- Preparation to an external certification

Programme:



Team working
 Training placement tests
 Professional writing (abstract, report, e-mail)
 Advanced grammar review

Evaluation:

Self-assessment with placement tests

Learning outcomes:

The student is able to run meetings
 The student has advanced grammar skills

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|---|-----------------------------|---|----------------|
|  | <i>Employability</i> |  | |
| | 5A / Semestre 9 | | UE 9-1 |
| | 16 h TD | | General course |

Keywords: job, employability, hiring, integration, professional watch

Prerequisites: None

Objectives:

- Give the keys to facilitate the integration of students leaving training
- Provide opportunities to share perspectives of students and their professional experiences with those of various structures (industry, consulting firms, recruitment ...)

Programme:



- 1 - "The key to integration in a team and individual skills evaluation from the internship experiences in the second year of engineering school"
 - ➔ Exchanges between students and professionals
- 2- "Professional watch as a driver of inclusion"
 - ➔ Presentation prepared
- 3- "Job interview skills focus"
 - ➔ Workshops from the areas for improvement identified in the preceding

Evaluation:

Evaluation: 100 % continuous assessment (work in group and individual)

References:

- [Jean-François Giret](#), **Pour une économie de l'insertion professionnelle des jeunes**, CNRS Editions (décembre 2000), Cnrs Economie, CNRS Editions, décembre 2000.
- [Michel Arliaud](#) (Sous la direction de), [Henri Eckert](#) (Sous la direction de), **Quand les jeunes entrent dan l'emploi, Broché**, juin 2002.
- [Philippe Labbé](#), **Les bricoleurs de l'indicible, tome 2 : De l'insertion en général, des missions locales en particulier**, Broché, avril 2004.
- [Florian Sala](#), **Bilan personnel et insertion professionnelle**, L'Harmattan, octobre 2000.

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|  QIF | <i>Employment law</i> |  POLYTECH ANGERS |
| | 5A / Semestre 9 | |
| | 12 h TD | General course |

Keywords: Labour code, employment contract, Collective Agreements, justice

Prerequisites: None

Objectives:

- Knowing labour law is essential; either you are worker or employer. Nobody can ignore it.
- Labour legislation is in constant discussion. It is therefore important to understand the legal, economic and social issues

Programme:

- Introduction
- Representation of employees and collective bargaining
- Hiring and contract
- Remuneration and working time
- Termination of the employment contract
- Court decisions

Evaluation:



Continuous assessment (100%): understanding the law, analyzing judgments

Learning outcomes:

The student has understood the meaning of law and is able to read and understand a court decision

References:

- Code du travail , ed.Dalloz
- RAY Jean-Emmanuel, « Droit du travail, Droit vivant 2017 », Ed Liaisons, 25^{ème} édition 2016

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|---|---------------------------------------|---|----------------|
|  QIF | <i>Project costs mastering</i> |  | |
| | 5A / Semestre 9 | | UE 9-1 |
| | 12 h TD | | General course |

Keywords :

Prerequisite :

Objectives :



Be able to calculate the financial profitability of an industrial project and to monitor and control the costs of this project.

Programme :

- Introduction
- Chapter 1: from the business plan to the forecast profit and loss account
- Market analysis
- Technical and operational analysis
- Financial plan
- Projected income statement
- Chapter 2: Choosing Investment
- decision criteria without updating
- Decision criteria with updating
- Decision in complex environment
- Chapter 3: costtenance
- Initial budget
- Budget to date
- Estimated cost
- Budget / cost comparison
- Treatment of inflation
- Currency processing
- Control of revenue and results
- Control of engineering costs
- Control of supply costs
- Control of construction costs
- Cost Control Tools
- Data Consolidation
- Inter-service relations

Evaluation :

Terminal examination 100%

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|  QIF | Quality engineering |  UE 9-3 Quality |
| | 5A / Semestre 9 | |
| | 10 h CM / 10 h TD | |

Keywords : Quality, Indicators, Process, Audit, ISO 9001, ISO 14001, EN 9100, ISO 18001, ISO/CEI 17025

Prerequisites : Quality management , Quality Audit

Objectives :

- To apply the knowledge acquired in the 3rd and 4th year in terms of Quality. To develop autonomy and become an expert in conducting and evaluating a quality system
- To Know and interpret the requirements of the main standards. To optimize and adapt a quality system according to the standard. To Know how to evaluate a quality system taking into account a quality reference system.

Program :

Quality management :

- Synthesis on the various Quality tools
- Role of a quality manager
- Practical situation in the organization
- Level of maturity and continuous improvement, what is expected?
- How to implicate actors in Quality?
- Improvement in auditing

Quality norms :

- National and international normative organization + Regulation
- Reading and interpretation of ISO 9001
- Industrial feedback
- Practical situation in the company
- Crossing audits of different systems.

Evaluation :

Continuous assessment (100%)

Learning outcomes:



The student will master the concepts and tools of the quality system, be autonomous and expert in this field

References:

3rd year course "Quality approach"

4th year course "Quality Audit"

4th year course "Risk Analysis"

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|  QIF | <i>Environmental management</i> |  UE 9-3 Quality |
| | 5A / Semestre 9 | |
| | 9 h CM / 9 h TD / 3h TP | |

Keywords : LCA, Sustainable Development, Social responsibility, ISO 26000

Prerequisites: ISO approach, environmental assessment (4th year : first approach with LCV and energy balance)

Objectives:

Deepening the LCA and taking ownership of it in a concrete case.
Opening up the reflection on the notion of responsibility, from the search for "sustainable development" to CSR, social / societal responsibility of the company, to the individual responsibility of the manager.
Provide benchmarks on the concepts of CSR and sustainable development.
Understand how companies take ownership of them today.

Program:

Extending the LCA
Definition of sustainable development and its effects on businesses.
Stakeholder Theory.
Defining the concept of CSR and situating it in relation to sustainable development
Presentation the main tools and references used in the company to conduct a CSR approach
Extensive discovery of ISO 26000

Evaluation:



Continuous assessment (100%)

Learning outcomes:

Having good command of Simapro

References:

JOLLIET O., SAADE M., CRETTEZ P. (2010). Analyse du cycle de vie : Comprendre et réaliser un écobilan, 2^e Ed.
AFNOR (2010). ISO 26000, responsabilité sociétale. Comprendre, déployer, évaluer : environnement, loyautés des pratiques

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|---|--|---|---------|
|  | <i>Industrial process optimization and control</i> |  | |
| | 5A / Semestre 9 | | UE 9-3 |
| | 14 h CM / 14 h TD | | Quality |

Keywords: quality engineering, response surface method (RSM), complex process, design of experiments (DoE), multivariate control charts, maintenance

Prerequisites: probability and statistics, industrial optimization, DoE, SPC

Objectives: variability reduction by industrial process optimization; design and use experiments, monitoring, control and supervision of complex industrial processes

Program:

Optimality criteria, response surfaces, regression

Modelling

1st order polynomial model

2nd order polynomial model

Non linearizable models

Model validation

Optimization

Iso responses

Steepest ascent

Simplex method

Statistical multivariate process control

Maintenance game (CIPE)

Evaluation: Continuous assessment (100%)

Learning outcomes: The student will be able to design and implement complex experiments and to analyze their results. The student will be able to monitor, to supervise and to control multivariate industrial processes.

References:

« La méthode des plans d'expériences », J. Goupy, Dunod, 1988

« Conception de la qualité : les plans d'expériences », R.H. Lochner, J.E. Matar, AFNOR, 1992

« Pratique industrielle de la méthode Taguchi », J. Alexis, AFNOR, 1995

« Les plans d'expériences », G. Sado, MC. Sado, AFNOR, 1991



« Design and analysis of experiments », D. C. Montgomery, Wiley, 2001

« Design and analysis of experiments », A. Dean, D. Voss, Springer, 1999

« Appliquer la maîtrise statistique des procédés MSP-SPC », M. Pillet, Editions d'Organisation, 2000

« Six Sigma : comment l'appliquer », M. Pillet, Eyrolles, 2013

Gérald Baillargeon's books

| | | | |
|---|----------------------------------|---|------------|
|  | <i>Project Management</i> |  | |
| | 5A / Semestre 9 | | UE 9-4 |
| | 17 h CM / 17 h TD | | Management |

Keywords :

Project Management, leadership, objectives, communication, motivation, organization, collaborative projects

Prerequisites :

Niveau N : Work Breakdown Structure, PERT, Project Management Software

Objectives :

The course's objectives are to initiate the students to team project management concepts and tools. Learning is done through practical situations, case studies and continuous exchange with the teacher. Learning is organized through the following questions:

- How to build a project team?
- How to build the identity of a project team?
- How to manage communication and conflicts within the project team?
- Ho to improve performance of a project team?

At the end of the course, students will better understand:

- The key development steps of a team
- Methods to setup objectives and action plans for the team
- Communication and conflict management methods
- Methods to improve performance and motivation of team members

Program :

Session 1 – Conditions of success of a project

1 – The 4 project pillars: goals, organization, skills/motivation and communication. This work will be based on analysis on both positive and negative students' former experiences

2 – Setup project objectives – The vision document. The vision document is a prerequisite which is mandatory for any project: from half a page to a few pages, the vision document gets all stakeholders to the heart of action by giving team members a common vision of the results and confidence in the fact that the project will succeed.

3 – Case study: Eurotunnel. When project stakeholders do not follow the same objectives, you have to say no.

Session 2 – Project Organization

1 – Work Breakdown Structure: several ways to structure a project in manageable chunks. The work breakdown structure will influence the level of skills and the kind of teams that will be in charge.

2 – Planning as a leadership tool for the team. The project manager learns to launch teamwork by working with a common planning, gathering the team around it, helping everyone understand the stakes of a delay of one's task on another task, help everyone saying no to new features.

3 – Project simulation: team staffing and motivation. You are in charge of the development

of a peacemaker case and you have to select who may handle each task... but you will also have to consider motivation, team building, costs and delays.

Session 3 – Motivation and skills

1 – The 8 axis of motivation at work. Involvement and skills of each team member are key to project success. Which factor is of highest importance and should be carefully looked at? Everyone is unique and what may motivate one team member may not apply to another team member. How to nevertheless maintain fairness among the team?

2 – Qualifying requested skills for each task. From a project analysis standpoint, the project manager must identify the key skills to prepare a recruitment interview on a task.

Session 4 – Communication within the project

1 – Non violent communication. When you have to reframe an inadequate behavior or send an important message, the non violent communication framework suggests an efficient communication structure to be clearly understood without breaking the work relationship.

2 – Setup and objective. Project manager delegates but also controls and helps her team members in their tasks.

3 – Building a trustworthy team. Why are we lying at work? Based on an analysis on why we are lying, we will conclude a set of good practices that help building a work environment where team members tell the truth to each other's face.

Session 5 – Project risks management

1- Black Swan cases analysis and methods to prevent them

2- Simulation of risk forecast on a difficult project: a merger and acquisition project of two banks.

Evaluation :

(50 %) Online and Excel Simulator of a project organization

(30%) Simulator on project risks management



(20 %) A quiz at each start of a new lesson

Learning outcomes:

1. Be capable to identify the stakes of a situation, analyze different options and evaluate their impact
2. Know how to apply appropriate decision-making processes in the framework of one's mission or tasks
3. Demonstrate capacities of adaptation and problem-solving in managerial situations
4. Have good command of project management methodology and of the tools for effective management of the human resources involved

References:

S. Berkun – Making things happen

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|  | <i>Management of organisations</i> |  | |
| | 5A / Semestre 9 | | UE 9-4 |
| | 22 h CM / 16 h TD | | Management |

Keywords :

Human resources Management, consultant, innovative organizations, knowledge management

Prerequisites :

Theoretical and practical understanding of Project Management

Objectives :

Understanding the HR dimension of project management
Knowing the innovative organizations and the conditions for their implementation
Discovering the specificities of consulting activities and the conditions for success as a consultant

Program :

The HR dimension of project management

- Missions and stakes of the HR function
- HR issues related to project management (selection of project managers, evaluation of team workers, project managers back to functions, training ...)

Innovative organizations

- Overview of innovative organizations
- The conditions for successful transformation

Knowledge management

- Définition and issues
- Operational characteristics

Consulting activities

- Based on his experience in the world of consulting, the teacher will describe the specificities, calls for tenders, the consultant's skills, techniques of animation

Evaluation :

Continuous assessment (100%)

Learning outcomes:

Future project managers will be prepared, if necessary, to interface with the HR function.

The students will have received a consultant's testimony which will enable them to better understand this status

Future engineers will know the innovative organizations and the conditions for a successful transformation of the organization

References:

Belout A., Gauvreau C., “Factors influencing project success : the impact of human resource management”, *International Journal of Project Management*, vol. 22, 2004, p. 1-11.



Bloch A., Constantin T., Leduc O., Oger F., Renault O., *Déjouer les pièges de la gestion de projet*, Éditions d’Organisation, Paris, 2000.

Dinsmore P. C., *Human factors in project management*, American Management Association, NY, 1990.

Garel G., Giard V., Midler C., « *Management de projet et gestion des ressources humaines* », Document inédit, GREGOR, l’IAE de Paris, 2001.

Minzberg H., *Structure & dynamique des organisations*, Éditions d’Organisation, Paris, 1982.

Simmat B., Bercovici B. , « *Les entreprises libérées* », Ed d’Organisation , Paris, 2016

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|  QIF | <i>Management and Human factor</i> |  UE 9-4 Management |
| | 5A / Semestre 9 | |
| | 15 h CM / 17 h TD / 6 h TP | |

Keywords: Human factor, resistance to change, cooperation, influence, intercultural management, negotiation techniques

Prerequisites:

Management courses in 3rd and 4th year

Objectives:

Understand and respond to resistance to change, common reaction with continuous improvement projects

Understand situations related to intercultural management in the company

Discover and experiment with negotiation techniques

Program :

The course is divided into 3 parts:

The human factor in performance improvement projects

Resistance to change

Cooperation

Influence

Intercultural management

Theoretical bases of intercultural management

Simulations

Negotiation techniques

Basics of negotiation techniques

Trading negotiation, negotiation and management, negotiation and project management

Simulations

Evaluation :

Continuous assessment (100%)

Learning outcomes:



The future engineer will have understood the necessary consideration of the human factor in the transformation projects, particularly the performance improvement initiatives.

He will have experimented through simulations the issues of intercultural management.

He will be able to reuse the negotiation techniques in any professional situation.

Bibliographie :

- Amar P. Psychologie du manager Ed. Dunod, 2000
- Beauvois J.L, Joule R-V, Petit traité de manipulation l'usage des honnêtes gens, Ed PUG, 2014
- Robbins S. et Judge T. Comportements organisationnels. Ed Pearson, 2011
- Roche C. Petit guide Lean à l'usage des managers ,Ed L'Harmattan, 2015
- Berry, J.W. 1997. Immigration, acculturation and adaptation. *Applied Psychology : An International Review*.
- Cornet A., Internationalisation des entreprises et multiculturalité. HEC – Université de Liège
- Demorgon J., Critique de l'interculturel. L'horizon de la sociologie. *Economica*. 2005.
- Druskat V., Wolff S. **Building the Emotional Intelligence of groups.** *Harvard Business Review*.
- Forthomme P., Bekhoucha S. 2009. Mes équipes travaillent sur trois continents », *Expansion Management Review*.
- Forthomme P. « Entreprise et société en Suède : un regard aux sources du modèle », compte rendu réalisé par l'Ecole de Paris de management suite à une conférence donnée par Pierre Forthomme le 8 juin 2007.
- Hofstede G. 1999. The universal and the specific in 21th Century global management, *Organizational Dynamics*.

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|  QIF | <i>Communication and crisis management</i> |  POLYTECH ANGERS |
| | 5A / Semestre 9 13 h CM / 12 h TD | |

Keywords : Communication et crisis management,

Prerequisite :

Acquired in the 4th year: vocabulary and principles of financial analysis, major functions of the company, fundamentals of marketing

Objectifs :

Adopt a good manager behavior under crisis

Programme :

1 / Organize the Crisis Staff according to different risk scenarios

Organization of crisis unit (s): definition of the business functions and support to be integrated into crisis units and on-call missions Identification of profiles and members for each crisis unit (internal collaborators and external stakeholders)

Definition of Responsibilities and Responsibilities (Chain of Command)

Location of the crisis site (s)

2 / Identify and prepare the logistical means of crisis management

Plan for the mobilization and maintenance of infrastructures, premises, equipment and crisis management resources

Material means: crisis rooms, means of communication, information systems, documentation, supplies, ...

3 / Build the crisis communication plan and plan

Identification of target audiences: employees, clients, authorities, media, ...

Identification and preparation of persons authorized to communicate

Defining policies and prefiguring messages and response scripts

Alert, notification and reporting procedure

Back-up procedure and checklist of emergency actions

4 / Deploy crisis management action plans and procedures

Process of control (chain of command): gathering and exploitation of intelligence, coordination, decision-making, expert consultation, reporting, communication and enforcement

Procedure for assessing the crisis: origin, impacts, actions carried out, ...

Procedure for activating the crisis cells according to the indicators and triggering thresholds

Definition and production of crisis management documentation: action sheets, reflex cards, decision cards, event traceability, pre-formatted letters, crisis guide, etc.)

Definition of action plans for ending the crisis

Animation of feedback sessions

Elaboration of the diagnosis and assessment of crisis management

Organization and deployment of follow-up units

5 / Anticipating the process of exit from crisis and standardization

Business Continuity and Return to Normal

6 / In peacetime, identify and define mechanisms for monitoring, tracking and monitoring crisis signs and ensuring the operational maintenance of the crisis mechanism

Organization and deployment of risk management committees, by business line (distribution, production, IT, HR, ...) or by risk typology



Implementation of indicators for monitoring low-intensity signals and risk management dashboards

Definition of monitoring, analysis and information processing circuits

Establishment of specific mechanisms: monitoring traditional media and social networks, social monitoring, regulatory and legal monitoring, customer and supplier surveys, economic and strategic intelligence, incident monitoring, ...

Evaluation :

100% continuous assessment

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|  QIF | <i>Change management</i> |  UE 9-5 Performance |
| | 5A / Semestre 9 | |
| | 18 h CM / 18 h TD | |

Keywords :

Resistance to change, individual and collective commitment, pedagogy of meaning, Agile Manifesto, SCRUM, COMCOLORS,

Prerequisites :

Basics of management

Basics of Complex Systems Engineering

Objectives :

In turbulent contexts, managers and their teams are constantly adjusting and developing agility for change.

How can we make sense, facilitating commitment in the project by all?

How can we communicate with the actors of transformation and lift resistance to change?

How can we identify risks of failure and promote a project ?

Understanding the contributions of Holism, individual autonomy, team creativity and the Agile effect for collective performance.

Program :

The module is divided into two parts:

1- Change management

- Definition of a vision for the organization
- Development of strategies

2- Agile management

- Agility, general overview of agile methods
- Introduction to SCRUM
- 2 key points of SCRUM: backlog and burndown
- Agile organization: PUMA, RUP and Agile
- COMCOLORS Personality Model

Evaluation :

Continuous assessment (100%)

Business case

Learning outcomes:

At the end of the course, the student will have a good understanding of the notions of strategy and general policy in the company.

The student will have gained more comfort to promote a project
He/she will be able to lead change with more efficiency, both in operational and human terms.
He/she will have understood the basics of agile management and behavior for team performance.

References:

A. Larroumet / J.Lusteau, Le Management Inventif – (2006)

A. Larroumet Donner du sens – (2013)

Barry W. Boehm avec Richard Turner, Grady Booch et Alistair Cockburn : Balancing Agility and Discipline / A Guide for the Perplexed (2003)

Jeff Sutherland : Scrum, The Complete Overview and Guide (Boxset), For the Agile Scrum Master, Product Owner, Stakeholder and Development... (2013)



Ken Schwaber :

- Mike Beedle : Agile Software Development with Scrum (2001),
- Agile Project Management With Scrum (2004),
- The Enterprise and SCRUM (2007),

Steve Zielinski : The Great Convergence: Merging Lean, Agile, Knowledge-based New Product Dev. (2013)

Jean-Pierre Vickoff : Systèmes d'Information et Processus Agiles, PUMA (2003)

Méthodes et modèles : BOEHM, RAD, DSDM, RUP, SCRUM, PUMA, XP, COMCOLORS,

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|  QIF | <i>Driving global performance</i> |  POLYTECH ANGERS | |
| | 5A / Semestre 9 | | UE 9-5 |
| | 24 h CM / 18 h TD / 6 h TP | | Performance |

Keywords: Organizational Analysis, SWOT, Process Analysis, Cost Reduction, Productivity, Change Management, Quality, KPI, scoreboards

Prerequisites:

no

Objectives:

- Through a case study, provide a methodology of conducting a diagnosis of an organization,
- Be able to identify organizational dysfunction, to argue and explain it,
- Based on the results of the diagnosis, conduct or participate in solution research sessions on the basis of a participatory methodology,
- Be aware of change management aspects when setting up a new organization
- Be able to measure performance

Program :

Organizational diagnosis

- Definition of an organization: Organization chart and structure, Process, Steering tools,
- Organizational analysis: tactical and technical aspects,
- The phases of the organizational diagnosis (tools),
- The search for solutions for organizational improvement,
- Installation: tracks and practical advice,
- Case study

Measure of performance



- Methods and tools for measuring performance
- Case study

Evaluation :

Continuous assessment (100%)

Option Quality,
innovation and
reliability engineering

Syllabus for Reliability,
semester 9

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|  | <i>English</i> |  |
| | 5A / Semester 9 | |
| | 16 h TD | General course |

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Required: TOEIC validation

Objectives:

- Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of international environment
- Good command of oral techniques

Programme:

- Team working.
- Practising on the oral presentation of the final industrial projects (focusing on pronunciation, fluency of speech, using idioms, etc...)
- Practising on job/internship interview.

Evaluation:



Continuous assessment

Learning outcomes:

The student can carry out a job/internship interview.

The student can make a professional oral presentation on a long-term project (5th year industrial project)

The student can write a professional report, an abstract, a professional e-mail and a personal profile.

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|  QIF | <i>German / Spanish</i> |  POLYTECH ANGERS |
| | 5A / Semester 9 | |
| | 12 h TD | General course |

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: B2 level on listening and comprehension skills

Objectives:

- Meeting the requirements of the CEFRL (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of German/Spanish-speaking countries
- Preparation to an external certification

Programme:



Team working
Training placement tests
Professional writing (abstract, report, e-mail)
Advanced grammar review

Evaluation:

Self-assessment with placement tests

Learning outcomes:

The student is able to run meetings
The student has advanced grammar skills

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|  QIF | <i>Employability</i> |  | |
| | 5A / Semester 9 | | UE 9-1 |
| | 16 h TD | | General course |

Keywords: job, employability, hiring, integration, professional watch

Prerequisites: None

Objectives:

- Give the keys to facilitate the integration of students leaving training
- Provide opportunities to share perspectives of students and their professional experiences with those of various structures (industry, consulting firms, recruitment ...)

Programme:



- 1 - "The key to integration in a team and individual skills evaluation from the internship experiences in the second year of engineering school"
 - ➔ Exchanges between students and professionals
- 2- "Professional watch as a driver of inclusion"
 - ➔ Presentation prepared
- 3- "Job interview skills focus"
 - ➔ Workshops from the areas for improvement identified in the preceding

Evaluation:

Evaluation: 100 % continuous assessment (work in group and individual)

References:

- [Jean-François Giret](#), **Pour une économie de l'insertion professionnelle des jeunes**, CNRS Editions (décembre 2000), Cnrs Economie, CNRS Editions, décembre 2000.
- [Michel Arliaud](#) (Sous la direction de), [Henri Eckert](#) (Sous la direction de), **Quand les jeunes entrent dan l'emploi, Broché**, juin 2002.
- [Philippe Labbé](#), **Les bricoleurs de l'indicible, tome 2 : De l'insertion en général, des missions locales en particulier**, Broché, avril 2004.
- [Florian Sala](#), **Bilan personnel et insertion professionnelle**, L'Harmattan, octobre 2000.

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|  | <i>Employment law</i> |  | |
| | 5A / Semester 9 | | UE 9-1 |
| | 12 h TD | | General course |

Keywords: Labour code, employment contract, Collective Agreements, justice

Prerequisites: None

Objectives:

- Knowing labour law is essential; either you are worker or employer. Nobody can ignore it.
- Labour legislation is in constant discussion. It is therefore important to understand the legal, economic and social issues

Programme:

- Introduction
- Representation of employees and collective bargaining
- Hiring and contract
- Remuneration and working time
- Termination of the employment contract
- Court decisions

Evaluation:



Continuous assessment (100%): understanding the law, analyzing judgments

Learning outcomes:

The student has understood the meaning of law and is able to read and understand a court decision

References:

- Code du travail , ed.Dalloz
- RAY Jean-Emmanuel, « Droit du travail, Droit vivant 2017 », Ed Liaisons, 25^{ème} édition 2016

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|  QIF | <i>Project costs mastering</i> |  POLYTECH ANGERS |
| | 5A / Semester 9 | |
| | 12 h TD | General course |

Keywords :

Prerequisite :

Objectives :



Be able to calculate the financial profitability of an industrial project and to monitor and control the costs of this project.

Programme :

- Introduction
- Chapter 1: from the business plan to the forecast profit and loss account
- Market analysis
- Technical and operational analysis
- Financial plan
- Projected income statement
- Chapter 2: Choosing Investment
- decision criteria without updating
- Decision criteria with updating
- Decision in complex environment
- Chapter 3: costtenance
- Initial budget
- Budget to date
- Estimated cost
- Budget / cost comparison
- Treatment of inflation
- Currency processing
- Control of revenue and results
- Control of engineering costs
- Control of supply costs
- Control of construction costs
- Cost Control Tools
- Data Consolidation
- Inter-service relations

Evaluation :

Terminal examination 100%

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|  QIF | <i>System modelisation in design process</i> |  UE 9-3 System modeling and safety |
| | 5A / Semester 9 | |
| | 20 h CM / 3h TD / 7h TP | |

Keywords: model-driven engineering, system modeling, SysML, UML, AltaRica, modeling

Required: value analysis, modeling, state graph, Petri nets, structural and behavioral analysis

Objectives: The aim is to provide the basis for the design of a complex model-driven system to define its architecture, define and validate the specification requirements and measure performance. The design should take into account the safety constraints and the interaction of the system with its environment.

Contents:

- Introduction to model-driven engineering
- Model driven architecture (MDA)
- Models in MDA (Platform Independent Model vs Platform-Specific Model)
- Archetypes and patterns of analysis to support conceptual modeling with consideration of risk analysis
- Syntax and semantics of a model
- Specifying constraints on models
- Modeling of failure modes and undesirable events
- Tools supporting model-driven engineering

The contents will not necessarily be presented in this order. However, all subjects will be presented as part of this course.



Evaluation: Continuous assessment

Learning outcomes:

Ability to model the operation of a complex system based on its requirements and the failures of complex systems, in order to estimate dependability metrics

References:

- Jean-Marc Jézéquel, Benoît Combemale et Didier Vojtisek. Ingénierie Dirigée par les Modèles : des concepts à la pratique. Ellipses Marketing, 2012.
 - Craig Larman. Applying UML and Patterns. 3rd edition, Prentice Hall, 2005.
 - Stephen J.Mellor and Marc J. Balcer. Executable UML: A Foundation for Model Driven Architecture. Addison-Wesley. ISBN-10: 0201748045
 - Dezfuli, Homayoon, Allan Benjamin, Christopher Everett, Curtis Smith, Michael Stamatelatos, et Robert Youngblood. 2011. *NASA System Safety Handbook. Volume 1; System Safety Framework and Concepts for Implementation.*
 - Noergaard, Tammy. 2012. *Embedded systems architecture: a comprehensive guide for engineers and programmers.* Newnes.
 - PIQUES, Jean-Denis. 2016. « SysML for embedded automotive ». Consulté le mars 2.
- Arnold, André, Gérald Point, Alain Griffault, et Antoine Rauzy. 2004. *AltaRica, Manuel méthodologique.* LaBRI, Université Bord

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|  QIF | <i>functional and dysfunctional modeling for performance evaluation</i> |  UE 9-3 System modeling and safety |
| | 5A / Semester 9 | |
| | 10 h CM / 8h TD / 6h TP | |

Keywords: modeling, state graph, Markov chains, Petri nets, structural and behavioral analysis, evaluation MTTF, MTBF, MUT, MDT, R(t), A(t)

Required: mathematics, statistics and probabilities, linear algebra, predictive reliability, operational reliability

Objectives: complex systems modeling and analysis, predictive dependability evaluation for complex systems with dependency between components.

Contents:

Stochastic process, Markovian and non-homogenous process; state graphs, states and transitions representation;

State defining equations and transition matrix

Flow conservation method

Applications: reliability and availability assessment: active and passive redundancy, small number of maintenance teams, maintenance priorities.

Parameter evaluation: MTTF, MTBF, MUT, MDT

Discrete event systems and Petri nets

Structural analysis

Behavioral properties

Stochastic PN and random events modeling

Dependability parameters computation

Simulation

Evaluation: Continuous assessment

Learning outcomes: The student will have ability in complex systems modeling and analysis, predictive reliability evaluation (main average parameters or time dependent parameters) for complex systems with dependencies between components (inventory constrains, maintenance priorities or passive redundancy).

References:

Sûreté de fonctionnement des systèmes industriels, Alain Villemeur, Eyrolles, 1988



Performance modelling with deterministic and stochastic Petri Nets, C. Lindemann, Wiley, 1998

Petri Nets for systems engineering, C. Girault, R. Valk, Springer, 2003

Réseaux de Petri : Théorie et pratique, G.W. Brams (ouvrage collectif), Masson, 1983

Application of Petri Nets in Manufacturing Systems. Modeling, Control and Performance analysis, A. A. Desrochers, R.Y. Al-Jaar, IEEE Press, 1994

Practice of Petri Nets in Manufacturing, F. DiCesare, G. Harhalakis, JM. Proth, M. Silva, F.B. Vernadat, Chapman&Hall, 1993

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|  QIF | <i>System modelisation in design process</i> |  UE 9-3 System modeling and safety |
| | 5A / Semester 9 | |
| | 12 h CM / 6 h TD / 6 h TP | |

Keywords: model-driven engineering, system modeling, SysML, UML, AltaRica, modeling

Required: value analysis, modeling, state graph, Petri nets, structural and behavioral analysis

Objectives: The aim is to provide the basis for the design of a complex model-driven system to define its architecture, define and validate the specification requirements and measure performance. The design should take into account the safety constraints and the interaction of the system with its environment.

Contents:

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- Specifying constraints on models
- Modeling of failure modes and undesirable events
- Tools supporting model-driven engineering

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Evaluation: Continuous assessment

Learning outcomes:

Ability to model the operation of a complex system based on its requirements and the failures of complex systems, in order to estimate dependability metrics

References:

- Jean-Marc Jézéquel, Benoît Combemale et Didier Vojtisek. Ingénierie Dirigée par les Modèles : des concepts à la pratique. Ellipses Marketing, 2012.
 - Craig Larman. Applying UML and Patterns. 3rd edition, Prentice Hall, 2005.
 - Stephen J.Mellor and Marc J. Balcer. Executable UML: A Foundation for Model Driven Architecture. Addison-Wesley. ISBN-10: 0201748045
 - Dezfuli, Homayoon, Allan Benjamin, Christopher Everett, Curtis Smith, Michael Stamatelatos, et Robert Youngblood. 2011. *NASA System Safety Handbook. Volume 1; System Safety Framework and Concepts for Implementation.*
 - Noergaard, Tammy. 2012. *Embedded systems architecture: a comprehensive guide for engineers and programmers.* Newnes.
 - PIQUES, Jean-Denis. 2016. « SysML for embedded automotive ». Consulté le mars 2.
- Arnold, André, Gérald Point, Alain Griffault, et Antoine Rauzy. 2004. *AltaRica, Manuel méthodologique.* LaBRI, Université Bord

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|  | <i>Processus Safety in industry</i> |  |
| | 5A / Semester 9 | |
| | 6 h CM / 6 h TD | System modeling and safety |

keywords : REX, Bayésian,

Prerequisite : Statistics, Probabilities, Bayesian Statistics

Objectifs : Show how you implement the Feedback.

Programme :

Theoretical reminders

The Return of Experience: collecting and analyzing the REX

The analysis of REX

Bayesian probabilistic analysis and the use of expertise



Analysis of the aging of materials

Limits of the Bayesian Approach

The theory of statistical decisions

Applications of analytical procedures in several fields of activity (automotive, nuclear, rail, electronics, aeronautics ...)

Assessment : none

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|  QIF | <i>Systems reliability</i> |  |
| | 5A / Semester 9 | |
| | 15 h CM / 11 h TD / 4 h TP | Systems Validation and qualification |

keywords : Electronic reliability, failure rate, data collection, software reliability, reliability growth models, fault tolerance

Pré requis : Mechanics and stat-proba, basic reliability, predictable reliability

Objectifs :

To be able, according to the architecture, to estimate the reliability of a complex system integrating different technologies: Mechanics, Electronics, Software,



Programme :

- 1- System Reliability Models**
 - Reliability Diagram
 - Fault Tolerance Mechanism
 - Determination of functional safety levels
- 2- Reliability of mechanical components**
 - Components of reliability of mechanical components (NPRD95, NSWC 2011, ...)
 - Mechanical-Reliability approach
- 3- Reliability of electronic equipment**
 - Electronic reliability records (Fides, UTEC 80-810, ...)
- 4. Reliability of software**
 - Models Musa, Jelinski-Morenda, ...

Assessment : project et terminal examination

Bibliography :

- « Sûreté de fonctionnement des systèmes industriels » Alain Villemeur, Eyrolles, 1988
- « Fiabilité des structures des installations industrielles- Théorie et application de la mécanique probabiliste » Procaccia H, Morilhat P (1996), Eyrolles, 94
- « Fiabilité des systèmes », A.Pagès et M.Gondran, Coll. Eyrolles, Direction des Etudes et Recherches d'Electricité de France.

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|  QIF | <i>Reliability testing</i> |  |
| | 5A / Semester 9 | |
| | 9,5 h CM / 9,5 h TD / 4 h TP | Systems Validation and qualification |

keywords : Aggravated Tests, Reliability Tests and Debug Tests

Prerequisite : reliability

Objectifs : Define a validation and qualification testing strategy for different phases of product development

Programme :

Aggravated tests:

- HALT
- STRIFE

Reliability tests:



- Classical tests
- Low and strongly censored tests
- Bayesian Testing
- Accelerated tests (constant and staggered stress)

Debugging tests:

- HASS
- BURN IN
- ESS

Assessment : project of 4 h

Bibliographie : Accelerated Testing : Statistical Models, Test Plans and Data Analysis. Ed. Wiley Series in Probability and Mathematical Statistics, 1990

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|  QIF | <i>Cycles et Agile processus</i> |  |
| | 5A / Semester 9 | |
| | 6 h CM / 6 h TD | Software quality and IS management |

keywords : Agile Approaches, Software Development Cycle, SCRUM, Devops, Design Thinking, Incremental iterative development cycle

Prerequisite : none

Objectives : Understanding the development cycles and agile processes - the origins, philosophy and operating principles with a zoom on Scrum method.

Program :



Software Engineering and Development Cycles
Requirements, Use-Cases, Iterations, story-teling, story mapping, ...
Cycles and agile processes, Devops, Design Thinking, DAD ...
Earned Value, Agile & LSD Methods

Assessment : continuous assement and terminal examination

Learning outcomes : Ability to understand the practices and functioning of agile methods in designing and managing projects

Bibliography :

- *Agile Software Management with Scrum*, Ken Schwaber (Microsoft Press, 10 mars 2004)
- *The Power of Scrum*, Jeff Sutherland, Rini van Solingen, Eelco Rustenberg (Kindle Edition, 10 novembre 2011)
- *SCRUM : Le guide pratique de la méthode agile la plus populaire*, Claude Aubry (Dunod, 1 octobre 2015)
- *Agile, Scrum et au-delà, Pilotage de projets, Mise en œuvre rapide*, Jean-Pierre Vickoff, QI, 2016.

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|  QIF | <i>Standards and Maturity Models Software</i> |  |
| | 5A / Semester 9 | |
| | 6 h CM / 6 h TD | Software quality and IS management |

keywords : Software Quality, Maturity Models, ISO SQUARE, CMMi

Prerequisite : Software Development Cycle, Quality Assurance

Objectives : Present the standards and standards in the production of the software (product, process and organization) and in the IS

Program :



Software Quality Assurance Plan.
Quality Control Techniques Software
Quality management system ISO SQUARE (ISO 25000)
CMMi
RiskIT, ValIT

Assessment: Continuous assessment and terminal examination

Learning outcomes : Know how to set up and adapt standards and standards of good practices in software production in order to evaluate and improve the Quality software product

Bibliography :

François Dufay, CMMI par l'exemple : Pour une mise en place opérationnelle, Éditions Eyrolles, 16 juillet 2010, 287 p.
Richard Basque, CMMI : Un itinéraire fléché vers le Capability Maturity Model Integration Version 1.2, Éditions Dunod, novembre 2006, 253 p.
Alain April, Claude Laporte : Assurance Qualité Logicielle 1 -concepts de base, Hermes-Lavoisier; 2011

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|  QIF | <i>Quality and IS Management</i> |  |
| | 5A / Semester 9 | |
| | 9 h CM / 9 h TD | Software quality and IS management |

keywords : IS Management, IS of entreprise, services management, Process modeling, Governance, Architecture, Complex management, Corporate culture, ITIL, CobIT, LEAN IT

Prerequisite : Quality approach

Objectives : Understand the challenge of managing the information system vis-à-vis the management of the company and its objective of improving performance gathering all the knowledge, techniques and tools ensuring the management of data and their security, And more generally the organization and protection of the information system.

Program :

IS Management
Business IT
Governance of the IS
Urbanization of the IS
ITIL Services Management
Business Architecture
Business Process Modeling
Continuity of Services
Conduct of Change
LEAN Management and LEAN IT

Assessment : Continuous assessment and terminal examination



Learning outcomes : Ability to understand and implement the means of monitoring and steering the corporate information system in order to improve performance

Bibliography :

Kenneth C. Laudon, Jane Laudon, Essentials of Management Information Systems, Pearson, 2009

Suzanne Rivard, Jean Talbot, Le développement de systèmes d'information : une méthode intégrée à la transformation des processus, Montréal, Presses de l'Université du Québec, 2001, 718 p.

Kenneth Laudon, Jane Laudon, Management information systems, Pearson, 2009

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|  QIF | <i>Maintenance Planning and Optimization</i> |  UE 9-6a Maintenance in operational condition |
| | 5A / Semester 9 | |
| | 4 h CM / 2,67 h TD / 16 h TP | |

Key words: Maintenance, Policy, Preventive Maintenance, Corrective Maintenance, Maintainability, Management, Methods

Pre-requisites: Reliability, Probability, Statistics, System modelling, Simulation

Objectives: This course is a part of the module « Maintenance Engineering ». The global objective of this module is to introduce some global economical issues in the product development and operating phases combined to reliability concepts that have been introduced previously. These costs aspects will be tackled through :

- The overall cycle cost of a product and the introduction of some methodologies in product design phase such as the Integrated Logistic Support;
- The maintenance optimization in terms of preventive and corrective plannings, of organizations and of the introduction of the availability issues in the design;
- Advanced maintenance concepts and methodologies which combine complex system diagnosis and their introduction for the maintenance decision-making: the PHM concepts (Prognosis and Health Management)

Specifically, the objective of the Maintenance Planning and Optimization course is to introduce the classical methods for the construction and the setting of maintenance policies from the design to the operating phase of a product. Classical definitions, basic concepts, organizational methods and construction and optimization decision models will be discussed.



Program:

1. Introduction to the maintenance concepts and methods through the « Game of Maintenance »
2. Some new challenges in Maintenance Decision
3. Product Maintenance-Based design approach
4. How to construct a Maintenance Program: the Maintenance-oriented FMECA
5. Maintenance optimization of Complex Systems

Examination: Ongoing evaluation

Bibliography:

- *La maintenance basée sur la fiabilité* – G. Zwingelstein – Hermès – 1996
- *La maintenance : mathématiques et méthodes (4^e édition)* – P. Lyonnet – Tec&Doc – 2000
- *Maintenability : A key to effective serviceability and Maintenance Management* – B. Blanchard – Wiley – 1995

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|  QIF | <i>Logistic Support and Life Cycle Cost</i> |  UE 9-6a Maintenance in operational condition |
| | 5A / Semester 9 | |
| | 1,33 h CM / 3 h TD / 5,33 h TP | |

Key words: ILS, LCC, System Engineering, Complex Systems, Product Life Cycle

Pre-requisites: Reliability, Maintenance, Probability, Statistics, System modelling, Simulation

Objectives: This course is a part of the module « Maintenance Engineering ». The global objective of this module is to introduce some global economical issues in the product development and operating phases combined to reliability concepts that have been introduced previously. These costs aspects will be tackled through :



- The overall cycle cost of a product and the introduction of some methodologies in product design phase such as the Integrated Logistic Support;
- The maintenance optimization in terms of preventive and corrective plannings, of organizations and of the introduction of the availability issues in the design;
- Advanced maintenance concepts and methodologies which combine complex system diagnosis and their introduction for the maintenance decision-making: the PHM concepts (Pronosis and Health Management)

Specifically, the objective of the course « Logistic Support and Life Cycle Cost » is to understand the importance of dimensioning, during the design phase of complex systems, the maintenance process for the operating phase and particularly the maintenance support and logistics such as spare parts dimensioning and the role of suppliers

Curriculum:

1. The design of complex systems: Challenges and methods
 - a. Some of the challenges in design of complex systems
 - b. Design and Life Cycle
 - c. Design and Total Cost of Ownership: Definition
 - d. Introduction to methods in Design Engineering
2. The overall lifecycle cost: Definition and assessment
 - a. Cost Engineering: Tools and methods
 - b. Life Cycle Cost Modeling
 - c. Theoretical cost models
 - d. The cost incurred to unavailability
3. The Integrated Support Logistic: Concepts and definitions of the ILS, the LSA and the associated database.
 - a. The issues of the ILS
 - b. How to implement an ILS strategy: from the LSA to the ILS database
 - c. Tools and methods of the Logistic Support

Examination: Ongoing evaluation

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|  QIF | <i>Diagnostic and Prognostic for Maintenance</i> |  |
| | 5A / Semester 9 | UE 9-6a |
| | 5.33 h CM / 2.67 h TP | Maintenance in operational condition |

Key words: Diagnostic, Prognostic, Predictive maintenance, PHM, HUMS, Degradation, Useful Remaining Lifetime

Pre-requisites: Maintenance, Reliability, Probability, Statistics, System modelling, Simulation

Objectives: This course is a part of the module « Maintenance Engineering ». The global objective of this module is to introduce some global economical issues in the product development and operating phases combined to reliability concepts that have been introduced previously. These costs aspects will be tackled through :



- The overall cycle cost of a product and the introduction of some methodologies in product design phase such as the Integrated Logistic Support;
- The maintenance optimization in terms of preventive and corrective plans, of organizations and of the introduction of the availability issues in the design;
- Advanced maintenance concepts and methodologies which combine complex system diagnosis and their introduction for the maintenance decision-making: the PHM concepts (Prognosis and Health Management)

Specifically, the objective of the course « Diagnostic et Prognostic for Maintenance » is to introduce advanced methods in maintenance for technical products based on prognostic. These methods can be based on Non-Destructive Testing techniques such as embedded systems (sensors, IoT, ...) also named HUMS (Health in Usage Monitoring Systems). Based on this information, an on-line diagnostic is performed: this is a part of the SHM – Structural Health Monitoring – topic. Then the objective would be how to organize the decision based on such on-line information to optimize the product use at a minimum maintenance cost.

Program:

6. The predictive maintenance : principles and concepts
7. Data-driven and model-based diagnostic methods
8. Monitoring technologies
9. The prognosis as a function of the maintenance policy:
 - a. The Remaining Useful Lifetime: The RUL
 - b. The state distribution over time
10. The Big Data: one of the challenges in Maintenance Decision-Making

Examination: Ongoing evaluation

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|  QIF | <i>Introduction to Data Science and Big Data</i> |  |
| | 5A / Semester 9 | |
| | 5 h CM / 5 h TD | Quality and management in data science |

Keywords : Data Science, Big Data, massive Data analysis

Prerequisite : Knowledge of the organization of the company, Statistical and Data Analysis

Objectives : Introduce the Data Science

Program :

Introduction to Data Science (Definition of Data Science, what do we do? Data Science in Business, Applications, Data Science People)

Data, technology & business digitalization

Definition & Principles in Data Science

Processes and methods of analysis of massive or non-mass data

Modeling & algorithms



Ecosystem and Data Science Tools

Assessment : Continuous assessment and terminal examination

Learning outcomes : Understanding the technical, technological and financial stakes of Data Science at the enterprise level

Bibliography :

William Cleveland, « Data Science : An Action Plan for Expanding the Technical Areas of the Field of Statistics », International Statistical Review / Revue internationale de statistique, vol. 69, 2001, p. 21-26

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|  QIF | <i>Advanced Data Science & Quality</i> |  |
| | 5A / Semester 9 | |
| | 10.5 h CM / 10.5 h TD | Quality and management in data science |

keywords : Machine learning, Deep Learning, automatic learning, statistical learning, Data Science, Classification, Neural networks, data quality

Prerequisite : Introduction to Data Science, Statistics, Data Analysis

Objectives : Present the standards and standards in the production of the software (product, process and organization) and in the IS

Program :

Data quality

Machine Learning: Baseline models, Bayesian naive classifier, closest neighbors classification and regression, decision trees, kernel methods, neural networks, clustering recommendation systems, analysis of social networks, analysis Of texts and feelings, models in streaming & online Machine Learning, process mining, analysis of time series, detection of anomalies

Deep Learning: convolutional neural networks, recursive and recursive networks, Boltzman machine, autoencoders

Quality and data governance: methods and improvement approaches - Quality of processes, algorithms, predictions: improvement methods and approaches - Project management and organization of projects with high valuation of data

Assessment : Continuous assessment and terminal examination

Learning outcomes : Knowledge of the main analytical techniques in Data Science and know how to put in place the steps to improve the valuation of data in the company

Bibliography :



Trevor Hastie, Robert Tibshirani et Jerome Friedman, The Elements of Statistical Learning : Data Mining, Inference, and Prediction, 2009, 2e éd.

Richard O. Duda, Peter E. Hart, David G. Stork, Pattern Classification, Wiley-interscience, 2001

Antoine Cornuéjols, Laurent Miclet, Yves Kodratoff, Apprentissage Artificiel : Concepts et algorithmes, Eyrolles, 2002

Tom M. Mitchell, Machine Learning, 1997

Christopher M. Bishop, Pattern Recognition And Machine Learning, Springer, 2006

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|  QIF | <i>Data Science For business solutions</i> |  POLYTECH ANGERS |
| | 5A / Semester 9 | |
| | 5 h CM / 5 h TD | Quality and management in data science |

keywords : Data Science, Big Data, Mass Data Analysis, Data Science Value Chain, Digital Marketing, Standby

Prerequisite : Introduction to Data Science, Statistics, Data analysis

Objectives : Presenting the added value of the Data Science

Program :



Value chain of the Data Science,
Platform Business & information system,
Producer-consumer matching algorithms,
Machine learning for predictive and prescriptive maintenance
Business Optimization

Assessment : Continuous assessment and terminal examination

Learning outcomes : Understand value added from analysis of company and external data

Bibliography :

Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data,
Wiley
Thomas W. Miller - Marketing Data Science: Modeling Techniques in Predictive Analytics with
R and Python

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|  QIF | <i>Project management and human resources management</i> |  |
| | 5A / Semester 9 | |
| | 11 h CM / 11 h TD | Management, Performance and job survey |

Keywords : Behavioral Analysis, Leadership, Project Risk, PMI, Conduct of Change

Prerequisite : Project management, project planning

Objectives : Present the major stakes of the success of a project: the management of human resources

Program :



Leadership in project management
Behavioral Analysis COMCOLORS
Project Risk Management
PMI Pmbok
Conduct of Change

Assessment : Continuous assessment and terminal examination

Learning outcomes : Know how to take human resources management into account in the project management approach

Bibliography :

Valérie LAROSE et Gilles CORRIVEAU - Management des RH en contexte de projets, revue française de gestion
Alain Desroches, Franck Marle, Emilio Raimondo et Frédérique Vallée - Le management des risques des entreprises et de gestion de projet
PMBOK® Guide and Standards
Le modèle Comcolors®

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|  | <i>Global responsibility, co-development and business intelligence</i> |  |
| | 5A / Semester 9 | |
| | 6 h CM / 6 h TD | Management, Performance and job survey |

Keywords: CSR, business intelligence, co-development, collective intelligence, analysis of practice, behavioral analysis, professional project,

Prerequisites: Knowledge of the trades of the path of deepening followed

Objectives: Offer a personal reflection of the student in co-development (confronted with those of other students) on his professional project based on his immediate and future professional wishes, his personal aspirations, his abilities and skills, his axes Progress, the analysis of his experiences and the market.

Program :

Global Responsibility and CSR
 Business intelligence
 Analysis of professional practices
 Behavioral Analysis
 Co-development
 Collective and Collaborative Intelligence
 Professional and professional integration

Evaluation: Continuous assessment

Learning outcomes: Knowing how to do business and job monitoring - Getting to know one another better to better plan your career plan

Bibliography:

Bibliographie :

RSE et développement durable en PME - Comprendre pour agir, dirigé par Jean-Marie COURRENT, Bruxelles, De Boeck, 2012
La Responsabilité sociale des entreprises : défis, risques et nouvelles pratiques, Jacques Igalens, Paris, Editions Eyrolles, 2012
Anne Marie Lagadec, « L'analyse des pratiques professionnelles comme moyen de développement des compétences : ancrage théorique, processus à l'œuvre et limites de ces dispositifs », Recherche en soins infirmiers 2009/2 (N° 97), Éditeur A.R.S.I.
Pierre Lévy, L'intelligence collective. Pour une anthropologie du cyberspace, Paris, La Découverte, 1994.
Olivier Zara, Le management de l'intelligence collective, vers une nouvelle gouvernance, M21 éditions, 2e édition 2008