CENTRALE NANTES

ENGINEERING PROGRAMME

2023-2024

Year 2 / Year 3

Specialisation option

Health Innovation Manufacturing

OD SANTIPRO

PROGRAMME SUPERVISOR

Tugdual LE NÉEL

Autumn Semester

Course unit	ECTS Credits	Track	Course code	Title
UE 73 / 93	12	Core course	CDMAT MANAPROJ P1SANTIPRO PROD RECAP	Materials Selection in Mechanical Design Managing and project undertaking Project framing Sustainable Production Summary: Healthcare and Impedance
UE 74 / 94	13	Core course	DEVMEP MAPIN P2SANTIPRO USINE	Development and Production of an HM interface Process control and industrialization Project: pre-industrialization of the solution Factory choice

Spring Semester

Course unit	ECTS Credits	Track	Course code	Title
UE 103 / 83	14	Core course	EXPERT P3SANTIPRO	Expertise on the project Project: Industrialization, protection and valorization

Materials Selection in Mechanical Design [CDMAT]

LEAD PROFESSOR(S): Guillaume RACINEUX

Objectives

Today, there are more than 100,000 materials available for product design, which constitutes a tremendous opportunity for innovation.

In order to choose the proper material, one needs:
- sound knowledge of the different classes of materials
- good understanding of their properties,
- a methodology that best meets the design specifications

At the end of this course, the students will:
- know the different classes of materials
- be able to proceed to a rational choice of materials

Course contents

- Presentation of the different classes of materials (metals, polymers, ceramics, composites and their properties)
- Presentation of the Ashby method for material selection
- Case studies

Course material

- Engineering Materials, I & II, M.F. Ashby and D.R.H. Jones, Elsevier (4th edition), 2012.
- Materials Selection in Mechanical Design, Butterworth-Heinemann (4th edition), 2010.

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	10 hrs	12 hrs	8 hrs	0 hrs	2 hrs

Managing and project undertaking [MANAPROJ]

LEAD PROFESSOR(S): Thomas LECHEVALLIER

Objectives

The conference presents different theoretical and practical aspects of Management. The course will successively establish the theoretical framework with a practical application on projects and management contexts. The main objective of this course is to understand that management is a relationship of oneself towards others helped by techniques

Course contents

Definition of Management,
- Know yourself,
- Know others,
- the role of manager,
- manage others,
- project management,
- change management,
- decision,
- some management tools.

Course material

Industrial and General Administration, Henry Fayol
- The management toolbox, 2020
- The 7 habbits of highly efficient people, S. Covey
- Power and organization, Michel Crozier

Assessment

Collective assessment: EVC 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Project framing [P1SANTIPRO]

LEAD PROFESSOR(S): Tugdual LE NÉEL

Objectives

A project is a collective and individual adventure. The division of labor, the diversity of any team, the confrontation with changes and decisions make it necessary to set up a balanced management and the experienced use of project management. The objective of the course is to give:
- the essential tools for writing each key deliverable in a project approach: opportunity analysis, pre-scoping, Go/NoGO, scoping, quality plan, progress monitoring, arbitration note, report, . ..),
- the keys to project management (functions, habits, styles) in relation to the work of others, including change management and decision-making capacity while minimizing bias.

The learning will follow the typical chronology of a project, the practice will be done from the projects of the option on the first expected deliverables (Scoping).

Course contents

Course material

Assessment

Collective assessment: EVC 1 (coefficient 0.5)

Individual assessment: EVI 1 (coefficient 0.5)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	2	0 hrs	0 hrs	0 hrs	90 hrs	0 hrs

Sustainable Production [PROD]

LEAD PROFESSOR(S): Yasamin ESLAMI

Objectives

Combine the constraints of productivity with those of sustainability

Course contents

Review of production management
- Sustainable production:
  - Sustainable KPI
  -Sustainable Manufacturing
  -Life Cycle Assessment (LCA) methodology and example
  - Recyclability and waste management
  - Circular economy: Definition, Butterfly Diagram, RESOLVE methodology, Circular Economy Business Models, Product Service Systems, Agents of Change, Combinations of PSS, LCA for PSS
  - Remanufacturing
  - ACV
- Product variability/diversity and impacts (production and environment)
- Standards and labels (eg: ISO 14000)

Part of the sessions of this course are given in English.

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	8 hrs	16 hrs	6 hrs	0 hrs	2 hrs

Summary: Healthcare and Impedance [RECAP]

LEAD PROFESSOR(S): Tugdual LE NÉEL

Objectives

This lesson reviews the work carried out in previous years. To be effective this year, we'll be increasing our knowledge of electronics and microcontroller computing.
A speaker from the CHU will present the challenges of dehydration.

Course contents

- Introduction MINT/Santinno project
- Sensor explanation
- Microcontroller explanation
- Using thinkerCad
- Presentation ESP32 /AD5933
- KiCad design
- Intervention CHU

Course material

Assessment

Collective assessment: EVC 1 (coefficient 0.5)

Individual assessment: EVI 1 (coefficient 0.5)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	1	0 hrs	16 hrs	0 hrs	0 hrs	0 hrs

Development and Production of an HM interface [DEVMEP]

LEAD PROFESSOR(S): Tugdual LE NÉEL

Objectives

The course is the application of the knowledge acquired on the development of the expected application from professional specifications reviewed and validated by the project manager (Nantes University Hospital). The industrial stages of putting an application mock-up into production will be taught by practice with the learning of the technical application architecture, portability, customer relations and confrontation with technological and functional trade-offs

Course contents

1. Definition of the development method
2. Getting started with development technologies
3. Review of developments
4. Production and follow-up of incidents

Course material

Assessment

Collective assessment: EVC 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Process control and industrialization [MAPIN]

LEAD PROFESSOR(S): Hervé THOMAS

Objectives

OPTIMIZE THE PRODUCTION OF A PART :
- Know how to define a manufacturing study project.
- Generate machining trajectories in CAM.
- Define operating strategies and parameters to optimize machining time and the quality of machined surfaces.

Course contents

Design a moldable object in epoxy resin: goodies, jewelry, key rings, etc.
Model the counter-mold of the product.
Define the counter-mold manufacturing process.
Generate machining paths in CAM to machine the counter-mold.
Machine the counter-mold.
Make the mold of the product in silicone.
Make the product in epoxy resin.
Optimize costs for producing 200 parts.

Course material

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	4 hrs	12 hrs	16 hrs	0 hrs	0 hrs

Project: pre-industrialization of the solution [P2SANTIPRO]

LEAD PROFESSOR(S): Tugdual LE NÉEL

Objectives

These project hours allow students to take time to modify the design of the model to make it industrializable. In addition, a reflection must be carried on the site of industrialization, the necessary means, the tooling, the budget, and all other tasks related to pre-industrialization.

During the course, students will have the opportunity to visit: companies dedicated to industrial subcontracting, adapted companies, the Jules Verne Manufacturing Academy. These visits aim to understand and adapt the device to be industrialized according to the implementation site.

Course contents

Students are independent.

Course material

Assessment

Collective assessment: EVC 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	5	0 hrs	0 hrs	0 hrs	120 hrs	0 hrs

Factory choice [USINE]

LEAD PROFESSOR(S): Tugdual LE NÉEL

Objectives

The aim is to learn new industrial manufacturing processes that could be of use to the project. To this end, courses, practical sessions and lab work will take place at the Jules Vernes Manufacutring Academy (JVMA).
Various processes, such as RTM, plastic injection, robotics and metrology, will be taught.

Course contents

TD at JVMA:
- Manufacture of composite preforms (for RTM)
- RTM
- Plastic injection
- Metrology

Course material

Assessment

Collective assessment: EVC 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	2	0 hrs	16 hrs	0 hrs	0 hrs	0 hrs

Expertise on the project [EXPERT]

LEAD PROFESSOR(S): Tugdual LE NÉEL

Objectives

The expert course aims to mobilize experts to help students in critical phases of the project where their knowledge and skills must be tutored. On this project, complements in modeling, layout, product production will probably be essential depending on the starting level of the students (previous options) and the level to be reached to create the product. An intervention on Triz for the development of innovation and on use are already targeted. An intervention will be planned at the start of the project on the specific Life Cycle Analysis for the equipment to be built.

Course contents

Patents
design-thinking
Sustainable development

Course material

RAS

Assessment

Collective assessment: EVC 1 (coefficient 0.5)

Individual assessment: EVI 1 (coefficient 0.5)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	3	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Project: Industrialization, protection and valorization [P3SANTIPRO]

LEAD PROFESSOR(S): Tugdual LE NÉEL

Objectives

Last phase of the project. The bases are acquired, the plan is made, it only remains to. During the industrialization phase, the students will have to deal with assembly templates, production rates, quality, and stock management. And potentially a spin-off through the incubator...

Course contents

Students are independent.

Course material

Assessment

Collective assessment: EVC 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
French	11	0 hrs	0 hrs	0 hrs	166 hrs	0 hrs