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## 1EL3000 – Industrial Engineering

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**Instructors:** Ludovic-Alexandre VIDAL

**Department:** DÉPARTEMENT GÉNIE INDUSTRIEL ET OPÉRATIONS

**Language of instruction:** FRANCAIS, ANGLAIS

**Campus:** CAMPUS DE PARIS - SACLAY

**Workload (HEE):** 60

**On-site hours (HPE):** 35,00

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### Description

- Know the issues and stakes of firms and organisations, their products and services, and their relationships with innovation, economy and human societies.
- Understand the multidisciplinary and complex character of firm-oriented systems along the lifecycle of an organization (design, industrialisation, production, distribution, reliability and return on experience,...).
- Understand how the choices made to determine the strategy for products/services development is a compromise between many constraints : availability of resources and skills, competition, environmental impact, organizational culture and strategy,...
- Understand and use the fundamental concepts, models and tools (and their application through several examples) which are used internationally in the field of industrial engineering (academic world and industrial practitioners).

### Quarter number

SG1 and SG3

### Prerequisites (in terms of CS courses)

None

### Syllabus

This course presents to the students the essential concepts and tools of industrial engineering, helping them to understand the stakes of product and organisation lifecycles. Thanks to the tutorials (with a ratio of about 1h theory for 2h tutorial), this course will offer the students a very exhaustive introduction to industrial and organisational systems, as well as their interdependences.

### Sessions :

Session 1 : Life Cycle of an Organization / a Product / a Service Life Cycle Concept, Stakeholders and Values, Systems Thinking, Main Phases and Processes.



Session 2 : Design Processes - 1 Design Processes and Activities, Functional Analysis, Specifications.

Session 3 : Design Processes - 2 Life Cycle Analysis, V-Cycle, Design Flexibility, Product-based FMECA.

Session 4 : Industrialisation Processes Process Representation, Industrialisation Decisions, Introduction to the concept of Industry 4.0. Industrial Conference.

Session 5 : Production Processes - 1 Make-to-Order Approaches, MRP and Associated Mathematical Models.

Session 6 : Production Processes - 2 Make-to-Stock Approaches, Kanban, Associated Mathematical Models.

Session 7 : Distribution Processes - 1 Stages of Distribution Activities, Distribution Monitoring and Control, Distribution Performance, Stock, DRP.

Session 8 : Distribution Processes - 2 Warehouses and Cross-Docking Models, Flows & Vehicle Route Optimisation, Supply Chain Sustainability and Performance, Tracking.

Session 9 : Quality Processes Product Reliability, Reliability Functions, Reliability and Safety Analysis Parameters, Bathtub Curve, Reliability of Parallel or Series Components. Maintenance Processes.

Session 10 : Introduction to Statistical Process Control. Introduction to 6 Sigma. Control Charting. Capability Measures.

Session 11 : Industrial Conference (3h) Synthesis of all sessions with an industrial conference.

Session 12 : Final Test (2h) Final Test.

### **Class components (lecture, labs, etc.)**

Overall the ratio of sessions (3 hrs) is :

- A lecture of 1h15/1h30
- A work session of 1h30/1h45

Some of the sessions will be carried out in reverse pedagogy mode in distance mode for the lectures (to promote proactive and flexible learning of the concepts), followed by on-site tutorials to answer all questions before addressing the exercises of the tutorials.

Occurrences of this course will be taught in the following languages :

Occurrence 1.1. English

Occurrence 1.2. French

Occurrence 1.4. French

### **Grading**

2 intermediate controls will take place during the course.

Final exam duration : 2h.

Documents authorized, calculator authorized. No Internet access or computer.



The score of continuous (intermediate) controls will be worth 40% and that of the final exam 60%.

### **Course support, bibliography**

Given Lesson after Lesson (specific references).

### **Resources**

Teaching staff : Ludovic-Alexandre Vidal and Julie Le Cardinal for courses.  
Loïc Pineau, Ludovic-Alexandre Vidal & Julie Le Cardinal for exercises and case studies. Some industrial conferences.

### **Learning outcomes covered on the course**

At the end of this course, the student will be able to: (Skills)

C1.1 Analyze: Study a system as a whole, the situation as a whole. Identify, formulate and analyze a system within the framework of a transdisciplinary approach with its scientific, economic, human dimensions, etc.

C1.2 Model : use and develop suitable models, choose the right modeling scale and the relevant simplifying assumptions

C1.4 Design : Specify, build and validate all or part of a complex system

C2.1 Deepen a field of engineering sciences or a scientific discipline (adapted to industrial engineering)

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