Introduction

The Mechanical Engineering Teaching Unit covers a set of knowledge and know-how for the design, manufacture and performance analysis of a mechanical system. It is a fundamental element in the training of a general engineer.

The diversity of the industrial branches concerned goes far beyond the mechanical industries. Most objects and products have a solid material base. Their performance and lifetime depend to a large extent on the quality of this material base.

Semester

S06

Programme

Learning Outcomes

- Know how to analyse the architecture of a mechanical system and its geometric description from technical drawings
- Know how to design a mechanical system
- Know how to define the toleranced geometry of a mechanical part and implement manufacturing means that respect the conditions of correct operation

Employment Sectors

Mechanical engineers work in SMEs as well as in large groups and in many fields of activity (automotive, steel, aeronautics, machine tools, consumer goods, food processing, metallurgy, electronics, IT, energy production, telecommunications, etc.).

Requirements

Notion of rigid solid, kinematic torsor, force torsor
Fundamental principle of dynamics

Assesment

Option Website

Additional Information

GÉNIE MÉCANIQUE TECHNOLOGIE-MÉCANIQUE GÉNÉRALE-RDM

MECHANICAL ENGINEERING

Lecturers: Hélène MAGOARIEC, Damien CONSTANT, Emmanuel RIGAUD, Olivier

| Lecturers : 18.0 | TC : 22.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The aim of this module is to study the technical design, dimensioning and realization of a mechanical system, as well as the study of its functioning. The first part allows the students to understand the architecture of a mechanical system from the description of the connections between the parts and to define the toleranced geometry of the functional surfaces. The second part allows the students to establish the equations of motion of a system of rigid bodies, using a Newtonian or a Lagrangian approach based on the principle of virtual powers. The third part makes it possible to dimension thin deformable structures as beams, according to stresses and displacements criterion, starting from the internal forces induced by the loading and the reactions to the

Keywords : Effects and connections, Functional dimensioning, Analytical mechanics, Principle of virtual powers, Lagrange equations, Beam theory, Sizing : stresses, strains, and displacements

Programme

- Mechanical technology: Efforts and connections in mechanical systems. Functional specifications and product definition. Obtaining parts by machining using cutting tools.
- General and analytical mechanics of rigid solids systems: Description of the movement, fundamental principle, principle of the virtual powers (PVP), hypotheses of the model. PVP for a single solid, definition of different torsors, kinetic energy theorem. PVP for a system of solids, schematization of the connections, equations of Lagrange. Discussion on the limitations of the model.
- Strength of materials: Definition, schematization of a beam and model hypotheses. Elastic dimensioning. Constitutive relation.

Learning outcomes

- To know how to analyse the architecture of a mechanical system and its geometrical description from the technical drawings.
- To know how to design a mechanical system an define its functional tolerancing that respect the conditions of good functioning.
- To be able to analyse the dynamic behaviour of a rigid solids system.
- To know how to dimension a slender piece subjected to static loading.

Independent study

Objectifs : Understanding and assimilating the course.

Méhodes : Exercises complementary to the tutorials available online, to be solved in self-evaluation (DidacTest).
Corrected exercises available on teaching server.

Core texts

Trotignon J.P., *PRÉCIS DE CONSTRUCTION MÉCANIQUE TOMES 1 ET 2*, Nathan, 2007
Brousse P. *MÉCANIQUE ANALYTIQUE*, Vuibert, Paris, 1981
Timoshenko S.P.*RÉSISTANCE DES MATÉRIAUX, TOMES 1 ET 2*, Dunod, Paris, 1990

Assessment

Mark = 100% knowledge (Knowledge mark = final exam + micro-tests)

ACTIVITÉS PRATIQUES DE GÉNIE MÉCANIQUE

TECHNOLOGY ANALYSIS & PRODUCT DEVELOPMENT

Lecturers: Bertrand HOUX, Hélène MAGOARIEC, Olivier DESSOMBZ

| Lecturers : 0.0 | TC : 0.0 | PW : 20.0 | Autonomy : 0.0 | Study : 10.0 | Project : 0.0 | Language : FR

Objectives

The objective of the training action is to put into practice (know-how) the skills of the GM Teaching Unit. The objective of the technological product development project is to implement all the stages of design, manufacture and control of the geometric conformity of the components of a mechanical system. The other practicals aim to analyze the architecture of a real mechanical system, to carry out a performance diagnosis, according to the external stresses and the technological elements used to make the connections between solids or to put the system into action.

Keywords : Architecture of a mechanical system; Building elements; Design; Manufacturing; Metrology; Elastic sizing; Performance diagnostics.

Programme

- Discovery lab program - Technological analysis (4h)
- BE drawing - Technological project (2h)
- BE quotation - Technological project (4h)
- BE manufacturing - Technological project (2h)
- BE machining range - Technological project (4h)
- Machining TP - Technological project (4h)
- Dimensional metrology practical work - Technological project (4h)
- Design work in RdM (4h)
- Dynamic lab (4h)

Learning outcomes

- Knowing how to analyze the architecture of a mechanical system.
- Master the stages of design and manufacture of a mechanical system.
- To be able to control the geometric conformity of a mechanical system.
- To be able to diagnose the performance of a mechanical system.

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

Know-how = 100% continuous control: Bearing assembly analysis + Microtest1 + Microtest2 (Technological project) (75%) + TP reports (25%)

MODÉLISATION ET CONCEPTION

MECHANICAL DESIGN

Lecturers: Olivier DESSOMBZ, Francesco FROIIO

| Lecturers : 4.0 | TC : 4.0 | PW : 0.0 | Autonomy : 0.0 | Study : 12.0 | Project : 0.0 | Language : FR

Objectives

Give more advanced notions on the mechanics of solids and structures, having a direct link with applications.

Keywords : Dimensioning, truss, static, dynamic

Programme

- Course 1 and TD 1: Calculation of isostatic and hyperstatic lattices. Buckling.
- Course 2 and TD 2: Small movements in vibration. Clean modes, free response and forced response.
- Design office 1 and 2: Calculation of the coverage of a gymnasium (static sizing and dynamic analysis)

Learning outcomes

- Apply the concepts of structural statics to the design of a truss.
- Apply the concepts of structural dynamics to the design of a truss.
- Use digital calculation platforms (Matlab, Scilab) for the analysis of structures.
- Report on the static and dynamic analysis of a structure.

Independent study

Objectifs : Finalize the work of the design office.

Méhodes : Group work: case study and report writing.

Core texts

Assessment

Know-how score = 100% continuous assessment

CONCEPTION DE MÉCANISME

MECHANICAL DESIGN

Lecturers: Didier LACOUR

| Lecturers : 4.0 | TC : 4.0 | PW : 0.0 | Autonomy : 0.0 | Study : 12.0 | Project : 0.0 | Language : FR

Objectives

Knowledge and dimensioning of power transmission elements, particularly those used in ground transport, understand their operation and analyse their performance.

Keywords : power transmission, gearbox, vehicle, hydraulics transmission

Programme

- Elements of technology for power transmission.
- Epicyclic trains and applications.
- Gearboxes and drives.
- Hydraulics transmissions.
- Hybrid vehicle architectures.
- Three 4h studies: Analysis of the operation of a DSG7 gearbox. Simulation of the operation of a gearbox and a DPC differential (with Catia software and applications). Analysis of the power transmission system of a 4x4 vehicle

Learning outcomes

- Be able to perform functional analysis of a mechanical transmission system.
- Be able to analyse and simulate the operation of a mechanical transmission system

Independent study

Objectifs :

Méhodes :

Core texts

Esnault F., *CONSTRUCTION MÉCANIQUE, TOME 1*, Dunod, 2009
Esnault F. *CONSTRUCTION MÉCANIQUE, TOME 2*, Dunod, 2009
Esnault F.*CONSTRUCTION MÉCANIQUE, TOME 3*, Dunod, 2009

Assessment

N = average of reports from studies