Course guide
330127 - TMEC - Mechanics Technology

Last modified: 25/04/2024

Unit in charge: Manresa School of Engineering
Teaching unit: 712 - EM - Department of Mechanical Engineering.

Degree: BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2016). (Compulsory subject).
BACHELOR'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2017). (Optional subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: ANAS AL OMAR MESNAOUI

Others: JOSE IGNACIO ALCELAY LARRION - JOAN VALLEJO SERRANO - DANIEL VALLS MARGARIT

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Know how to use the instruments of measurement and application of manufacturing methods.
2. Design manufacturing processes, according to the type of part, its properties and its characteristics, selecting the appropriate machines and the parameters to be controlled.
3. Optimize manufacturing process control parameters.
4. Evaluate the manufacturing costs of a piece using different methodologies.

Transversal:
5. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.
7. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

TEACHING METHODOLOGY

- Expository class of theory and problems: in this class it is not intended to make an exhaustive demonstration of the subject, but the student will be given a global vision of it insisting on the key concepts for a better understanding. Doubts will be discussed and standard problems and questions will be solved to ensure understanding of the subjects. The resolution of the problems in face-to-face class aims for the student to learn to analyze them and identify the key elements for their approach and resolution. For each face-to-face session, the student will be provided, well in advance in the virtual classroom, the notes on the topic covered in the session and a series of problems. The reading of the theoretical content before the face-to-face session is mandatory and will be controlled by formulating questions during the class.
- Carrying out laboratory practices in small groups. Preparation of reports.
- Resolution and delivery of problems proposed individually.
- Tutoring, study and personal and team work.
- Exams and evaluation tests.

LEARNING OBJECTIVES OF THE SUBJECT

Once this course is finished, the student must be able to:
- Identify and characterize the fundamental parameters of the manufacturing processes, being able to calculate the requirements for them (force, power, time, etc.).
- Choose and Design the most suitable manufacturing process in each case.
- Know and select the appropriate measurement methods and equipment to check the specifications of the manufacturing plans.
- Apply the knowledge acquired to the search for optimal solutions to real mechanical manufacturing problems.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours large group	45,0	30.00
Hours small group	15,0	10.00

Total learning time: 150 h

CONTENTS

1: Introduction to Mechanical Technology

Description:
Introduction to mechanical technology. Classification of manufacturing processes. Product design. Process planning. Flexible manufacturing. Production Systems. Future trends. Materials used in industry. Production of ferric metals. Steel processes. Heat Treatments.

Related activities:
A 1, A 2, A 3, A 4, A 5, A 6, A 7, A 8 and A 9.

Full-or-part-time: 13h
Theory classes: 5h
Self study : 8h

2: Metrology

Description:
Measurement. Units and standards of measurement. Measurement errors. Measurement of lengths and angles. Verification by limits gauges. Thread control. Thread systems. Gear Control. Control of surface finish.

Related activities:
A 1, A 7 and A 9.

Full-or-part-time: 18h
Theory classes: 5h
Laboratory classes: 2h
Self study : 11h

3: Forming processes

Description:
Fundamentals of plastic deformation. Sheet Metal Forming: Cutting, Drawing and Bending Processes. Forging processes: free forging, stamping forging, upsetting. Machines for forging processes. Forging defects. Extrusion processes: direct extrusion, indirect extrusion, hydrostatic extrusion. Tools and extrusion machinery. Extrusion defects.

Related activities:
A 2, A 7 and A 9.

Full-or-part-time: 31h
Theory classes: 10h
Laboratory classes: 2h
Self study : 19h

4: Machining processes

Description:
Foundations of machining theory. Cutting movements. Cutting tool materials. Tool life. Tool wear criteria. Chip formation. Cutting speeds. Cutting forces. Power in the cut. Lubricants Turning Operations. Turning tools. Influence of the angles in the turning. Turning power. Calculation of times in turning processes. Milling Operations. Milling tools. Milling power. Calculation of times in milling processes. Drilling operations. Drilling tools. Drilling power.

Related activities:
A 3, A 8 and A 9.

Full-or-part-time: 32h
Theory classes: 10h
Laboratory classes: 3h
Self study : 19h

5: Casting processes

Description:
Introduction to casting processes. Models and Core. Hand molding. Shell molding processes. Lost wax molding processes. Chill casting. Die casting. Hot chamber die casting. Cold chamber die casting. Centrifugal casting. Cooling of the metal in the mold. Solidification. Mazarotas. Finishing operations for castings. Defects and quality control of castings.

Related activities:
A 4, A 8 and A 9.

Full-or-part-time: 22h
Theory classes: 7h
Laboratory classes: 2h
Self study : 13h

6: Welding

Description:
Fundamentals of welding. Concepts of welding technology. Classification of welding processes. Fusion welding processes. Oxyacetylene welding. Welding with consumable electrode. Non-consumable electrode welding. Electric submerged arc welding. TIG welding. MIG / MAG welding. Welding safety. Defectology. Inspection and quality control techniques.

Related activities:
A 5, A 8 and A 9.

Full-or-part-time: 17h
Theory classes: 5h
Laboratory classes: 2h
Self study : 10h

7: Introduction to Numerical Control

Description:
Definition of the numerical control. Classification of numerical controls. Advantages and Disadvantages of the use of numerical control. Characteristics of numerical control machine tools. Control system. Types of programming in numerical control. General structure of a numerical control program. ISO programming. Parametric programming. Computer Aided Programming (CAM).

Related activities:
A 6, A 8 and A 9.

Full-or-part-time: 17h
Theory classes: 3h
Laboratory classes: 4h
Self study : 10h

ACTIVITIES

1: LABORATORY PRACTICE. METROLOGY.

Description:
In this practice it is intended:
- Know and know how to use the different measurement instruments available in the laboratory.
- Carry out measurements and verifications of parts with the instruments available in the laboratory.
- Check the dimensions and shape errors, indicated in the drawings of two pieces (one of revolution and the other rectangular) using appropriate measuring instruments.

Specific objectives:
At the end of this activity, the student must be able to carry out measurements and verifications of industrial parts, using appropriate instruments for each measurement, to work autonomously and as a team and to communicate effectively and clearly the results obtained.

Material:
Practice Manual (available on the Digital Campus) and Teacher's Notes.

Delivery:
Students must prepare, in small groups, a report of the practice carried out, according to the instructions indicated, and deliver it to the teacher within the deadline set for this practice.
The evaluation of this activity together with that of the other activities will form part of the evaluation as specified in the corresponding section of the teaching guide.

Full-or-part-time: 5h
Laboratory classes: 2h
Self study: 3h

2: PROBLEMS RESOLUTION. FORMING PROCESSES.

Description:
The activity consists of solving problems related to plastic deformation forming processes: sheet metal forming, forging, extrusion, etc.

Specific objectives:
At the end of this activity the student should be able to:
correctly apply the concepts studied in class related to the control parameters of the different processes of forming by plastic deformation, to work autonomously and in a team and to communicate effectively and clearly the results obtained.

Material:
Series of Problems (available on the Digital Campus) and Teacher's Notes.

Delivery:
Delivery of Proposed Problems.
The evaluation of this activity together with that of the other activities will form part of the evaluation as specified in the corresponding section of the teaching guide.

Full-or-part-time: 5h
Laboratory classes: 2h
Self study: 3h

3: LABORATORY PRACTICE. MACHINING PROCESSES

Description:
Machining on a Lathe. This practice consists of making the process sheet and machining a part of revolution on a conventional lathe, available in the mechanics shop.
Machining on a Milling Machine. This practice consists of elaborating the process sheet and machining: 4 flat and perpendicular faces between them, a groove and a chamfer in a cylindrical piece, using a conventional milling machine available in the mechanical workshop.

Specific objectives:
At the end of this activity the student should be able to:
carry out different basic turning and milling operations identifying the most important variables of each operation, working autonomously and as a team, and communicating effectively and clearly the results obtained.

Material:
Practice Manual (available on the Digital Campus) and Teacher's Notes.

Delivery:
Students must prepare, in small groups, a report of the practice carried out, according to the instructions indicated, and deliver it to the teacher within the deadline set for this practice.
The evaluation of this activity together with that of the other activities will form part of the evaluation as specified in the corresponding section of the teaching guide.

Full-or-part-time: 7h
Laboratory classes: 3h
Self study: 4h

4: PROBLEMS RESOLUTION. CASTING PROCESSES.

Description:
The activity consists of solving various problems related to the casting processes. These problems are intended to carry out the necessary calculations to design molds for industrial parts.

Specific objectives:
At the end of this activity the student should be able to:
correctly apply the concepts studied in class, related to the casting processes, to work autonomously and as a team and to communicate effectively and clearly the results obtained.

Material:
Series of Problems (available on the Digital Campus) and Teacher's Notes.

Delivery:
Delivery of Proposed Problems.
The evaluation of this activity together with that of the other activities will form part of the evaluation as specified in the corresponding section of the teaching guide.

Full-or-part-time: 5h
Laboratory classes: 2h
Self study: 3h

5: LABORATORY PRACTICE. WELDING.

Description:
In this session the students will use the different welding equipment available in the mechanics workshop. The main objective will be to familiarize the student with these processes, while observing the technical characteristics of the machines. In addition, they will understand the importance of the preparation phase of the pieces to be welded to avoid possible deformations.

Specific objectives:
At the end of this activity the student should be able to:
Identify the most important aspects of the different welding techniques, to work autonomously and as a team and to communicate effectively and clearly the results obtained.

Material:
Practice Manual (available on the Digital Campus) and Teacher's Notes.

Delivery:
Students must prepare, in small groups, a report of the practice carried out, according to the instructions indicated, and deliver it to the teacher within the deadline set for this practice.
The evaluation of this activity together with that of the other activities will form part of the evaluation as specified in the corresponding section of the teaching guide.

Full-or-part-time: 5h
Laboratory classes: 2h
Self study: 3h

6: LABORATORY PRACTICE. NUMERICAL CONTROL

Description:
NC Machines Programming: Case of a Lathe. This practice consists of preparing an ISO-coded program for machining a part established on a numerical control lathe and subsequently checking the program using Fagor-8025 simulation software.
NC Machines Programming: Case of a Milling Machine. This practice consists of developing an ISO-coded program for machining a part set on a numerical control milling machine. The practice consists of two parts: checking the program using Fagor-8025 simulation software and executing the part on a small C. N. ALECOP milling machine available in the mechanical workshop.

Specific objectives:
At the end of this activity the student should be able to:
assimilate the most important basic concepts related to numerical control and computer-aided manufacturing, understand the importance of numerical control in manufacturing processes and see when it is necessary or profitable to apply numerical control, carry out numerical control programs for the machining of pieces, to work autonomously and as a team and to communicate effectively and clearly the results obtained.

Material:
Practice Manual (available on the Digital Campus) and Teacher's Notes.

Delivery:
Students must prepare, in small groups, a report of the practice carried out, according to the instructions indicated, and deliver it to the teacher within the deadline set for this practice.
The evaluation of this activity together with that of the other activities will form part of the evaluation as specified in the corresponding section of the teaching guide.

Full-or-part-time: 9h
Laboratory classes: 4h
Self study: 5h

7: FIRST INDIVIDUAL TEST OF CONTINUOUS EVALUATION.

Description:
Individual test in the classroom to evaluate the first part of the theoretical concepts studied and solve exercises and problems related to the learning objectives.

Specific objectives:
At the end of this activity the student should be able to:
Know, understand and apply the concepts studied in the theoretical sessions taught.

Material:
Statement and Calculator.

Delivery:
Test Resolution
The evaluation of this activity together with that of the other activities will form part of the evaluation as specified in the corresponding section of the teaching guide.

Full-or-part-time: 12h
Theory classes: 2h
Self study: 10h

8: SECOND INDIVIDUAL TEST OF CONTINUOUS EVALUATION.

Description:
Individual test in the classroom to evaluate the second part of the theoretical concepts studied and solve exercises and problems related to the learning objectives.

Specific objectives:
At the end of this activity the student should be able to:
Know, understand and apply the concepts studied in the theoretical sessions taught.

Material:
Statement and Calculator.

Delivery:
Test Resolution
The evaluation of this activity together with that of the other activities will form part of the evaluation as specified in the corresponding section of the teaching guide.

Full-or-part-time: 12h
Theory classes: 2h
Self study: 10h

9: FINAL TEST.

Description:
Final test in the classroom to evaluate the theoretical concepts studied throughout the subject and solve exercises and problems related to the learning objectives.

Specific objectives:
At the end of this activity the student should be able to:
Know, understand and apply the concepts studied in all the theoretical sessions.

Material:
Statement and Calculator.

Delivery:
Test Resolution
The evaluation of this activity together with that of the other activities will form part of the evaluation as specified in the corresponding section of the teaching guide.

Full-or-part-time: 18h
Theory classes: 3h
Self study: 15h

GRADING SYSTEM

- Delivery of Proposed Problems: 10% of the grade for the course.
- First Individual Continuous Assessment Test (Activity 7): 35% of the grade for the subject.
- Second Individual Continuous Assessment Test (Activity 8): 35% of the grade for the subject.
- Attendance at the laboratory practices (5%) and the preparation of reports (15%) related to the results obtained in said practices: 20% of the grade for the subject.

Therefore, the Note for Written Tests (NPE) = 35% * (First Written Test Note) + 35% * (Second Written Test Note) + 20% * (Practice Note) + 10% * (Delivery Note of the Proposed Problems).

It is important to note that the partial written tests are liberatory, so that, if the student obtains an NPE> -4.95, he will be exempted from passing the final test. Students who fail to pass the course by partial exams or those who want to improve their grade will have a second chance in a new final test.
Thus, the Final Test Grade (NPF) = 70% * (Final Written Test Grade) + 20% * (Practice Grade) + 10% * (Delivery Grade of the Proposed Problems).

EXAMINATION RULES.

- In order to pass the course, it is mandatory to attend and carry out all the activities, delivering all the reports of the laboratory practices, and the resolution of all the proposed problems within the indicated deadlines.
- In solving the proposed problems, the students will use the contents studied in the expository part of the face-to-face session and will be able to clarify the doubts and difficulties they may encounter with the teacher. The deadline for delivery of the resolution of the proposed problems and the reports of the laboratory practices will be specified, and no delivery will be accepted after this deadline.
- The reports of the practices will be original, so that the copy of practices (total or partial) will be sanctioned with the global suspension of the activity. It will be taken into account that the responsibility for the laboratory practice is shared by all the members of the group, so in case of detecting a copy the rule will be applied to all the members of all the groups involved in the copy.
- In the delivery of the resolution of the proposed problems, any total or partial copy of the solutions will suppose the suspension in the activity. The student must ensure the privacy and security of their data.
- If it is detected that a student has copied in a written test, it will be evaluated as a failure of the course.
- It's not allowed to use any type of notes or forms in the partial and final tests.

BIBLIOGRAPHY

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