Curricular Unit Form (FUC)

Course:	**FIRST CYCLE IN MECHANICAL ENGINEERING**					
Curricular Unit (UC)	**Mechanical Technology II**			Mandatory	**X**	
				Optional		
Scientific Area:	**Mechanical Design, Manufacturing and Industrial Maintenance**					
Year: **3º**	Semester: **1º**	ECTS:**5,0**		Total Hours: **4,5**		
Contact Hours:	T: **22.5**	TP:**45**	PL:	S:	OT:	TT:**67.5**
Professor in charge		Academic Degree /Title		Position		
Alexandra Sousa Rodrigues		**Ph.D.**		**Professor Adjunto**		

T- Theoretical ; TP – Theory and practice ; PL – Laboratory ; S – Seminar ; OT –Tutorial ; TT – Total of contact hours

Entry into Force	Semester: **Winter**	Academic Year: **2010/2011**

Objectives of the curricular unit and competences (max. 1000 characters)

The main objective of this course is delivering to students knowledge about processing technologies, available to produce diverse industrial components, having in mind their potentialities and limitations.

The main purpose is to prepare the student to select the best technological process, having in mind the production of pieces with a specified geometry and mechanic characteristics, choosing equipments, processing parameters and materials geometries. It is also underlined the quality of the final pieces attained and the costs involved.

Syllabus (max. 1000 characters)

1 - Plasticity

i. Empirical Rigid-plastic and Elastic-plastic Models
ii. Influence of Temperature and Strain Rate
iii. Concept of Plastic Work. Effective Plastic Stress and Strain
iv. Strain Hardening
v. Prandtl-Reuss and Levy-Mises Equations
vi. Anisotropy. Hill Yield Criterion
vii. Formability
viii. Calculation Methods in Plasticity

2 - Metal Forming Processes

2.1 – Roll Forming
i. Process Description and Applications
ii. Contact distance
iii. Rol forming depth
iv. Load and Power to produce metal ferrules

2.2 – Press Brake Bending

i. Process Description and Applications
ii. Air Bending and Bottoming
iii. Bending Table
iv. Calculus of the Unbent Flat Pattern
v. Elastic recovery and punch depth
vi. Load and bending work

2.3 - Deep Drawing
i. Process Description
ii. Equipment
iii. Parameters to Control
iv. Calculation of Geometries, forces, work and power
v. Multi-step Deep Drawing
vi. Direct and Reverse Deep Drawing

2.4 – Rolling
vii. Process Description
viii. Equipment
ix. Hot and cold rolling
x. Section rolling
xi. Forces and geometrical relationships in rolling

2.5 – Extrusion (direct and indirect)
2.6 – Forging (open and closed-die)

3 - Molding Processes

3.1 – Rapid Prototyping
i. Process Objectives and Applicability
ii. Current Technologies

3.2 – Powder Metallurgy
i. Powder Production
ii. Compaction
iii. Sintering
iv. Finishing

3.3 – Casting
i. Introduction to Casting Processes
ii. Casting Microstructures
iii. Sand Casting
iv. Shell Molding
v. Lost Wax Casting
vi. Die Casting

4 - Welding Processes

4.1 – Adhesive Bonding
4.2 – Solid State Welding (Resistance, Friction, Brazing and Soldering)
4.3 – Fusion Welding
i. Introduction to Welding Technology
ii. Arc Welding Physics
iii. Shielded Metal Arc Welding (SMAW)

iv. Gas Tungsten Arc Welding (GTAW)
v. Gas Metal Arc Welding (GMAW) and Flux Cored Arc Welding (FCAW)
vi. Submerged Arc Welding (SAW)
vii. High Energy Density Processes (Laser e Electron Beam Welding)

Demonstration of the syllabus coherence with curricular unit's objectives (max. 1000 characters)

The study of several industrial processes used nowadays in the industry, its applicability, advantages and constraints, as well as the methodologies to be applied in the parameter calculation for components fabrication, allow students to acquire a broad vision of the equipments and machines available for components manufacturing with specific geometries, properties and surface finish.

The purpose is to provide students with a good background to work in companies related with components production, with the goal of select and optimize manufacturing processes, making parameter calculations and cost analysis.

Teaching methodologies (including evaluation) (max. 1000 characters)

The Curricular Unit will be lectured with oral exposition of the subjects followed by slides, films and drawings related with the processes under study. Practical exercises applied to the subjects will be performed. The welding lectures will be complemented with laboratory visits where students will have the opportunity to observe the various welding processes studied. Study trips to industrial plants using the described processes will also be done.

The assessment is obtained through an:

- **Overall grade = 0,7 * Theoretical component grade + 0,3 * Practical component grade**

Where the:

- **Theoretical component** comprises two mid-term tests, according to the approved standards of assessment in ISEL, or a Final Examination.
- **Practical component** comprises one research work related with processes selection, related to a specific application, with a final report submission fallowed by oral presentation and discussion.

Eventually, the professor can ask students to accomplish some homework's, which can count until 10% of the final grade.

Demonstration of the teaching methodologies coherence with the curricular unit's objectives (max. 3000 characters)

The delivered classes provide an approach of the main theoretical concepts related with each kind of industrial processes, being screened several videos, diagrams and graphics related, which allow students the perception and analysis of the scientific concepts behind the development of a process. The exercises resolution stimulates and train students regarding fabrication parameters calculation for diverse industrial components.

Main Bibliography (max. 1000 characters)
"Tecnologia Mecânica", Vol. 1 e 2 Jorge Rodrigues, Paulo Martins Escolar editora "Tecnologia da Fundição" José Carvalho Ferreira F. C. Gulbenkian "Processos de Soldadura" Oliveira Santos, Luísa Quintino ISQ – Edições técnicas