Curricular Unit Form (FUC)

Course:	**FIRST CYCLE IN MECHANICAL ENGINEERING**					
Curricular Unit (UC)	**Fluid Networks**			Mandatory	**X**	
				Optional		
Scientific Area:	**Energy and Control Systems**					
Year: **3rd**	Semester:**2nd**	ECTS:**5,0**		Total Hours: **4,5**		
Contact Hours:	T:	TP:**67,5**	PL:	S:	OT:	TT:
Professor in charge		Academic Degree /Title		Position		
Jorge Mendonça e Costa		**Doctor**		**Coordinator Professor**		

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

Entry into Force	Semester: **Winter**	Academic Year: **2012/2013**

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

Theoretical and practical approach on the fundamental core aspects of fluid networks, introducing the components, materials, technical terminology and methodologies pertaining to the design, project and construction of industrial piping, including the requisites of Quality Systems, Codes and National and European standards in order to provide the necessary project and fluid networks building skills.

Syllabus (max. 1000 characters)

PRESSURE LOSSES IN PIPING SYSTEMS:
Viscosity; Roughness; Laminar and turbulent flows; Reynolds number; Major and minor pressure losses; Friction factor; *Moody* chart; Multiple-pipe systems (series, parallel, network).
STANDARDS AND PROJECT CODES, CONSTRUCTION AND CERTIFICATION:
Standards and Project and Construction Codes ANSI/ASME, EN, NP e ISO
Material Standards and Codes, Inspection and Certification; Portuguese Legislation – Decree No.390/94.
PIPING PROJECT:
Pipe systems design; Applied forces, Impulse forces and hydraulic transients; Design pressure and temperature; Stress calculation, wall thickness and flexibility in piping
Piping connection to accessories / equipment; Supports; Thermal insulation and thermal marking.
EQUIPMENT ASSOCIATED TO PIPING NETWORKS:
Mechanical Power and efficiency; Pumps and Compressors, Theoretical topics, Characteristic curves, Construction; Cavitation in Pumps and Compressors; Association of Pumps and Compressors.
CONTROL SYSTEMS AND INSTRUMENTATION ASSOCIATED TO PIPING NETWORKS:

Isolation valves, check valves, safety valves, control valves, piloted regulators;
Control chain, Sensors, Transducers, Controllers and Actuators, Precision, Set-Points, Repeatability
Measurement of Pressure, Temperature, Flow, Level, Density, etc. Flow correctors and computers
PROJECT OF SPECIAL FLUIDS NETWORKS:
Pumping Systems; Liquid Fuels; Gaseous Fuels; Compressed Air; Cryogenic Fluids; Steam; Special Gases (oxygen, hydrogen, etc.); Two-phase flows (pneumatic transport, *slurry*, etc.)
EXAMPLES OF INDUSTRIAL INSTALLATIONS:
Thermal Power Plants (Conventional, Cogeneration and Combined Cycle); Oil and Oil Industry; Pulp and Paper.

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

The syllabus encompasses the curricular unit objectives. A good balance is achieved between the depth with which the different subjects are treated and the contact time with the students.

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

The teaching methodology foresees theoretical and practical lectures supported on the bibliographic references suggested for the curricular unit (UC), powerpoint presentations, complementary support material for the UC is provided in the Moodle platform (resolution of practical examples, etc.).
The following laboratory sessions are carried out:

- Reynolds experiment for the visualisation of internal laminar and turbulent flows;
- Major and minor pressure losses measurement in order that the students become aware of the impact of different accessories in a piping network;
- Centrifugal pump association in parallel and series in order to obtain the resulting characteristic curves.

The evaluation (assessment) comprises:
1 Exam;
1 Project to be discussed with the students.
The final score will be obtained according to the following weighing applied to the partial scores:
1/3 – Project
2/3 – Exam

Demonstration of the teaching methodologies coherence with the curricular unit's objectives (max. 3000 characters)
The curricular unit aims at the students' development of project know-how in the fluid network domain, following existing good practice guidelines. Therefore a strong practical course component is assured trough project support classes. The theoretical knowledge required for project development is delivered to the students in an early phase of the curricular unit and the acquired competences are thoroughly assessed.

Main Bibliography (max. 1000 characters)
• Textbook (Base) and Engineering Technical tables: Carlos Mendes REDES DE FLUIDOS – AEISEL; • White, Frank M. **FLUID MECHANICS** - McGraw-Hill; • Telles, Pedro C. Silva: **TUBULAÇÕES INDUSTRIAIS;** • Crane Co. **FLOW OF FLUIDS – through valves ,fittings and pipe;** • J. Paul Tullis **HYDRAULICS OF PIPELINES – Pumps, Valves, Cavitation, Transients;** McGraw-Hill. • Mohinder Nayyar **PIPING HANDBOOK -** McGraw-Hill.