

<p style="text-align: center;"><b>English courses</b> <b>ICAM Toulouse -</b></p>
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I Fluid Mechanics (First part. 36 hours) .....	4
I.1 Objectives: .....	4
I.2 Key words: .....	4
I.3 Module content: .....	4
I.4 Documentation provided: .....	4
II Hydraulic networks (14 hours) .....	4
II.1 Objectives: .....	4
II.2 Key words: .....	4
II.3 Module content:.....	5
II.4 Documentation provided: .....	5
III Fluid Mechanics (Second part. 40 hours) .....	5
III.1 Objectives: .....	5
III.2 Keywords: .....	5
III.3 Module content:.....	5
III.4 Documentation provided: .....	5
IV Heat Transfer (30 hours) .....	6
IV.1 Objectives: .....	6
IV.2 Keywords: .....	6
IV.3 Module content: .....	6
IV.4 Documentation provided: .....	6
V Applied Thermodynamics .....	7
<i>(Lectures : 30h, Practicals : 4h)</i> .....	7
V.1 Objectives: .....	7
V.2 Keywords: .....	7
V.3 Module content: .....	7
V.4 Documentation provided: .....	7
VI CERAMICS (15 hours) .....	8
VI.1 Objectives: .....	8
VI.2 Keywords: .....	8
VI.3 Module content: .....	8
VI.4 Documentation provided: .....	8
VII ARTIFICIAL INTELLIGENCE (30 hours) .....	9

(Lectures: 16h, Practicals : 14h).....	9
VII.1 Objectives:.....	9
VII.2 Keywords:.....	9
VII.3 Module content: .....	9
VI.4 Documentation provided:.....	9
VIII ANALOGUE ELECTRONICS.....	10
(Lectures : 12H, Practicals : 12H).....	10
VIII.1 Objectives:.....	10
VIII.2 Keywords:.....	10
VIII.3 Module content: .....	10
IX Sequential Control.....	11
(Lectures : 14h Practical : 20 h.....	11
IX 1 Objectives :.....	11
IX 2 Keywords :.....	11
IX 3 Module content : .....	11
Models.....	11
Multi-taskings systems .....	11
IX 4 Documentation provided :.....	12
X Programmable Electronics (microcontrollers) ( <i>Lectures : 12h, Tutorials : 4h; Labs : 20h</i> ) .....	14
X.1 Objectives:.....	14
X.2 Key words:.....	14
X.3 Module content: .....	14
X.4 Documentation provided:.....	14
XI Computational Fluid Dynamics.....	15
(lectures 4h - practical 6h -applied project 20h).....	15
XI.1 Objectives:.....	15
XI.2 Key words: .....	15
XI.3 Module content: .....	15
XI.4 Documentation provided:.....	15
XII Finite Element Method .....	16
(lectures 8h – Exercises 6h - practical 20h).....	16
XII.1 Objectives:.....	16
XII.2 Keywords:.....	16
XII.3 Module content: .....	16
XII.4 Documentation provided:.....	16



## I FLUID MECHANICS (FIRST PART. 36 HOURS)

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Cyril Mazin – Fluid Mechanics Department – ICAM Toulouse – France – [cyril.mazin@icam.fr](mailto:cyril.mazin@icam.fr)

### I.1 Objectives:

The first part of the fluid mechanics course is given to acquire the basic principles of fluid mechanics in order to be able to approach typical fluid mechanics problems. The aim of the laboratory sessions is to familiarise students with measuring equipment used in fluid mechanics and specially pressures losses.

### I.2 Key words:

Statics fluids, fluid in motion, Bernoulli equation, incompressible flow, pressures or head losses, dimensional analysis

### I.3 Module content:

- Fundamentals of fluid mechanics.
- Static fluids.
- Finite control volume analysis.
- Pressure drop in a round pipe.
- Measurement of pressure and velocity.
- Dimensional analysis.
- Open channel flow.

### I.4 Documentation provided:

Handouts, laboratory sheets, class works

## II HYDRAULIC NETWORKS (14 HOURS)

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Cyril Mazin – Fluid Mechanics Department – ICAM Toulouse – France – [cyril.mazin@icam.fr](mailto:cyril.mazin@icam.fr)

### II.1 Objectives:

The hydraulic network course deals with the calculation of the pressures losses and flowrates in different networks. The aim of the laboratory sessions is to familiarise students with hydraulic components.

### II.2 Key words:

Network, fluid in motion, KIRCHOFF laws, pumps, pressures or head losses.

### II.3 Module content:

- Water supply systems
- Hydraulic network analysis method.
- Hydraulic network graphical method.
- HARDY CROSS method.
- Hydraulic components.

### II.4 Documentation provided:

Handouts, laboratory sheets, class works

## **III FLUID MECHANICS (SECOND PART. 40 HOURS)**

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Cyril Mazin – Fluid Mechanics Department – ICAM Toulouse – France – [cyril.mazin@icam.fr](mailto:cyril.mazin@icam.fr)

### III.1 Objectives:

This second part of the fluid mechanics course is directed towards both the theoretical and practical training of an engineer; it also gives the opportunity to develop a critical and thoughtful approach to engineering practice. The aim of the laboratory sessions is to familiarise students with measuring equipment used in fluid mechanics.

### III.2 Keywords:

Viscous flow, aerodynamics, turbulence, boundary layer, mechanics of flight, compressible flow, shock waves.

### III.3 Module content:

- Viscous flow.
- Flow over immersed bodies.
- Viscous flow past a flat plate.
- Viscous flow past a sphere and cylinder.
- Aerofoil.
- Mechanics of flight
- Flight at transonic speed.
- Compressible flow
- Shock waves
- Space flight

### III.4 Documentation provided:

Handouts, laboratory sheets, class works

## IV HEAT TRANSFER (30 HOURS)

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Cyril Mazin – Fluid Mechanics Department – ICAM Toulouse – France – [cyril.mazin@icam.fr](mailto:cyril.mazin@icam.fr)

### *IV.1 Objectives:*

To acquire knowledge of the basic principles of thermal processes in order to be able to approach and master a typical heat transfer problem. Many examples for building heat transfer.

### *IV.2 Keywords:*

Thermal resistance, thermal conductivity, conduction, convection, radiation, heat exchanger.

### *IV.3 Module content:*

- Introduction.
- Conduction.
- Convection.
- Radiation.
- Heat exchanger.
- Transient conduction.

### *IV.4 Documentation provided:*

Handouts, laboratory sheets, class works

## **V APPLIED THERMODYNAMICS**

### **(LECTURES : 30H, PRACTICALS : 4H)**

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Dominique Elzo – Fluid Mechanics Department – ICAM Toulouse – France - [dominique.elzo@icam.fr](mailto:dominique.elzo@icam.fr)

#### V.1 Objectives:

#### V.2 Keywords:

#### V.3 Module content:

- Gas turbine power cycles :  
Applications in turbofan and turbojet engines performances. Solve problems based on Brayton cycle with regeneration, intercooling reheating and regeneration
- Thermo electrical plants and combined plants :  
We determine the efficiency of the cycles and the level of electric power produced according the plants and the thermodynamic cycles involved.
- Vapor and combined power cycles :  
Rankine with Reheat and Superheat cycles and nuclear plants cycles principle are detailed. We focus our attention in this course on the ability to produce simultaneously electric power and heat power...
- Refrigeration cycles :  
Analyze of the vapor-compression refrigeration cycle. Evaluate the performance of refrigeration and heat pump systems.
  - Practicals study of the cycle of a real refrigeration device.

#### V.4 Documentation provided:

Handouts, laboratory sheets, class works

## VI CERAMICS (15 HOURS)

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Olivier Quenard – Materials Engineering Department – ICAM Toulouse – France – [olivier.quenard@icam.fr](mailto:olivier.quenard@icam.fr)

### VI.1 Objectives:

### VI.2 Keywords:

### VI.3 Module content:

- General properties
- Manufacturing, influence of parameters of caking on microstructure and general properties (mechanical, electrical...)
- Crystallized and amorphous ceramics
- Fields of use

### VI.4 Documentation provided:

Handouts, laboratory sheets, class works



## VII ARTIFICIAL INTELLIGENCE (30 HOURS)

(LECTURES: 16H, PRACTICALS : 14H)

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Gilles Bézard – GEI – ICAM Toulouse – France – [gilles.bezard@icam.fr](mailto:gilles.bezard@icam.fr)

### VII.1 Objectives:

Develop the ability to detect a problem which draws its solution from artificial intelligence

Know how to manage a project using artificial Intelligence

Lab work explore: interpreters, logic of applicative programming, recursiveness, object representation, grammar of languages ...

### VII.2 Keywords:

Expert system, neural network, heuristic, lisp, prolog, constraint programming

### VII.3 Module content:

Quick overlook of the industrial and technical applications of artificial Intelligence

- Cognitive approach : how to represent knowledge by symbols in a formalism which can be easily used by a computer program in order to simulate cognitive activity.
- Connectionist approach : imitate intelligent reasoning by a neuronal model; this approach defines knowledge as abstract processing of raw data, using a model based on the physiology of a nervous system.
- Heuristic algorithmic approach : this approach gives good results with problems with impossible exhaustive processing for solutions , or problems with a high combinatorial analysis like workshop planning
- Artificial Intelligence today
- Lab work : use of the following tools : G2 (expert-system shell), Neuro-on-line, Statistica Neuro Network, Intellisphere, Chip, Lisp, Prolog

### VI.4 Documentation provided:

Handouts, laboratory sheets, class works

## VIII ANALOGUE ELECTRONICS

### (LECTURES : 12H, PRACTICALS : 12H)

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Françoise Vareilhias –GEI- Icam Toulouse –France- [francoise.vareilhias@icam.fr](mailto:francoise.vareilhias@icam.fr)

#### VIII.1 Objectives:

Acquisition of methods of analysis of electronic circuits, development of ability of analysis electronic circuits, understanding of basic electronic functions.

Develop ability to implement basic electronic functions.

#### VIII.2 Keywords:

#### VIII.3 Module content:

A top down approach is offered, from complex electronic systems to simple single components. First block diagrams are used to represent electronic systems that have found their way into almost all aspects of life. The course goes on to describe the components found in these basic blocks by explaining their technology and characteristics in more detail. Finally, electronic circuits are analyzed.

#### **Content:**

- Introduction to semiconductors
- Active components
- Diodes, Bipolar Transistors and MOSFETs
- Operational Amplifiers
- Basic electronic functions
- Rectification
- Commutation
- Amplification
- Filtering
- Sensor characteristics, signal conditioning and performance

#### **Program: Practical sessions**

- Electronic systems studied include: power supply, lamp and motor controls with sensor implementation
- Students work in pairs. They use lab equipment such as oscilloscopes and signal generators. They should be able to set up a concrete electronic circuit by choosing the right components.

## IX SEQUENTIAL CONTROL

### (LECTURES : 14H PRACTICAL : 20 H)

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Simona d'Attanasio –Icam Toulouse – [Simona.dattanasio@icam.fr](mailto:Simona.dattanasio@icam.fr)

#### IX 1 Objectives :

#### IX 2 Keywords :

#### IX 3 Module content :

##### Models

- A sequential approach: FSM Finite State Machine
- A parallel approach : Petri nets (PN)
- Petri net syntax
- Synchronization and parallelism
- Resource sharing
- Capacity and stock management
- Petri net and GRAFCET

##### Multi-taskings systems

- Multi-tasking concepts
- Simple examples of multi-tasking systems
- Formalism of multi-tasking systems
- Multi-tasking management: task states
- Multi-tasking and state machines
- Multi-tasking and its implementation: sharing, synchronization and communication
- Resource sharing: the semaphore
- Communication: the message queue
- Synchronization: semaphore and message queue

*IX 4 Documentation provided :*

Handouts, laboratory sheets, class works

<p><b>English courses</b> <b>ICAM Nantes</b></p>
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## **X PROGRAMMABLE ELECTRONICS (MICROCONTROLLERS)**

### **(LECTURES : 12H, TUTORIALS : 4H; LABS : 20H)**

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Frédérique Pasquier – Electronics and Automation Department – Icam Nantes – France – [frederique.pasquier@icam.fr](mailto:frederique.pasquier@icam.fr)

#### X.1 Objectives:

The goal of this course is to understand the general principles of a microprocessor and of a microcontroller, the development flow of an application, and the advanced techniques used to improve performances: parallel executions (pipelines, superscalar architectures...) and efficient memory hierarchies (caches, virtual memory...).

#### X.2 Key words:

Microprocessor, microcontroller, assembler, C language, high performance architectures, embedded application

#### X.3 Module content:

- Hardwired logic vs programmed logic
- Introduction to embedded C-language
- Working principles of a microprocessor
  - Internal and external architecture
  - Instruction set ; addressing modes
  - Stack; interrupts
- The AVR microcontroller
  - Memories and registers
  - Peripherals
  - Ports
  - Clock system; sleep modes; reset sources
- Advanced techniques
  - Parallelism; pipeline
  - Memory hierarchy; caches; MMU

#### X.4 Documentation provided:

Handouts, laboratory sheets, class works

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## **XI COMPUTATIONAL FLUID DYNAMICS**

### **(LECTURES 4H - PRACTICAL 6H -APPLIED PROJECT 20H)**

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Jérôme Soto – LE2M – ICAM Nantes – France – [jerome.soto@icam.fr](mailto:jerome.soto@icam.fr)  
Joseph Power – Airbus Filton - UK

#### *XI.1 Objectives:*

Acquire the basic principles of Computational Fluid Dynamics.

#### *XI.2 Key words:*

Numerical simulation, Fluid dynamics, heat transfer

#### *XI.3 Module content:*

- Introduction
- Problem description: physical aspect, mesh and boundary conditions
- Mathematical model
- Numerical model and discretization methods
- Turbulence models
- Industrial applications of CFD

#### *XI.4 Documentation provided:*

Handouts, laboratory sheets, class works

## **XII FINITE ELEMENT METHOD**

### **(LECTURES 8H – EXERCISES 6H - PRACTICAL 20H)**

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Pascal VINOT – LE2M – ICAM Nantes – France – [pascal.vinot@icam.fr](mailto:pascal.vinot@icam.fr)

#### *XII.1 Objectives:*

Acquire the basics of the finite element method and analysis.

#### *XII.2 Keywords:*

Finite Element Method / Analysis, Numerical simulation

#### *XII.3 Module content:*

- Introduction
- General formulation for linear static case
- Rod finite element in tension-compression-torsion
- Beam finite element in bending
- 2D and 3D finite elements
- Modal parameters calculation – Mass matrix
- More on FEM (Advices, misuses, numerical analysis, etc.)

#### *XII.4 Documentation provided:*

Handouts, laboratory sheets, class works



