EUROMIND
EUROPEAN MASTER IN DESIGN AND TECHNOLOGY OF ADVANCED VEHICLES SYSTEMS

COMMON CORE

EUROMIND European Master In Design and Technology of Advanced Vehicles Systems		
COMMON CORE	**Module 1** **French Language and Culture**	
Prerequesites		
Syllabus		
AIMS: * To improve student's oral and written proficiency in French language in discovering and discussing French history, culture and politics. **CONTENTS:** Basic Written Skills Written Comprehension Listening Comprehension Speech French culture, politics, history and society		Lectures: 50h Independent learning: 50h Assessment: * written exam * oral exam
TOTAL	**ECTS = 4**	**Total workload:100 hours**

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COMMON CORE	**Module 2** **Applied Mathematics - Mathematics Tools**
Prerequesites	* Algebra, linear algebra * Laplace and Fourier transformation *Impulse function, Convolution * Probabilities

Syllabus

AIMS:

* To know the main numerical methods for solving linear and non-linear systems, ODE,PDE
* To understand the two different approaches: time and frequency, to know how to process signals
* To know the main tools for statistics used in industry

CONTENTS:

STATISTICS (10h)

Probabilities review
Basic distributions
Tests of significance and confidence interval
Planning of experiments
Study of the most common laws (chi-squared, student)

SIGNAL PROCESSING (10h)

Fourier representation of continuous-time periodic signals, Fourier transform
The discrete-time Fourier transform
Signals energy and power

NUMERICAL ANALYSIS (10h)

Numerical techniques for problems commonly encountered in ME
Approximation, interpolation, derivation, integration
Solving linear and non-linear systems
Solving differential equations
Solving partial differential equations

Lectures: 30h

Independent learning: 50h

Laboratories: 24h
MATLAB

Assessment:
*written exams
*oral exams

TOTAL	**ECTS = 4**	**Total workload: 104 H**

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COMMON CORE	**Module 3 Structural Design**
Prerequesites	* strength of materials * Basics on materials

Syllabus

AIMS:

* To learn the physical and numerical parameters which have to be taken into account in structures design
* To learn how to manage a structural analysis and to analyse results
* To understand and to know how to deal with structural non-linearity

CONTENTS:

MECHANICS (3h)

Basis review (kinematics, static and dynamic)
Energy (kinetic and potential) and mechanical work
Center of mass and moment of inertia
Lagrangia formulations of mechanics

ELASTICITY (3h)

Stress, Strain concepts
Principal of virtual work

NON LINEAR PHENOMENA (21 h)

* Material Law
* Applications
* FEM apllied to non linear calculations

FEM (21 h)

in linear static: Displacement approximation
Mesh definition, dofs
Shape functions, stiffness matrix, assembly
Different kinds of FE (rod, beam, shell, membrane, shear panel)
Resolution of linear system (Gauss method)
in linear dynamic:
Mass matrix (lumped, distributed)
Resolution of dynamic equation

Lectures: 48h
Independent learning: 70h

Laboratories: 56H
GLOBAL APPROACH:
ADAMS (12h)
LOCAL APPROACH:
CATIA (16h)
NASTRAN (20h)
LS-DYNA (8h)

Assessment:
* 2 written exams
* mini-projects

TOTAL	**ECTS = 7**	**Total workload: 174H**

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COMMON CORE	**Module 4** **AUTOMATIC - Control Systems**
Prerequesites	Mechanics: Lagrange Equations Math: Laplace and Fourier transformation Analysis of mechanics systems and dynamics systems

Syllabus

AIMS:
* To give methods and concepts to
represent dynamic systems in order to
characterise their time
and frequency responses
* To give the methodology for modeling and implementing

CONTENT:
Basic properties of discrete and continuous linear time-intervariant (LTI) systems.
Open-loop, feed-forward, closed-loop configurations.
Single-Input-Single-Output (SISO) systems.
Multi-Input-Multi-Output (MIMO) systems.
Laplace transform.
Time and frequency analysis of continuous-time LTI systems.
State variable - state and transfer function descriptions.
State-space representation of dynamic systems
Observability, controllability, Stability.
The Nyquist criterion - Pole placement
Observers, controllers,
Bode, Nyquist, Black representations,
Stability criteria
Controllers PI and PID. Tuning of PI and PID controllers.

Lectures: 24h

Laboratoires: 20h

Independent learning: 60h

MATLAB (4h)
SIMULINK (16h)

Assessment:
* written exams
* labwork reports

TOTAL	**ECTS = 4**	**Total workload: 104H**

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COMMON CORE	**Module 5** **CFD * Heat Transfer**	
Prerequesites	* Basic fluid dynamics * Differential and Integral *Numerical analysis *Calculus	
Syllabus		
AIMS: * To know and To understand the main methods used in CFD * To know the different means of heat transfer in order to be able to understand and manage a thermal analysis **CONTENT:** **CFD (18 h)** Review on the Physical properties of fluid, Kinematics and dynamics of fluid flow Conversion equations (mass, linear momentum, energy and chemical species) Introduction to CFD methods (space and time discretization schemes) Finite Volume Method TDMA (Tri-diagonal Matrix Algorithm) Workshop on a 1D conduction case **HEAT TRANSFERT (18h)** Steady and unsteady heat conduction Convective heat transfer Governing equations, dimensionless parameters Design correlations for forced, natural, and mixed convection Radiative heat transfer, black - and gray-body radiation, shape factors Enclosure theory Applications to Heat exchangers		Lectures: 36h Laboratories: 32h MATLAB (4h) GLOBAL APPROACH: AMESIM (12h) LOCAL APPROACH: FLUENT (16h) Independent learning: 60h Assessment: * 2 written exams * Mini-projects
TOTAL	**ECTS = 5**	**Total workload: 128H**

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COMMON CORE	**Module 6** **Systems Engineering**
Prerequesites	*statistics *numerical calculus

Syllabus

AIMS: * To know the methods used in project management and the different steps of a design project * To know the RAMS methods used on complex systems Project management and system engineering Human resources Time and schedule management Economic and Financial Management Concurrent engineering Risk management System performance management Management of system engineering Functional Analysis RAMS Entrepreneur Ship		Lectures: 58h Independent learning: 80h Assessment: * 2 2-hour written exams * 1 project
TOTAL	**ECTS = 6**	**Total workload: 138H**

EUROMIND European Master In Design and Technology of Advanced Vehicles Systems		
COMMON CORE	**Module 7** **Introduction to Automotive (ESTACA)- Workshop seminar**	
Prerequesites		
Syllabus		
History Functions and components European market (constructors and suppliers) Technological innovations Jobs		Lectures Seminar/ Discussion Discussion
TOTAL	**ECTS =0**	**Total h = 16h**

EUROMIND European Master In Design and Technology of Advanced Vehicles Systems		
COMMON CORE	**Module 8 Introduction to Aeronautics (Linköping)**	
Prerequesites		
Syllabus		
		Lectures Seminar Discussion
TOTAL	**ECTS = 0**	**Total h = 16h**

EUROMIND European Master In Design and Technology of Advanced Vehicles Systems		
COMMON CORE	Module 9 Introduction to Spacecraft engineering	
Prerequesites		
Syllabus		
TOTAL	ECTS = 0	Total h = 16h

EUROMIND European Master In Design and Technology of Advanced Vehicles Systems		
COMMON CORE	Module 10 Introduction to Marine Craft engineering	
Prerequesites		
Syllabus		
TOTAL	ECTS = 0	Total h = 16h