MASTER OF SCIENCE, TECHNOLOGY AND HEALTH

2021-2022

YEAR 1

CONTROL AND ROBOTICS

CONTROL SYSTEMS

PROGRAMME SUPERVISOR(S):

Guy LEBRET

Control and Robotics - Control Systems

YEAR 1 – Autumn Semester

CORE COURSES

Course code	Title	ECTS Credits
ARTIN	Artificial Intelligence	4
CLACO	Classical Linear Control	5
MANIP	Modelling of Manipulators	4
MICRO	Embedded Computing	4
SIPRO	Signal Processing	5
SISIF	Systems Identification and Signal Filtering	4

LANGUAGE COURSES

Course code	Title	ECTS Credits
CCE1	Cultural and Communication English	4
ESP1	Spanish Language	4
FLE1	French Language	4

YEAR 1 – Spring Semester

CORE COURSES

Course code	Title	ECTS Credits
DYBAC	Dynamic Model Based Control	4
MOBRO	Mobile Robots	4
NOLCO	Non Linear Control Theory	4
OPTEC	Optimization Techniques	4
PRETS	Programming Real Time Systems	4
PROJECT	Group Project	6

LANGUAGE COURSES

Course code	Title	ECTS Credits
CCE2	Cultural and Communication English	4
ESP2	Spanish Language	4
FLE2	French Language	4

Artificial Intelligence [ARTIN]

LEAD PROFESSOR(S): Diana MATEUS LAMUS

Objectives

This course introduces the key notions of artificial intelligence and machine learning, essential today in dealing with the ubiquitous collection of increasing amounts of data. Starting from general theoretical concepts, we will review the most influential methods for unsupervised and supervised learning, and link them to applications. The sessions will alternate between lectures and practical exercises in Python. Although the techniques will be presented from a broad and general perspective, the applications will focus on image and signal processing

Course contents

- General concepts
- Unsupervised methods for clustering and dimensionality reduction
- From linear classification to Support Vector Machines (SVM)
- Decision trees and ensemble methods
- Neural networks and introduction to deep learning
- Evaluation measurements

Course material

[1] Bishop C. : Pattern Recognition and Machine Learning. Springer, 2006.
[2] Kevin Patrick Murphy. Probabilistic Machine Learning: An Introduction. 2022

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	16 hrs	4 hrs	12 hrs	0 hrs	2 hrs

Classical Linear Control [CLACO]

LEAD PROFESSOR(S): Guy LEBRET

Objectives

Review the fundamentals of classical control for linear systems and provide a control methodology starting from the open loop analysis of the system to be controlled to the synthesis of a closed loop using classical PID type controllers (one degree of freedom controllers) which can be combined with a feedforward part (two degrees of freedom controllers).

Course contents

- Description of SISO linear systems through the transfer function
- Analysis of behaviour (poles/zeros, first/second/more general systems, time domain/frequency domain responses etc)
- Definition the Control objectives (stability/performance, tracking/regulation)
- Nominal/robust stability (Routh, Nyquist criteria, stability margins).
- Nominal/robust performance and the unavoidable trades off between stability and performance.
- Synthesis of PID type controllers, using frequency approach tunings, in a classical closed loop (one degree of freedom controller strategy).
- Possibility of introducing a feedforward contribution which tries to "invert" the first closed loop obtained (two degrees of freedom controllers).

After completing this course, the students will be able to:
- Analysis of the dynamic behaviour of a SISO linear system
- Design a PID type controller as an example of a feedback controller
- Design a feedforward controller to increase tracking performance

Course material

Recommended texts: course notes will be provided by the lecturer.
Further reading:
- "Modern Control Systems", R.C. Dorf and R.H. Bishop, Prentice Hall, 2011.
- "Control Systems Engineering", N. S. Nise, John Wiley & Sons, 2011.
- "Control system design", G.C. Goodwin, S.F. Graebe and M.E. Salgado, Prentice Hall, 2001.
- "Multivariable Feedback Control Analysis and Design", D.S. Skogestad and I. Postlethwaite, Wiley, 2005.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	5	22 hrs	6 hrs	4 hrs	0 hrs	2 hrs

Modelling of Manipulators [MANIP]

LEAD PROFESSOR(S): Olivier KERMORGANT

Objectives

This course introduces the modelling and basic control of serial robot arms. The topics include robot architecture and modeling conventions, forward and inverse kinematic model, differential kinematic modelling and the basics of trajectory planning and tracking.

At the end of the course, students will be able to:

- Have a clear view of 3D geometry, including rotation parametrization and velocity screws
- Define a table of modified Denavit-Hartenberg parameters to model a robot from a sketch
- Compute (manually or with software) the direct and differential kinematic models
- Derive the inverse kinematic model for standard manipulators (6R / 3P3R)
- Understand position and velocity control modes
- Know how to generate a trajectory from a sequence of 3D waypoints
- Know various symbolic or numeric software tools that can be used to model and control robots

Course contents

- Robot architecture, joint and operational spaces
- Homogeneous transformation matrices, 3D geometry, velocity screw
- Modified Denavit-Hartenberg parametrization and direct kinematics
- Definition and computation of the robot Jacobian
- Inverse kinematics in exact and iterative forms
- Trajectory generation
- Basic position and velocity control modes (trajectory / velocity tracking)

Exercises will involve modelling and simulating various serial manipulators.

Course material

- Slides and labs are available online.
- W. Khalil, and E. Dombre, Modeling, identification and control of robots, Hermes Penton, 2002.

Further reading:

- C. Canudas, B. Siciliano, G. Bastin (editors), Theory of Robot Control, Springer-Verlag, 1996
- J. Angeles, Fundamentals of Robotic Mechanical Systems, Springer-Verlag, New York, 2002.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	16 hrs	0 hrs	16 hrs	0 hrs	2 hrs

Master Programme - Control and Robotics - Control Systems
YEAR 1 - Autumn Semester

Embedded Computing [MICRO]

LEAD PROFESSOR(S): Mikael BRIDAY

Objectives

At the end of the course the students will be able to:

- understand the architecture of a microcontroller;
- design a low-level driver to access a peripheral of a microcontroller and deal with microcontroller interrupts;
- design a bare metal application, i.e. without any real time operating system.

Course contents

The first part of the course deals with the software environment for deeply embedded systems:
- data representation
- cross compiler: bit operations, memory model, common C design rules, low level C and assembly specific attributes
- debugging with a JTAG probe (breakpoints, memory watch, etc)

The second part introduces some basic hardware peripherals of a microcontroller to interact with the environment:
- standard GPIO
- timers and PWM
- interrupts
- serial communication peripherals

The third part of the module focuses on the design of both bare metal applications and driver, including concurrent execution of both software and hardware parts.

Course material

- Philip Koopman, Better Embedded Software Systems, Drumnadrochit Education LLC, 2010
- D. Patterson & J. Hennessy, Computer Organization and Design – ARM Edition, Morgan Kaufmann, 2017

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	12 hrs	4 hrs	16 hrs	0 hrs	2 hrs

Signal Processing [SIPRO]

LEAD PROFESSOR(S): Eric LE CARPENTIER

Objectives

- To interpret the spectral representations of signals
- To understand the time sampling of signals (sample rate, anti-aliasing filter etc.)
- To model a system using the transfer functions language
- To model a system using the state space language
- To switch from one representation to the other
- To link the physical phenomena to the parameters of these representations (stability, response velocity etc.)
- To simulate these mathematical representations with adapted scientific software tools (Matlab, Simulink)

Course contents

- Analysis of continuous-time and discrete-time signals
  o Fourier, Laplace and z transforms
  o Sample, hold, quantization, Shannon theorem
- Modelling of continuous-time and discrete-time linear time invariant (LTI) systems
  o Transfer function, state space representation
  o Poles, zeros, stability
  o Time response, frequency response
  o Sampling
  o Simulation (Matlab Simulink)
  o First-order and second-order systems
- Design of an actual digital control implementation
  o Analog to Digital Converter, Digital to Analog converter
  o Sample and hold
  o Link with the previous mathematical representations
- Lab work
  o A simple encoder
  o Spacecraft control simulation

Course material

- Modern Signals and Systems, H. Kwakernaak, R. Sivan, Prentice Hall.
- Signals and Systems, R. Baraniuk, http://www.eng.ucy.ac.cy/cpitris/courses/ece623/notes/SignalsAndSystems.pdf
- Signal processing. Introduction to signals and systems theory, E. Le Carpentier, https://hippocampus.ec-nantes.fr/mod/resource/view.php?id=9179

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	5	16 hrs	0 hrs	16 hrs	0 hrs	2 hrs

Systems Identification and Signal Filtering [SISIF]

LEAD PROFESSOR(S): Mira RIZKALLAH

Objectives

Signal filtering is a basic operation in signal processing which allows, for instance, undesired content to be deleted. The first part of this course deals with methods to design analog and digital filters and their application for the processing of real signals. The second part of the course focuses on experimental modeling of time series. It provides a detailed description of the time series forecasting and modeling chain from data acquisition to model validation.

After completing this course, the students will be able to:
- specify all the desired properties of a linear filter
- design a linear filter fulfilling the specifications and apply it to a real signal
- model time series and estimate model parameters
- undertake times series forecasting, estimate future values of a time series.

Course contents

1. Signal filtering
- principles of linear filtering, filter characterization in the frequency domain
- analog filter synthesis
- digital filter synthesis (FIR, IIR)

2. Time series analysis
- Time series basics: important features on a time series plot, Auto-regressive(AR) model, Autocorrelation function (ACF)
- Moving Average (MA) models, partial autocorrelation, useful notations (backshift operators etc)
- Identifying and estimating ARMA, ARIMA models; using ARIMA models to forecast future values.

3. Applications
- Audio signal filtering
- Time series 1: fMRI BOLD signals, time series analysis from plotting, correlation
- Time series 2: Forecasting the pandemic trend of Covid 19 (based on past values and models)

Course material

H. Kwakernaak and R. Sivan, Modern signals and systems, Prentice Hall, Englewood Cliffs, 1991
C. Chatfield and H. Xing, The Analysis of Time Series: An Introduction with R, 2019

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	12 hrs	10 hrs	10 hrs	0 hrs	2 hrs

Cultural and Communication English [CCE1]

LEAD PROFESSOR(S): Spencer HAWKRIDGE

Objectives

Introduction to Cultural and Communicational English:

- Understand the general concepts of communication English (different levels of language, etc.)
- Build a communicational project
- Develop strategies for enhanced interaction
- Organize, lead and participate in discussions, interviews and meetings
- Behavioral skills in an inter-cultural environment:
- Strengthen engagement and level of conviction
- Develop a capacity to explain and argue
- Acquire notions of corporate culture and values
- Enhance team work

Course contents

Cultural and Communicational English: exercises to explore in practice the areas of culture and communication
Inter-cultural project (for example, documentary project, publishing project: construct a work of fiction or of educational value and experience the complete publishing process)
VEC (Virtual Environmental Challenge) Challenge - international competition to design an Eco-campus with participants from French and foreign universities.

Course material

Written and televised press, information and digital tools, general documents, business environment and company strategies.
Internet conferences (Ted Talks, etc.), our own educational materials on Hippocampus (Moodle).
Our own eZoomBook template for the Intercultural project.
VEC padlet and PMooc ('The stories we live by' - Professor Arran Stibbe lecturing on Ecolinguistics)

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	0 hrs	64 hrs	0 hrs	0 hrs	0 hrs

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YEAR 1 - Autumn Semester

Spanish Language [ESP1]

LEAD PROFESSOR(S): Marta HERRERA

Objectives

For beginners:
Practice and reinforcement of the five skills (oral and written expression and comprehension as well as interaction)
Acquisition of vocabulary and linguistic structures
Be able to talk about yourself and those around you
Be able to express oneself during daily activities
Know how to give your opinion

For advanced students:
Practice and reinforcement of the five skills (oral and written expression and comprehension as well as interaction)
Acquisition of specialised vocabulary
Be able to understand the essential content of concrete or abstract subjects including a technical discussion
Be able to communicate spontaneously and fluently
Be able to express oneself in a clear and detailed manner, to express an opinion on a topical subject

Course contents

For beginners:
Personal environment (introduce yourself, express yourself, your tastes, your character, your hobbies, etc.), your surroundings (friends, family, location, climate), your interests (sports, leisure)
Present tense (regular and irregular)
Language patterns to express habit, obligation, "gustar" and its equivalents,
Possessive adjectives
Differences between "es", "está", "hay"
Use of "por" and "para"
Adverbs and frequency patterns
Numeral adjectives

For advanced students:
Knowledge of the Hispanic world (economic, technical, cultural and social environment)
Present tense (regular and irregular)
Imperative
Past tenses
Direct / indirect style
Future tense
Conditional tense
Present and past subjunctive moods

Course material

Preparation manuals, our own tailor-made documents, written and internet press, general civilization documents, digital tools

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	0 hrs	64 hrs	0 hrs	0 hrs	0 hrs

French Language [FLE1]

LEAD PROFESSOR(S): Silvia ERTL

Objectives

The objective is to familiarize the learner with the French language and French culture through an entertaining task-based communicative language teaching, focused on speaking combined with:

- Phonetics
- Self-correcting exercises on our learning platform
- Learning Lab activities
- Project work
- Tutoring

Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation by both traditional means and through the use of digital resources.
Students will learn general French, develop language skills of oral and written comprehension and expression.

After completing this course (32 hours + personal work), the students will be able to communicate in spoken and written French, in a simple, but clear manner, on familiar topics in the context of study, hobbies etc. Another important goal of this course is to introduce the student to French culture. At the end of the course (2 semesters), complete beginners can achieve an A1 level and some aspects of the A2 of The Common European Framework of Reference for Languages. More advanced students may aim for B1/B2 levels.

Course contents

Full range of practical communication language exercises: reading comprehension, listening comprehension, written expression, oral expression.

Learners will be able to use the foreign language in a simple way for the following purposes:

1. Gving and obtaining factual information:
- personal information (e.g. name, address, place of origin, date of birth, education, occupation)
- non-personal information (e.g. about places and how to get there, time of day, various facilities and services, rules and regulations, opening hours, where and what to eat, etc.)

2. Establishing and maintaining social and professional contacts, particularly:
- meeting people and making acquaintances
- extending invitations and reacting to being invited
- proposing/arranging a course of action
- exchanging information, views, feelings, wishes, concerning matters of common interest, particularly those relating to personal life and circumstances, living conditions and environment, educational/occupational activities and interests, leisure activities and social life

3. Carrying out certain transactions:
- making arrangements (planning, tickets, reservations, etc.) for travel, accommodation, appointments, leisure activities
- making purchases
- ordering food and drink

Course material

Preparation manuals, our own tailor-made documents, written and televised press, internet, general civilization documents, digital tools, our own educational materials on Hippocampus (Moodle).

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	0 hrs	64 hrs	0 hrs	0 hrs	0 hrs

Dynamic Model Based Control [DYBAC]

LEAD PROFESSOR(S): Guy LEBRET / Sébastien BRIOT

Objectives

To show that using in a control law "a dynamic model" of a dynamical system can be the base of a fruitful control methodology. This course is an extension of two courses: Classical Linear Control and Modelling of Manipulators.
In the first part (16h), for linear multivariable systems, the model is used, first of all, to obtain observer-based controllers (state space approach of linear multivariable systems) as the feedback part of the control law, and secondly, in a possible feedforward part.
In the second part (16h), it is shown how the dynamic model of mechanisms or, more specifically, serial robots can be obtained, as this model is the basis of the so-called "computed torque control law". Different formalisms for the computation of the dynamic model will be explored (Newton-Euler, Lagrange equations).

Clearly, the objective of the course is to present a unified methodology to obtain control laws. In this methodology, once the dynamic model has been obtained, then the non-linear coupled MIMO systems can be linearized and decoupled, and finally the linear methodology of the first part can be applied.

Course contents

Part 1 state space approach of linear multivariable systems:
- Time domain state response, modal decomposition of the response
- Controllability, observability
- Observer-based controllers
- Possible two degrees of freedom controllers.

Part 2, mechanisms or more specifically, serial robots:
- Recalls of classical mechanics
- Newton-Euler equations
- Euler-Lagrange equations
- Optimal computation of dynamic models for serial robots (recursive formalisms)

Skills: After completing this course the students will be able to
- Use all classical tools of the linear state space approach to analyse (mode, controllability, etc) and design observer-based controllers.
- Compute the dynamic model of open-loop mechanisms and robots
- Evaluate the benefit of the use of a dynamical model in a control law.

Course material

Recommended texts: Course notes will be provided by the lecturers.

Further reading:

- "Control system design", G.C. Goodwin, S.F. Graebe and M.E. Salgado, Prentice Hall, 2001.
- "Linear Multivariable Control, A Geometric Approach", W.M.Wonham. Springer Verlag, New York, 1985.
- "Linear Systems", T. Kailath, Prentice-Hall, New Jersey, 1980.
- "Modelling, Identification and Control of Robots" W. Khalil and E. Dombre, Hermes Penton, Ltd, 2002

Assessment

Individual assessment: EVI 1   (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	22 hrs	6 hrs	4 hrs	0 hrs	2 hrs

Mobile Robots [MOBRO]

LEAD PROFESSOR(S): Gaëtan GARCIA

Objectives

The objective of the course is to provide students with the necessary tools to model, localize and control conventional wheeled mobile robots, along with tools to plan their path..

Course contents

The following subjects will be addressed:

- Modelling of wheeled Robots: Constraint equations, Classification of robots using degrees of mobility and steerability, Posture kinematic model, Configuration kinematic model, Motorisation of wheels.
- Localization: Relative localization using odometry, Absolute localisation, Localization sensors, Localization using extended Kalman filtering. Observability analysis of localization problems.
- Control: Controllability and stabilization, static and dynamic feedback linearization, non-linear control based on Lyapunov functions.

Practical Work: The students will study various control laws in simulation. They will also implement a Kalman filter-based localization algorithm using data recorded with a real robot.

Course material

- "Theory of robot control", Carlos Canudas de Wit, Bruno Siciliano, Georges Bastin, Springer Science & Business Media, 2012 - 392 pages.
- "Wheeled Mobile Robots—Kinematic Modelling", G. Garcia, Class material in book form.
- "Mobile robots—Localization", G. Garcia, Class material in book form.
- "Principles of robot motion", H. Choset et. al., Bradford books, MIT Pres.

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	20 hrs	0 hrs	12 hrs	0 hrs	2 hrs

Non Linear Control Theory [NOLCO]

LEAD PROFESSOR(S): Franck PLESTAN

Objectives

The goal is to provide the fundamentals of modern non-linear control theory. Analysis and control of non-linear systems are considered using a so-called algebraic approach. Many examples taken from different fields of applications demonstrate the feasibility of the methodologies. After completing this course, the students will be able to:

- Understand the theoretical fundamentals on the control of non-linear systems,
- Apply advanced non-linear control to a variety of systems

Course contents

- Introduction to the algebraic approach for non-linear systems and its mathematical tools.
- Structural analysis, concepts of relative degree, of controllability and accessibility.
- Control methods: feedback linearization, decoupling, reference trajectory tracking, sliding mode control, backstepping.
- Lyapunov functions and their properties.
- Practical Work: case studies on an inverted pendulum and a PVTOL model

Course material

- G. Conte, et al., Algebraic Methods for Nonlinear Control Systems. Theory and Applications, Springer, 2006.
- Isidori, Nonlinear Control Systems. 2nd edition, Springer, 1989.
- Y. Shtessel et al., Sliding Mode Control and Observation, Birkhauser, 2014.
- H. Khalil, Nonlinear systems – 2nd edition, Prentice Hall, 1996.

Assessment

Individual assessment:　　　EVI 1　(coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	16 hrs	4 hrs	12 hrs	0 hrs	2 hrs

Optimization Techniques [OPTEC]

LEAD PROFESSOR(S): Fouad BENNIS

Objectives

The lecture presents different theoretical and computational aspects of a wide range of optimization methods for solving a variety of problems in mechanical engineering. The main objective of this course is to give the students the ability to formalise, select the appropriate method, implement the optimisation problem and then analyse the results in order to take the best decision regarding the objectives, variables and constraints.

Course contents

- Basic concepts of optimization,
- Gradient based methods,
- Evolutionary algorithms,
- Multi objective optimization methods,
- Robust optimization methods,
- Multidisciplinary optimization problems,
- Programming aspects,
- Use of optimization toolbox.

Practical Work: exercises and a project on the design optimisation of a mechanical product, manufacturing process or system.

The students will be able to understand different theoretical and computational aspects of a wide range of optimization methods.

Course material

R. Fletcher, Practical Methods of Optimization, Wiley, 2000.
Mitchell Melanie: An Introduction to Genetic Algorithms, MIT Press 1996

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	16 hrs	0 hrs	16 hrs	0 hrs	2 hrs

Programming Real Time Systems [PRETS]

LEAD PROFESSOR(S): Sébastien FAUCOU

Objectives

At the end of the course the students will be able to:
- Design a software architecture for a real-time system
- Build deterministic programmes with a multitasking RTOS
- Handle time and recurring events in a real-time software system
- Understand and solve resource sharing issues in concurrent real-time software

Course contents

- Introduction to real time systems: what is a real time system, classes of timing constraints, basic model and results on real time scheduling
- Trampoline RTOS: what is a RTOS, when is it useful, architecture of Trampoline, build process, task management and scheduling, synchronisation, handling of recurring events, shared resources
- Design of real time applications: case studies and design patterns

Course material

- Alan Burns, Andy Wellings, Analysable Real-Time Systems: Programmed in Ada, CreateSpace Independent Publishing Platform, 2016
- Giorgio C. Buttazzo, Hard Real-Time Computing Systems: Predictable Scheduling Algorithms and Applications, Springer, 2011
- Philip Koopman, Better Embedded Software Systems, Drumnadrochit Education LLC, 2010

Assessment

Individual assessment: EVI 1   (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	12 hrs	4 hrs	16 hrs	0 hrs	2 hrs

Group Project [PROJECT]

LEAD PROFESSOR(S): Gaëtan GARCIA

Objectives

To contribute to solving a scientific, technological or theoretical problem proposed by any of the instructors of the master (professors, assistant professors, researchers etc.) or industrial partners.

Course contents

The students (individually or often as a group of two) organize the project. Depending on the subject, a bibliography may be necessary, an original methodology or solution can be proposed or it can involve purely the application of techniques learned throughout the courses.

32 hours are set aside for the project in the timetable, but additional personal work will be required. Project assessment is based on a written report and an oral presentation.

Course material

To be provided by the supervisor(s) if necessary.

Assessment

Collective assessment: EVC 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	6	0 hrs	0 hrs	0 hrs	32 hrs	0 hrs

Cultural and Communication English [CCE2]

LEAD PROFESSOR(S): Spencer HAWKRIDGE

Objectives

Interview techniques and communicational English:

- Understand the general concepts of interactive communication
- Build a media project
- Acquire interview techniques
- Understand the process of sourcing and checking facts and figures
- Understand issues related to plagiarism
- Create a bibliography
- Behavioral skills in an inter-cultural environment:
- Strengthen self-confidence and capacity for interaction
- Develop active listening and reformulation skills
- Develop networking skills

Course contents

Cultural and Communicational English: exercises to explore in practice the areas of culture and communication.
Media project (for example: prepare, conduct and promote interviews for a radio programme: L'Heure Centralienne (http://www.euradionantes.eu/emission/l-heure-centralienne), with the contribution of professors, PhD students, industrial partners, industry players at fairs, etc.

Course material

Written and televised press, information and digital tools, general documents business environment and company strategies.
Internet conferences (Ted Talks, etc.), our own educational materials on Hippocampus (Moodle).
Our own eZoomBook template for the Intercultural project.

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Spanish Language [ESP2]

LEAD PROFESSOR(S): Marta HERRERA

Objectives

For beginners:
Practice and reinforcement of the five skills (oral and written expression and comprehension as well as interaction)
Acquisition of vocabulary and linguistic structures
Be able to talk about yourself and those around you
Be able to express oneself during daily activities
Know how to give your opinion

For advanced students:
Practice and reinforcement of the five skills (oral and written expression and comprehension as well as interaction)
Acquisition of specialised vocabulary
Be able to understand the essential content of concrete or abstract subjects including a technical discussion
Be able to communicate spontaneously and fluently
Be able to express oneself in a clear and detailed manner, to express an opinion on a topical subject

Course contents

For beginners:
Personal environment (introduce yourself, express yourself, your tastes, your character, your hobbies, etc.), your surroundings (friends, family, location, climate), your interests (sports, leisure)
Present tense (regular and irregular)
Language patterns to express habit, obligation, "gustar" and its equivalents,
Possessive adjectives
Differences between "es", "está", "hay"
Use of "por" and "para"
Adverbs and frequency patterns
Numeral adjectives

For advanced students:
Knowledge of the Hispanic world (economic, technical, cultural and social environment)
Present tense (regular and irregular)
Imperative
Past tenses
Direct / indirect style
Future tense
Conditional tense
Present and past subjunctive moods

Course material

Preparation manuals, our own tailor-made documents, written and internet press, general civilization documents, digital tools

Assessment

Individual assessment: EVI 1 (coefficient 1)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs

Master Programme - Control and Robotics - Control Systems
YEAR 1 - Spring Semester

French Language [FLE2]

LEAD PROFESSOR(S): Silvia ERTL

Objectives

The objective is to familiarize the learner with the French language and French culture through an entertaining task-based communicative language teaching, focused on speaking combined with:

- Phonetics
- Self-correcting exercises on our learning platform
- Learning Lab activities
- Project work
- Tutoring

Course objectives include the acquisition and reinforcement of vocabulary, syntax, and pronunciation by both traditional means and through the use of digital resources.
Students will learn general French, develop language skills of oral and written comprehension and expression.

After completing this course (32 hours + personal work), the students will be able to communicate in spoken and written French, in a simple, but clear manner, on familiar topics in the context of study, hobbies etc. Another important goal of this course is to introduce the student to French culture. At the end of the course (2 semesters), complete beginners can achieve an A1 level and some aspects of the A2 of The Common European Framework of Reference for Languages. More advanced students may aim for B1/B2 levels.

Course contents

Full range of practical communication language exercises: reading comprehension, listening comprehension, written expression, oral expression.

Learners will be able to use the foreign language in a simple way for the following purposes:

1. Giving and obtaining factual information:
- personal information (e.g. name, address, place of origin, date of birth, education, occupation)
- non-personal information (e.g. about places and how to get there, time of day, various facilities and services, rules and regulations, opening hours, where and what to eat, etc.)

2. Establishing and maintaining social and professional contacts, particularly:
- meeting people and making acquaintances
- extending invitations and reacting to being invited
- proposing/arranging a course of action
- exchanging information, views, feelings, wishes, concerning matters of common interest, particularly those relating to personal life and circumstances, living conditions and environment, educational/occupational activities and interests, leisure activities and social life

3. Carrying out certain transactions:
- making arrangements (planning, tickets, reservations, etc.) for travel, accommodation, appointments, leisure activities
- making purchases
- ordering food and drink

Course material

Preparation manuals, our own tailor-made documents, written and televised press, internet, general civilization documents, digital tools, our own educational materials on Hippocampus (Moodle).

Assessment

Individual assessment: EVI 1 (coefficient 1.0)

LANGUAGE OF INSTRUCTION	ECTS CREDITS	LECTURES	TUTORIALS	LAB	PROJECT	EXAM
English	4	0 hrs	32 hrs	0 hrs	0 hrs	0 hrs