POLYTECH ANGERS

Syllabus en anglais de la spécialité :

Automatique et Informatique

Control Engineering and Computer Engineering

En formation initiale sous statut étudiant (FISE)

Nom d'usage : SAGI

Systèmes Automatisés et Génie Informatique

Syllabus – Spécialité Automatique et Informatique

[Syllabus en anglais]

Syllabus
SAGI – S5

Version anglaise - Aout 2022

Responsable : L. Autrique

Semestre 5   360 h/E

	H/E	H CM	H TD	H TP24	H TP16
UE 5-1 Formation Générale	**100**				
Anglais	28		28		
Allemand/Espagnol/Français	12		12		
Culture économique	12		12		
Sport / Parrainage scolaire / Atelier NaN	12		12		
Connaissance de l'entreprise et comptabilité	16		16		
Challenge d'intégration	20		20		
UE 5-2 Automatique et Automatisation *	**148**				
Génie mécanique (*commun QIF*) *	28		16		12
Automatismes industriels *	44	8	16		20
Modélisation et simulation en Python *	36	5.33		30.67	
Mécatronique *	40	4	14.67		21.33
UE 5-3 Génie informatique *	**112**				
Langage C *	40			24	16
GNU/Linux *	20	8		12	
SGBD & SQL *	28	8		20	
Réseaux informatiques *	24	5.33		5.33	13.33

(*) taught in English

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	English	POLYTECH ANGERS
SAGI	3A / Semester 5	UE 5-1
	28h TD	Formation Générale

Compétences développées	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Level B2 / CEFR

Objectives:
-Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction to achieve proficiency in everyday and professional situations.
-Cross-cultural skills: knowledge of international environment

Organization of Language proficiency levels groups based on Toeic practice scores from the TOEIC . A base TOEIC score is required in the final year to graduate as an Engineer.

Contents:
Oral and written communication skills
Looking for a mandatory training experience abroad, writing a cover letter, a CV
Communication skills in companies (letters, memos, emails, phone conversations, interviews etc.)
Current political, economic and social and professional issues
Speech and presentation techniques.
Regular pronunciation and accent work.

	LV2 : German or Spanish or French	POLYTECH ANGERS
SAGI	3A/Semester 5	UE 5-1
	12h TD	Formation Générale
Compétences développées	(C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Basic oral and written communication skills

Objectives:
Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
Cross-cultural skills: knowledge of international environment

Organization of Language proficiency levels whenever it is possible.

The target for the advanced group is CEFR B2 ; A2 or B1 for the intermediate group,

Successful completion of a linguistic certification is compulsory in the last year of the LV2 engineering cycle depending on the level of the students.

For students in the confirmed group, obtaining an additional external certification may be recommended in the last year of the engineering cycle.

Programme:
Looking for a training experience abroad, writing a cover letter, a CV, an abstract
Oral and written communication skills
Communication skills in Companies
Political, economic and social news

Evaluation
100% Continuous assessment

Learning outcomes:
Intermediate groups
- The student can write a CV in German/Spanish
- The student can speak for a few minutes on a topical issue or a topic of personal interest.
- The student can take part in a conversation on simple topics that can be related to his/her personal interests.

Advanced groups
- The student car write a cover letter in German/Spanish
- The student can read an article or listen to a program in a standard language and comment on it.

	Economics	POLYTECH ANGERS
SAGI	3A / Semester 5	UE 5-1
	12 h TD	Formation Générale
Compétences développées	(C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Keywords: market, economic growth, political economics, sharing economy

Prerequisites: none, except interest and curiosity

Objectives:
- Understanding the issues of current economic debates
- oKnowing about vocabulary and economic indicators

Contents:
 Economics challenge
 ⚔ The basis of economics
 ⚔ Economic news and analysis (students reports)
 ⚔ Sharing economy

Evaluation:
Continuous assessment (100%)

	Sport / Parrainage scolaire / NaN	POLYTECH ANGERS
SAGI	3A / Semester 5	UE 5.1
	12h	Formation générale

Compétences développées	(C.1)	apply scientific and technical knowledge
	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Keywords: Sports ; Scientific mediation ; NaN

Prerequisites: None

Objectives:

Sport: Physical and sports education courses help train future engineers, promote their physical and mental balance, facilitate their integration, strengthen the team spirit and the dynamics of the school. Being able to work as a team, communicate, build relationships of trust, be healthy and resist stress are qualities that are required of future engineers. The proposed sports activities involve new motor acquisitions, individual and collective strategies, and an adaptation to the effort. These elements contribute to development and are additional assets for their training. Our missions are to participate in the training of future engineers, to promote the physical and psychic balance of the students, to facilitate the integration of the students of the school, to strengthen the team spirit.

Scientific mediation aims to offer our students to create a link, an exchange, between the scientific / technical world and young students. It is important to note that a special place is given to the social responsibility of our future engineers who must contribute as significantly as possible to the dissemination of knowledge. This specific scenario also allows students who choose this activity to develop their interpersonal skills, to think about the best approach to impart skills and finally to implement elements to ensure that the learner has really progressed. The students involved in this action start by following training in scientific mediation which they then put into practice by sponsoring a group of young students during the robotics trophies. This national meeting puts teams of young students in competition around scientific and technical challenges.

NaN: This is an interdisciplinary, inter-institution program on the theme of Digital Arts-Sciences. This program is supported by the Research-Training-Innovation program in Pays de la Loire as the winner of the call for projects "innovative initial training". Since 2017, the workshop takes the form of a time weekly (Thursday afternoon, from 2:00 p.m. to 5:00 p.m.) of experiments and collective work led and supervised jointly by teachers from ESAD TALM and Polytech Angers. It brings together an average of twenty students, half registered at ESAD TALM Angers (having chosen the workshop from the TALM grids) and the other half registered at Polytech Angers. The work carried out by the students is presented during events: exhibitions at the Musée des Beaux-Arts d'Angers (in 2018 and 2019), installation at the Jean Lurçat museum in 2018, conference performed at the Quai in 2019, exhibition within the Lycée Joachim du Bellay in Angers in 2019.

Contents:
Specific actions are implemented during participation in one of the following three components:
- the practice of team and individual sports
- or scientific mediation
- or the NaN workshop

Evaluation:
Continuous assessment (100%)

	Connaissance de l'entreprise et comptabilité	POLYTECH ANGERS
SAGI	3A / Semestre 5	UE 5.1
	16h TD	Formation Générale

Compétences développées	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Responsable Connaissance de l'entreprise (8h) : D. Rigole

Keywords: corporate functions, legal status, group, social economy, collaborative economy, CSR, business and corporate strategies

Prerequisite: None

Objectives: Discover :
- the main functions in companies
- the diversity of companies
- business and corporate strategies
- corporate social responsibility

Program: I- The main functions in companies
II- All forms of companies : size, legal status, social economy, collaborative economy
III- CSR
IV- Business and corporate Strategies:

Evaluation: 100% Continuous assessment.

Learning outcomes: The student must be able to present any company : global presentation (activities, brands…),

Responsable Comptabilité « Fondamentaux de la Gestion Comptable et Financière » (8h) : V. Billaudeau

Keywords: Accounting, balance sheet, income statement, expense, income, assets, liabilities, cash, investment, financing

Prerequisite: none

Objectives: Discover the fundamentals of accounting and financial management

Program: Section 1: Presentation: Balance sheet and income statement
- Management accounts: expense / income
- Balance sheet accounts: assets / liabilities
Section 2: Reconstruction of the balance sheet and the income statement
- Go from the income statement to the balance sheet and vice versa
- Impact study: cash flow / result
- The result and the cash flow
Section 3: Financing and investment operations
Section 4: Some specific accounting concepts
- VAT
- …

Evaluation: 100% Continuous assessment.

Bibliography: Colasse B., Comptabilité générale, Economica, 2000.

SAGI	Mechanical Engineering	POLYTECH ANGERS
	5A / Semester 5	UE 5.2
	16h TD – 12h TP16	Automatique & Automatisation
Compétences développées	(S.1) control industrial processes (S.2) model and analyze continuous or discrete dynamic systems (S.6) control and operate industrial robots (S.7) design and operate embedded, mobile systems and/or robotics equipment (C.1) apply scientific and technical knowledge	

Responsable : Anthony Delamarre

Keywords: Engineering, components , CAD, applied mechanics

Prerequisites: None

Objectives: To give the basics of mechanical technology

Contents:

Part 1: Mechanical Technology
22h40 CM 8hTD (2CM et 6TD) : Ensure bases : Technical drawing / knowledge of mechanical components (bearing / gear / etc) / linking piece / kinematic - goal : understand a mechanism

Part 2: CAD
12h TP (9TP) : Ensure CAD bases : design and / or use the digital model of a mechanism

Part 3: Applied Mechanics
2h40 CM 6h40 TD (2CM et 5TD) : Ensure bases of applied Mechanics: force , torque, wrench , Equilibrium equations, mechanical calculation (speed , power, energy , etc.)

Evaluation: 100% CC

Bibliography:
- « Système mécanique : Théorie et dimensionnement »,M. Aublin et co , Edition DUNOD
- « Guide des sciences et technologies industrielles » , JL. Fanchon,
- Site WEB : http://www.aae.ens-cachan.fr/
- Tutoriels Solidworks, disponibles à partir du logiciel

	Industrial automation	POLYTECH ANGERS
SAGI	3A / Semester 5	UE 5.2
	8h CM – 16h TD – 20h TP16	Automatique & Automatisation

Compétences développées	(S.1)	control industrial processes
	(S.2)	model and analyze continuous or discrete dynamic systems
	(S.6)	control and operate industrial robots
	(C.1)	apply scientific and technical knowledge

Responsable : Sébastien Lahaye

Keywords: Industrial automated systems, formal representation and control synthesis, programmable logic controller (PLC) programming, IEC 61131 and CEI 61499 standards, motion control, safety

Objectives: Prepare students to become a privileged interlocutor, or even a member, of an automation engineering and design office, able to interact with other offices, suppliers and/or customers.

Outline: Automated system: definition, structure and components
        Sequential digital systems
                Formal representation
                Modelling and control synthesis
        Programmable logic controllers
                Hardware structure
                Programs processing
        IEC 61131-3 standard: PLC programming
                Projects architecture
                Data structures
                Programming languages: SFC, LD, ST and LIST
        Motion control
                Theoretical and technical aspects (cams, speed profiles, …)
                Hardware implementation (selection and sizing of components)
                Software implementation
        Safety
                Challenges and issues
        Integration of safety aspects in an automation project

Examination: continuous assessment (written examinations and laboratories).

References:
- *Programmable Logic Controllers*, Franck D. Petruzella, McGraw-Hill Education, 2016
- *Programmable Logic Controllers*, W. Bolton, Elsevier, 2015
- *Langages de programmation pour systèmes automatisés : norme CEI 61131-3*, Nicolas Jouvray, Techniques de l'ingénieur, 2008
- *Norme CEI 61499 : programmation disribuée et événementielle des procédés*, Nicolas Jouvray, Techniques de l'ingénieur, 2008
- http://plcopen.org

	Modeling and simulation	POLYTECH ANGERS
SAGI	3A / Semester 5	UE 5.2
	5h20 CM – 30h40 TD	Sciences de l'ingénieur
Compétences développées	S.2. model and analyze continuous or discrete dynamic systems S.7. design and operate embedded, mobile systems and/or robotics equipment S.9. apply the procedural and object-oriented programming paradigms C.1. apply scientific and technical knowledge	

Responsable : Laurent Hardouin

Keywords: System, model, Euler method, Runge-Kutta method.

Prerequisites: Mathematics and basics of Physics.
                        Programmation : Algorithmique, Langage C

Objectives:

This course introduces some modelling technics for mechanical systems, hydraulic systems and biological systems.
Numerical methods (such as Euler method or Runge-Kutta method) for the simulation of these systems are also presented and illustrated using the Python language.

Program :

Introduction on differential equations and the state representation

Modelization:
• Modeling of compartmentalized systems, biological models (Lotka-Volterra, prey-predator, SIR epidemiological model, etc.).
• Modelling of hydraulic systems (multi-tank systems, dairy supervision application, etc.).
• Modelling of mechanical systems (inverted pendulums, mobile robots, autonomous boats, submarines, etc.)

Simulation:
• Euler method
• Runge-Kutta method
• Simulation based on Python, 2D graphical representation

Examination: Written examination.

Bibliography:
• Books on Physics (mechanics, electricity, ...),
• Luc Jaulin, « Représentation d'état pour la modélisation et la commande des systèmes ». ed. Lavoisier.

	Basis of mechatronic engineering	POLYTECH ANGERS
SAGI	5A / Semester 5	UE 5.2
	4h CM – 14h40 TD – 21h20 TP24	Automatique & Automatisation

Compétences développées	(S.1)	control industrial processes
	(S.2)	model and analyze continuous or discrete dynamic systems
	(S.6)	control and operate industrial robots
	(S.7)	design and operate embedded, mobile systems and/or robotics equipment
	(C.1)	apply scientific and technical knowledge

Responsable: Laurent Autrique

Keywords: Industrial sensors, computer technology for instrumentation, signal processing, Electric motors,

Requirements: Basic knowledge on electricity (PEIP-1), Sensors (PEIP-2), Applied mathematics and signal processing (PEIP-2)

Courses Objectives: The aim is to provide students with concepts related on the one hand to industrial instrumentation and on the other hand to electric motors.

To master the techniques for data acquisition in an industrial environment

The global framework relates to engineering services in instrumentation. Several investigations are proposed: principles of various physical measurements (used in the context of industrial applications), computing tools for the communication and recording of the collected data, implementation of mathematical methods to ensure information analysis.

To investigate the main principles of electric motors

In an automated system, the need for a servomechanism can be expressed as follows:
- a set of mechanical quantities
- associated with a defined production system
- has to follow a specified behavior
- with specified performance
- in a given production context.
In this part, we are focused on the servomotor and more specifically on the electric motor and the variable speed drive.

Evaluation: written examination and practical work evaluation.

Bibliography :
- G. Ash, *Acquisition de données : du capteur à l'ordinateur*, ed. Dunod, 516 pages, 2003.
- G. Ash, *Les capteurs en instrumentation industrielle*, ed. Dunod, 834 pages, 1999.
- L. Birglen, Mécatronique, ed. Dunod, 434 pages, 2016
- F. Authouart, *La métrologie mais c'est très simple*, ed. Crisalis, 262 pages, 2011.
- F. Baudoin, M. Lavabre, *Capteurs : principes et utilisation,* ed. Casteilla, 457 pages, 2007.
- H. Dang Van Mien, *Automatisation des systèmes industriels*, Eyrolles, 520 pages, 1999.
- P. Dassonvalle, *Les capteurs*, ed. Dunod, 277 pages, 2005.
- J.L. Fanchon, *Guide des sciences et technologies industrielles,* Nathan, 592 pages, 2001.
- M. Grout, *Instrumentation industrielle : spécification et installation des capteurs et des vannes de régulation*, ed. Dunod, 526 pages, 2002.

SAGI	**C Programming**	POLYTECH ANGERS
	3A / Semester 5	UE 5.3
	24h TD – 16h TP16	Génie informatique
Compétences développées	(S.9) apply the procedural and object-oriented programming paradigms (C.1) apply scientific and technical knowledge	

Responsable : Laurent Hardouin

Prerequisites

Knowledge in algorithmic basis, in C Language (first part given in the cycle préparatoire), or the common skill for engineers or for students from bachelor level

Objectives

Get the skills to develop software in C language. Open mind to the Object programming and genericity.

Outline

Chapter1 : Arrays and functions
Chapter 2 : Structure and type defintion
Chapter 3 : Dynamic Arrays
Chapter 4: File in C language
Chapter 5 : Genericity
Chapter 6 : Linked list

TP 1 : Sort algorithm and list, using of generic function qsort
TP 2 : Structured Data, Game : Navy Battle
TP 3 : File handling, transforming a file from csv format to html format.
TP 4: dynamical programming and cellular automata, game programming ' Minesweeper'

Examination

 Exam, and laboratories examinations and home exercices

	GNU / Linux	POLYTECH ANGERS
SAGI	3A / Semester 5	UE 5.3
	8h CM – 12h TP24	Génie informatique

Compétences développées	(S.9)	apply the procedural and object-oriented programming paradigms
	(S.13)	manage computer networks (infrastructure, services, control and command functions)
	(S.14)	administer computer servers
	(C.1)	apply scientific and technical knowledge

Responsable : Nicolas Delanoue

Keyworks : Unix operating system, Unix commands, shell scripts, Python langage.

Prerequisites : algorithmics and programming

Objectives : Knowledge of concepts and commands regarding the Unix operating system. Use of the shell and Python for different activities (e.g. search on the filesystem, file editing, permission modifications, user creation).

Content :
    Unix :
        - User and administrator (root)
        - Filesystem and permissions
        - Command for managing files and directories
        - Shell : flow redirection, pipeline
        - Regular expressions and manipulation of file data
        - Shell scripts
    Python
        - Data types, control flow and files
    Python-Unix coupling
    - Interoperability between Python program and Unix commands
    - Graphical user interface and Unix commands
    - Network, web and Unix commands

Evaluation : written examination

References :
- *Introduction to Unix*, Jerry Peek, Grace Todino & John Strang, Editions O'Reilly
- Python for Unix and Linux System Administration, Efficient Problem Solving with Python, Noah Gift, Jeremy M. Jones, O'Reilly Media, 2008

SAGI	Database (SQL)	POLYTECH ANGERS
	3A / Semester 5	UE 5.3
	8h CM – 20h TP24	Génie informatique

Compétences développées		
	(S.10)	develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.)
	(S.13)	manage computer networks (infrastructure, services, control and command functions)
	(S.14)	administer computer servers
	(S.15)	manage databases in different environments
	(C.1)	apply scientific and technical knowledge
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Responsable : Mehdi Lhommeau

Key-words: Relational Data Model, SQL

Prerequisites:

Objectives:

Introduces the fundamental concepts for design and development of database systems. Emphasizes relational data model and conceptual schema design using ER model, practical issues in commercial database systems, database design using functional dependencies, and other data models. Develops a working relational database for a realistic application.

Program:

- Database Design - This will include design philosophies such as E-R and Relational Algebra, along with studies of normal forms for databases;
- Query Languages - The main topic will be an in-depth study of SQL ;
- Physical Implementation - This will cover the basics of how the information in a database is stored and accessed on various systems;

Examination:

- Written examination

Bibliography:

- Judith Bowman, Sandra Emerson, and Marcy Darnovsky, *The Practical SQL Handbook: Using Structured Query Language*, Third Edition, Addison-Wesley, ISBN 0-201-44787-8, 1996.
- C. J. Date, *An Introduction to Database Systems*, Volume 1, Sixth Edition, Addison-Wesley, 1994.

SAGI	**Computer networks**	POLYTECH° ANGERS
	3A / Semester 5	UE 5.3
	5h20 CM – 13h20 TP24 – 5h20 TP16	Génie informatique
Compétences développées	(S.13) manage computer networks (infrastructure, services, control and command functions) (C.1) apply scientific and technical knowledge	

Responsable : Laurent Hardouin

Objective

Presentation of the basics of computer network.
OSI model. Howto Ethernet, and TCP/IP.

Outline

Computer Networks :

1 . Introduction to computer network and OSI Model
2. Ethernet, ARP, TCP/IP Protocols
3. Internet organization
4. How to make a Local ARea Network with Linux and Windows
5. Sever configuration : DHCP, DNS, with Linux
6. Socket API, how to program with internet

Evaluation

written exam and laboratories exams

References

Internet and Computer Network, Campus Press, D. E. Comer

CISCO website, : http://www.cisco.com

Syllabus
SAGI – S6

Version anglaise - Aout 2022

Responsable : L. Autrique

Semestre 6   340 h/E

	H/E	H CM	H TD	H TP24	H TP16
UE 6-1 Formation Générale	**80**				
Anglais	16		16		
Allemand/Espagnol/Français	12		12		
Communication	20		20		
Sport / parrainage scolaire / Atelier NaN	12		12		
Management	20		20		
UE 6-2 Sciences de l'ingénieur	**68**				
Analyse fonctionnelle	24	8	16		
Traitement du signal *	20	6.67	8		5.33
Intro. à la qualité et à l'innovation (*commun QIF*)*	24		24		
UE 6-3 Automatique & Automatisation *	**96**				
Automatique *	44	12	16		16
Microcontrôleur *	24	5.33	10.67		8
Robotique *	28	2.67		9.33	16
UE 6-4 Génie informatique *	**96**				
Programmation C# *	36	4		20	12
Interaction Homme Machine & Réalité virtuelle *	32	8		16	8
PHP/Web *	28	8		20	
UE 6-5 Stage					
Stage à l'étranger					

(*) taught in English

SAGI	**English**	POLYTECH ANGERS
	3A / Semester 6	UE 6-1
	16h TD	Formation Générale
Compétences développées	(C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Level B2 / CEFR

Objectives:

-Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction to achieve proficiency in everyday and professional situations.
-Cross-cultural skills: knowledge of international environment

Organization of Language proficiency levels groups based on Toeic practice scores from the TOEIC . A base TOEIC score is required in the final year to graduate as an Engineer.

Contents:
Oral and written communication skills
Looking for a mandatory training experience abroad, writing a cover letter, a CV
Communication skills in companies (letters, memos, emails, phone conversations, interviews etc.)
Current political, economic and social and professional issues
Speech and presentation techniques.
Regular pronunciation and accent work.

	LV2 : German or Spanish or French	POLYTECH ANGERS
SAGI	3A/Semester 6	UE 6-1
	12h TD	Formation Générale
Compétences développées	(C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Basic oral and written communication skills

Objectives:
Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
Cross-cultural skills: knowledge of international environment

Organization of Language proficiency levels whenever it is possible.

The target for the advanced group is CEFR B2 ; A2 or B1 for the intermediate group.

Successful completion of a linguistic certification is compulsory in the last year of the LV2 engineering cycle depending on the level of the students. For students in the confirmed group, obtaining an additional external certification may be recommended in the last year of the engineering cycle.

Programme:
Looking for a training experience abroad, writing a cover letter, a CV, an abstract
Oral and written communication skills
Communication skills in Companies
Political, economic and social news

Evaluation
100% Continuous assessment

Learning outcomes:
Intermediate groups
- The student can write a CV in German/Spanish
- The student can speak for a few minutes on a topical issue or a topic of personal interest.
- The student can take part in a conversation on simple topics that can be related to his/her personal interests.

Advanced groups
- The student car write a cover letter in German/Spanish
- The student can read an article or listen to a program in a standard language and comment on it.

SAGI	Communication	POLYTECH ANGERS
	3A / Semester 6	UE 6-1
	20h TD	General Skill

Compétences développées	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Keywords : presentation, Internship report, poster

Prerequisites : none

Objectives :
- Present a synthetic work experience
- Write an internship report
- Create a poster
- Stakes of the intercultural

Examination : oral presentation and poster

Bibliography :

L. Bellenger, *Etre constructif dans les négociations et les discussions*, Entreprise Moderne d'Edition, 1984.
A. Da-Silva, *Savoir se présenter efficacement*, Kindle, 2012.
M.I. Laborde, *Ecrire un rapport de stage*, Mémo 122, Seuil, 2012.
B. Lebelle, *L'art des présentations power point*, Broché, 2012.
P. Morin, *Organisation et motivations*, les éditions d'organisation, 1989.
P. Oléron, *L'argumentation*, Presses universitaires de France, 1987.
W. Ury, *Négocier avec des gens difficiles*, Paris, Le Seuil, 1990.

	Sport / Parrainage scolaire / NaN	POLYTECH ANGERS
SAGI	3A / Semester 6	UE 6.1
	12h	Formation générale
Compétences développées	(C.1) apply scientific and technical knowledge (C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Keywords: Sports ; Scientific mediation ; NaN

Prerequisites: None

Objectives:

Sport: Physical and sports education courses help train future engineers, promote their physical and mental balance, facilitate their integration, strengthen the team spirit and the dynamics of the school. Being able to work as a team, communicate, build relationships of trust, be healthy and resist stress are qualities that are required of future engineers. The proposed sports activities involve new motor acquisitions, individual and collective strategies, and an adaptation to the effort. These elements contribute to development and are additional assets for their training. Our missions are to participate in the training of future engineers, to promote the physical and psychic balance of the students, to facilitate the integration of the students of the school, to strengthen the team spirit.

Scientific mediation aims to offer our students to create a link, an exchange, between the scientific / technical world and young students. It is important to note that a special place is given to the social responsibility of our future engineers who must contribute as significantly as possible to the dissemination of knowledge. This specific scenario also allows students who choose this activity to develop their interpersonal skills, to think about the best approach to impart skills and finally to implement elements to ensure that the learner has really progressed. The students involved in this action start by following training in scientific mediation which they then put into practice by sponsoring a group of young students during the robotics trophies. This national meeting puts teams of young students in competition around scientific and technical challenges.

NaN: This is an interdisciplinary, inter-institution program on the theme of Digital Arts-Sciences. This program is supported by the Research-Training-Innovation program in Pays de la Loire as the winner of the call for projects "innovative initial training". Since 2017, the workshop takes the form of a time weekly (Thursday afternoon, from 2:00 p.m. to 5:00 p.m.) of experiments and collective work led and supervised jointly by teachers from ESAD TALM and Polytech Angers. It brings together an average of twenty students, half registered at ESAD TALM Angers (having chosen the workshop from the TALM grids) and the other half registered at Polytech Angers. The work carried out by the students is presented during events: exhibitions at the Musée des Beaux-Arts d'Angers (in 2018 and 2019), installation at the Jean Lurçat museum in 2018, conference performed at the Quai in 2019, exhibition within the Lycée Joachim du Bellay in Angers in 2019.

Contents:
Specific actions are implemented during participation in one of the following three components:
- the practice of team and individual sports
- or scientific mediation
- or the NaN workshop

Evaluation:
Continuous assessment (100%)

	Management	POLYTECH ANGERS
SAGI	3A / Semester 6	UE 6-1
	20h TD	General Skill

Compétences développées	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Keywords:
- Organizational behavior, social influence, corporate structures , corporate culture

Prerequisites: none

Objectives:
- To understand the human behavior in the organizations
- To meet the requirements to act more effectively in a professional situation

Program:

Management: Introduction to Organizational Behavior
               I- Individual characteristics and behavior
               II-Groups
               III- The impact of the organizational context on behavior

Evaluation: 100% Continuous assessment.

Bibliography
- Alexandre-Bailly F. (coll.) : « Comportements humains et management » Ed. Pearson Education, 2006
- Crozier M. et Friedberg E: « L'acteur et le système » Ed. Seuil, 1977
- Doise W. , Deschamps J-C. , Mugny G.: « Psychologie sociale expérimentale » Ed. Colin, 1991
- Robbins S. et Judge T.: « Comportements organisationnels. »: Ed Pearson, 2011
- Schermerhorn JR. Et al. (collectif): « Comportements humains et organisation » Ed ERPI, 2010

SAGI	**Functional analysis**	POLYTECH ANGERS
	3A / Semester 6	UE 6.2
	5h20 CM – 14h40 TD	Sciences de l'ingénieur

Compétences développées	(S.1) control industrial processes
	(S.2) model and analyze continuous or discrete dynamic systems
	(S.6) control and operate industrial robots
	(C.1) apply scientific and technical knowledge

Responsable: Philippe Declerck

Keywords: Communication, structuration, method

Prerequisites: none

Objectives: the aim is to present the spirit of the methods allowing the modelling of a process under the functional form and to clearly express its functions and data.

Program: SADT, OMT improved

Examination: terminal examination and exercises

Bibliography:
- IGL technologie , "SADT un langage pour communiquer" Eyrolle 1989.
- J-P. Perez, "Système temps réel : méthodes de spécification et de conception", Dunod 1990.
  - J. Gabey, "Merise et UML pour la modélisation des systèmes d'information. Un guide complet avec études de cas", Dunod, 2001

	Signal processing	POLYTECH ANGERS
SAGI	3A / Semester 6	UE 6.2
	6h40 CM – 8h TD – 5h20 TP16	Sciences de l'ingénieur

Compétences développées	(S.2)	model and analyze continuous or discrete dynamic systems
	(S.7)	design and operate embedded, mobile systems and/or robotics equipment
	(C.1)	apply scientific and technical knowledge

Responsable : Etienne Belin

Keywords : Deterministic signal, Digital signal, Frequency processing, Filtering,

Prerequisites : Mathematical bases : Differentiation and integration of elementary functions, complex numbers, trigonometric functions.

Objectives : The bases of signal processing are reviewed, with corresponding applications, as useful for a curriculum in industrial engineering, automation and computer engineering. Special emphasis is placed on deterministic signals, and frequency-domain processing of signals and their interactions with linear systems. These notions are presented both in the realm of continuous-time signals (physical level of the measured signals) and in the realm of discrete-time signals (digital processing).

For each important notion, typical applications are addressed, such as harmonics in electric power systems, modulation / demodulation, detection of signals in noise, statistical processing of measured data, electrical or mechanical systems modeling, digital processing of signals and data.

Program :
1) General notions on signal processing.
2) Frequency representation of signals :
    - Fourier series, Fourier transform (FT).
    - Dirac delta function : definition, properties, relation to FT.
3) Interaction of signals with linear systems :
    - Definition of a linear system, Impulse response, Convolution,
    - Transfer function in frequency, Filtering, identification, deconvolution.
4) Sampled signals :
    - Shannon sampling condition, z transform, truncation window,
    - discrete Fourier transform, fast Fourier transform.
5) Linear digital filters :
    - Analysis :
        Recurrence equation in time, Impulse response, z transfer function,
        Frequency transfer function, Example of the integrator filter.
    - Synthesis :
        Transformation method.

Evaluation :   Written examination and laboratory examination.

Bibliography :
- V. Oppenheim, "Signals and Systems", Prentice Hall.
- V. Oppenheim, "Discrete-Time Signal Processing", Prentice Hall.
- M. H. Hayes, "Schaum's Outline of Theory and Problems of Digital Signal Processing", McGraw Hill.

	Introduction to Quality and Innovation	POLYTECH ANGERS
SAGI	3A / Semester 6	UE 6.2
	24h TD	Sciences de l'ingénieur

Compétences développées	(C.1)	apply scientific and technical knowledge
	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Responsable : Anthony Delamarre

Keywords: Quality approach, innovation process approach

Prerequisites: no prerequisites

Objectives: to teach the innovation process and the quality approach to give a global view of these processes to the students. to allow students to understand the position of the methodological courses in a global process.

Contents: The course is divided in 2 parts : 12hTD describing the innovation process and 4h CM +8h TD describing the Quality approach.   -
The agenda of the innovation process is divided in courses of 1h20 like this :
 3 courses of introduction of innovation :
  Definitions ;
  Risk of innovation : the degree, the nature et intensity of innovation ;
  Panorama of innovation approaches : from project to open innovation
  The innovation organisation : from start-up to innovation cell
  Managing innovation portfolio
 6 courses of working group on designing a product by a innovation process
  First course : thématic choice and brainstorming
  Second course : organise your ideas with the mindmapping
  Third course : Formalise your ideas with idea sheet and review them
  Fourth course : Evaluate your ideas with the radar method
  Fifth course : Build you prototype or model (CAD, photomontage)
  sixth course : Build your marketing speech to sell your idea
The quality program is as follows:
 - Presentation of the World of Quality
 - 8 principles of quality management
 - Main Standards
 - Approach Process and Quality Indicators
 - Introduction to the 6 Sigma method
 - Introduction to quality control, statistical control of processes

Evaluation: CC (100%)

Bibliography:

- Boly Vincent, Camargo Mauricio, Morel Laure, *ingénierie de l'innovation*, Hermès science publications-Lavoisier, 2016, 288p.
- Cap Gemini, *l'innovation, dernier des processus sauvages,* Edition cap gemini, 2013
- Corsi Patrick, Neau Erwann, *les dynamiques de l'innovation*, Hermès science publications-Lavoisier, 2011, 231p.
- Delamarre Anthony, *Contribution de la conception d'un produit concept à l'organisation des phases préliminaires du processus de conception – Application dans la société Rossignol S.A. dans le cadre de la mise en place d'une cellule d'innovation,* Thèse de doctorat soutenue le 11 décembre 2006
- ISO 9001, ISO 10018, ISO 10006 ISO 14001, ISO 9100, ISO 18001, ISO 5725

SAGI	**Automatic control**	POLYTECH ANGERS
	3A / Semester 6	UE 6.3
	12h CM – 16h TD – 16h TP16	Automatique & Automatisation
Compétences développées	(S.1) control industrial processes (S.2) model and analyze continuous or discrete dynamic systems (S.6) control and operate industrial robots (S.7) design and operate embedded, mobile systems and/or robotics equipment (C.1) apply scientific and technical knowledge	

Responsable : Sébastien Lahaye

Keywords: linear systems, systems identification, parameter estimation discrete-time and continuous-time state-space representation, stability, controllability, observability, state feedback, state observer.

Prerequisites: introduction to automatic control , Modélisation et simulation (UE5-3)

Objectives and outline:

To provide students with a basic understanding of and an overview about
the principles of identification of linear systems. The focus is in particular on
      procedures allowing to estimate the order of systems
      parameter estimation (ordinary and recursive least squares regression).

To provide students with a basic understanding of and an overview about the principles of state-space representation for linear systems:
- Analysis (stabilty, controllability, observability)
- control techniques (state feedback, pole placement, state observer).

Examination :
written examination and laboratories examination

Bibliography :

Identification of Dynamic systems, R. Isermann, M. Munchoff, Springer, 2011

Cours d'automatique: Tome 3, M. Rivoire, J.-L. Ferrier, édition Eyrolles

Automatique : commande des systèmes linéaires, Ph. De Larminat, édition Hermès

Représentation d'état pour la modélisation et la commande des systèmes, L. Jaulin, Hermès science, éditions Lavoisier, 2005

Control System Design: An Introduction to State-Space Methods, B. Friedland, 1986

	Microcontroller	POLYTECH' ANGERS
SAGI	3A / Semester 6	UE 6.3
	5h20 CM – 10h40 TD – 8h TP16	Sciences de l'ingénieur

| Compétences développées	(S.1) control industrial processes (S.6) control and operate industrial robots (S.7) design and operate embedded, mobile systems and/or robotics equipment (S.9) apply the procedural and object-oriented programming paradigms (C.1) apply scientific and technical knowledge

Responsable : Nicolas Delanoue

Keywords :

    microcontrollers, AVR Atmel, ARDUINO board

Prerequisite : basics in digital systems

This lecture aims at tackling some elementary notions about programmable digital systems. First, we recall some usual descriptions of numbers in digital systems and we explain how processors execute programs. Then we introduce microcontrollers and their usual integrated input-output devices. All the examples are given with the Arduino UNO board.
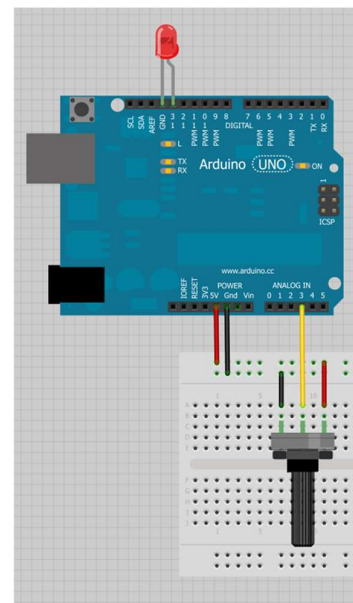
Outline :
Recalls on the binary description of numbers for processors (signed/unsigned integers, floats)
Description of the execution cycle of a processor
What is a microcontroller ? processor + memory + IO
Integrated IO devices on a microcontroller : digital IO, timers/counters, interrupts, Analog to Digital Converter, Two Wire Interface, …
Applications in C language for ARDUINO
Labs : small applications using switches, LED, 7-segment displays, rotary encoders …

Examination :

    written examination and laboratories examination

	Robotic	POLYTECH° ANGERS
SAGI	3A / Semester 6	UE 6.3
	2h40 CM – 9h20 TP24 – 16h TP16	Automatique & Automatisation

Compétences développées	(S.5)	model, analyze and predict robots behavior.
	(S.6)	control and operate industrial robots
	(S.7)	design and operate embedded, mobile systems and/or robotics equipment
	(C.1)	apply scientific and technical knowledge

Responsable : Jean-Louis Boimond

Keywords: industrial robot, link, position, orientation, degrees of freedom, joint space, operational space, homogeneous transformation, geometric model

Objectives: Introduction to robotics
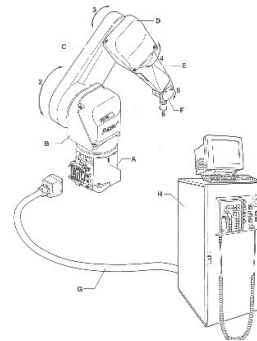
Program:
- General definitions:
  - Definitions
  - Components of a robot
  - Classification of robots
  - Characteristics of robots
  - Generations of robots
  - Robot programming
- Degrees of freedom - Architecture:
  - Positioning of a solid in space
  - Link
  - Mechanisms
  - Morphology of manipulator robots
- Geometric model of a simple chain robot:
  - Need for a model
  - Operational coordinates
  - Translation and rotation
  - Homogeneous transformation matrix

Examination: Written examination and laboratories examination.

Bibliography:
1) *Introduction to Robotics Mechanics and Control,* 2th edition, J. J. Craig, Addison-Wesley Publishing Company, 1989, 450 pages
2) *Modeling, Identification & Control of Robots*, W. Khalil, E. Dombre, Hermes Penton Science 2002, 480 pages
3) *Robotics Modelling, Planning and Control,* B. Siciliano, L. Sciavicco, L. Villani, G. Oriolo, Springer-Verlag 2009, 632 pages

	C# Programming	POLYTECH ANGERS
SAGI	3A / Semestre 6	UE 6.4
	4h CM – 20h TP24 – 12h TP16	Génie Informatique

Compétences développées	(S.9)	apply the procedural and object-oriented programming paradigms
	(C.1)	apply scientific and technical knowledge

Responsable : Bertrand Cottenceau

Keywords : C# language, .NET, object oriented programming, Windows Form applications

Prerequisite : procedural programming (C language)

Outline : this lecture aims at introducing the object oriented paradigm with the C# language. First, we give some simple examples of classes, and then we introduce the inheritance in C#. The class diagram of UML is used to give a graphical description of relations between classes. Several concepts have to be tackled along the lecture such as interfaces, abstract classes, virtual methods and events. Moreover, some basic classes of the .NET framework are presented (string, List<T> and LinkedList<T>).

The examples are first given for console applications and then for Windows Form applications.

- The class keyword
- Value type vs reference type in .NET
- Constructors, Properties
- composition in C#
- inheritance in C#
- virtual methods
- Interfaces, abstract classes
- Delegates Events
- Windows Form Applications

Examination : written exams and labs

Bibliography :

C# in a nutshell (Joseph Albahari, Ben Albahari)

SAGI	**Human-Computer Interaction & Virtual reality**	POLYTECH ANGERS
	3A / Semester 6	UE 6.4
	8h CM – 16h TP24 – 8h TP16	Génie informatique

Compétences développées	(S.10)	develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.)
	(S.11)	know the tools of augmented reality and immersive multimedia
	(C.1)	apply scientific and technical knowledge
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Lecturer : Paul Richard

Key-words: Human-computer interaction, 3D interaction devices, immersive displays, haptic interfaces, physics simulation, virtual and augmented reality
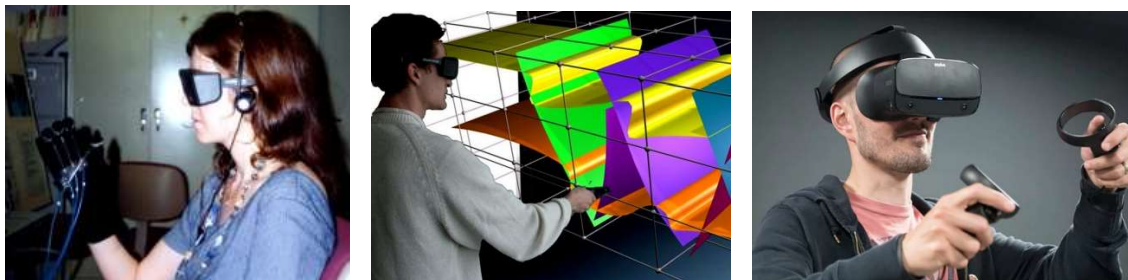
Prerequisites: basic knowledge in computer programming (C# or C)

Objectives: to address the general principles of human-computer interaction, advanced human-computer interfaces such as 3D interaction devices, natural user interfaces, haptics interfaces and advanced visualization systems. Overview of interaction metaphors and 3D interaction techniques. Programming of 3D real-time application using Unity3D.

Program:
- Principles of human-computer interaction
- Advanced human-computer interfaces
- Metaphors and interaction techniques
- 3D application programming (Unity3D)

Examination: Continuous assessment

Bibliography:

- Human-Computer Interaction (second edition) par Alan Dix, Janet Finlay, Gregory Abowd & Russell Beale. London, UK : Prentice Hall Europe, 1998, 638 p.
- 3D User Interfaces: Theory and Practice By Doug Bowman, Ernst Kruijff, Joe LaViola, and Ivan Poupyrev, 512 p. Addison Wesley (2004)
- Learning C# Programming with Unity 3D (English Edition), Alex Okita, Taylors and Francis, 2015

	PHP/WEB programming	POLYTECH ANGERS
SAGI	3A / Semester 6	UE 6.4
	8h CM – 20h TP24	Génie Informatique
Compétences développées	(S.10) develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.) (S.12) master the tools and methods of project follow-up in computer science (S.13) manage computer networks (infrastructure, services, control and command functions) (S.14) administer computer servers (S.15) manage databases in different environments (C.1) apply scientific and technical knowledge (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Responsable : Alain Godon

Keywords :
PHP, SQL, TWIG, API REST, JWT

Prerequisites :
HTML/CSS, JS, SQL, ALGORITHMIC, PYTHON or C

Objectives :
Have an expert knowledge of the development of a website in PHP

Content :
PHP basics, forms, sessions, libraries

Examination :
100% Continuous assessment

	Internship	POLYTECH ANGERS
SAGI	3A / Semester 6	UE 6.5
	20 weeks	Stage

Compétences développées	(C.1)	apply scientific and technical knowledge
	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Responsable :   Rémy Guyonneau & Service des relations internationales

Internship Objectives

Future engineers need to have both international and intercultural experience, not only to meet the demands of increasingly globally integrated companies, but also to enrich themselves through exposure to other cultural codes and lifestyles.

The intern is asked to carry out a mission that is related to our Engineering programs.

During the mission, the intern is required to develop autonomy, and take initiative in an unfamiliar cultural context.

The student internship lasts a minimum of 13 weeks and the intern is required to work full time. The intern's timetable can be established on a case by case basis. The intern must be be present in the organization as specified in the agreement.

Evaluation

As stated in Article 4 of the agreement, both supervisor and university academic tutor assess the intern.

- Internship Supervisor. The Internship supervisor assesses the student's performance using an online questionnaire. There is only one assessment required for the full three month period but this feedback is extremely useful for the School of Engineering when evaluating the students commitment to the internship. It also serves to indicate if the organization would accept an intern the following year. The supervisor's feedback will count for 1/4 of the mark on the final evaluation
- University Academic Tutor. The student is also required to provide the school with a number of documents at the end of the internship:
  - A report of twenty pages in which the trainee must retrace the internship assignment and develop an original essay based on personal observations.
  - An A2 size poster

The assessment of these elements is carried out by the university academic tutor and is based on the internship supervisor's assessment comments.

Syllabus
SAGI – S7

Version anglaise - Aout 2022

Responsable : L. Autrique

Semestre 7   **402 H/E**

	H/E	H CM	H TD	H TP24	H TP16
UE 7-1 Formation Générale	**106**				
Anglais	28		28		
Allemand/Espagnol/Français	16		16		
Communication professionnelle	20		20		
Entrepreneuriat	18		18		
Sport / Parrainage scolaire / Atelier NaN	12		12		
Responsabilité globale et prévention des risques professionnels	12		12		
UE 7-2 Sciences de l'ingénieur	**100**				
Vision industrielle & Traitement d'images *	24	1.33		9.33	13.33
Enterprise Resource Planning	20	4		16	
Algorithmique avancée et complexité	24	8		16	
Conférences *	32	32			
UE 7-3 Automatique & Automatisation	**64**				
Réseaux industriels *	32	5.33		8	18.67
Supervision industrielle *	20	4		8	8
Traçabilité	12		12		
UE 7-4 Génie informatique	**132**				
Génie logiciel	24	5.33		18.67	
Programmation orientée objet (C++)	24			12	12
Administration serveur unix	20	4		16	
Programmation JAVA	32			32	
Administration de base de données	16	8	8		
Sécurité informatique *	16	5.33	10.67		

(*) taught in English

SAGI	**English**	POLYTECH ANGERS
	4A / Semester 7	UE 7-1
	28h TD	Formation Générale
Compétences développées	(C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Level B2 from the CEFR

Objectives:
- Validating TOEIC minimum score to graduate as an Engineer.
- Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of international environment

A practice TOEIC test is organized at the beginning of term 7 to set up language proficiency groups for TOEIC Preparation.

Programme:
- Understanding the TOEIC test format and requirements.
- Practising oral and written communication skills.
- Reviewing and Strengthening English grammar skills.
- Regular practise of pronunciation and word stress.
- In company communication situations.
- Current political, economic and social issues.
- Oral proficiency practice.

Learning outcomes:
- The student can speak about a technical issue related to his/her field of expertise.
- The student can infer and understand gist, purpose and details in a spoken document related to a general or technical topic.
- The student can infer and understand gist, purpose and details in a written document related to a general or technical topic.
- The student can speak and write in a clear and fairly complex language.

Evaluation: Continuous assessment (100%)

	Foreign Languages: German or Spanish or French	POLYTECH° ANGERS
SAGI	4A / Semestre 7	UE 7-1
	16h TD	Formation Générale
Compétences développées	(C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Basic oral and written communication skills

Objectives:

Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
Cross-cultural skills: knowledge of international environment

Organization of Language proficiency levels whenever it is possible.

The target for the advanced group is CEFR B2 or C1; A2 or B1 for the intermediate group.

A certification in German/Spanish is recommended for advanced students in final year.

Program:
- Oral and written communication skills
- Communication skills in Companies
- Political, economic and social news

Learning outcomes:

Intermediate groups
- The student can speak for a few minutes on a topical issue or a topic of personal interest.
- The student can take part in a conversation on simple topics that can be related to his/her personal interests.

Advanced groups
- The student can read an article or listen to a programme in a standard language and comment on it.
- The student car write an abstract and a report in German/Spanish
- The student can make an oral presentation on professional topics
- The student can argue and justify his/her point of view fluently

Evaluation: 100% Continuous assessment

	Communication	POLYTECH ANGERS
SAGI	4A / Semester 7	UE 7-1
	20h TD	Formation générale

Compétences développées	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Keywords : Professional project, curriculum vitae, cover letter, meeting animation

Prerequisites : French language written and spoken

Objectives :
- Preparing for job search
- Meeting and group animation

Examination :
- Oral checks (50%)
- Written tests (50%)

Bibliography :

L. Bellenger, *Etre constructif dans les négociations et les discussions*, Entreprise Moderne d'Edition, 1984.

V. Billaudeau, *Le recrutement : quelles pratiques actuelles ?,* Julhiet Editions, 2012.

M.J Chalvin, *Prévenir conflit et violence*, Paris, Nathan, 1996.

S. Milgram, *Soumission à l'autorité*, Calman Lévy, 1974.

R. Mucchielli, *La conduite des réunions: Les fondamentaux du travail en groupe*, ESF éditeur, réédité, janvier 2016.

P. Morin, *Organisation et motivations*, les éditions d'organisation, 1989.

P. Oléron, *L'argumentation*, Presses universitaires de France, 1987.

C.Papetti, B. Dogor Di Nuzzo, *Un CV réussi !,* Ellipses, 2016.

D. Pérez, *Le guide du CV et de la lettre de motivation*, Solar, 2014.

W. Ury, *Négocier avec des gens difficiles*, Paris, Le Seuil, 1990.

	Entrepreneurship	POLYTECH ANGERS
SAGI	4A / Semestre 7	UE 7.1
	18 h TD	Formation Générale
Compétences développées	(C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Responsable : A. Delamarre

Keywords : Entrepreneurship, intellectual property,

Presrequisite : none

Objectives :
Discern the entrepreneurial spirit, the passion of entrepreneurs, their needs to create and innovate and their orientation towards action
Propose entrepreneurial projects
Establish creativity and monitoring methods
Build a CANVAS business model

Program :
This introductory course in entrepreneurship aims to develop students' sense of initiative and entrepreneurship, in order to make them discover and exploit their full entrepreneurial potential. The program sweeps the entrepreneurial process. Students are introduced to the process of business creation: from idea creation to marketing. This course integrates the concepts of industrial property: brands, model and patent. The concepts are approached through the construction of a virtual business that the students will build on the basis of creativity methods, construction of CANVAS business model through the creation of the identity and values of the business to be built.

Evaluation : 100 % continuous assessment.

Acquis d'apprentissage :
The student is expected to identify the stages of business creation and be able to organize a process from the idea to the realization of his entrepreneurial project. The student must understand the issues of intellectual protection and know the broad outlines of the rules of law that govern all activity in society

Bibliographie :
BODELL, Richard W., Garry RABBIOR et Larry W. SMITH, Entrepreneuriat - L'esprit d'aventure, Montréal, Les Éditions de la Chenelière, 1994, 35 p. *
BODELL, Richard W., Garry GASSE, Yvon, et al., PME - Posséder mon entreprise, Vanier, Centre franco-ontarien de ressources pédagogiques, 1998, 281 p.* GASSE, Yvon, et al., PME - Posséder mon entreprise, (Guide de l'étudiant et guide pour réaliser le plan d'affaires),
JOHNSON, M. W. CHRISTENSEN C.M., KAGERMANN H. Reinventing Your Business Model. Harvard Business Review, Dec 2008
LE LOARNE, S. BLANCO, S. et al., Management de l'Innovation, Ed. Pearson, 2e édition, 2012
RIES E., Lean startup, ed Pearson, 2015, 319p
SILBERZAHN P., Effectuation, ed Pearson, 2ième edition, mai 2020, 192p.

SAGI	**Sport / Parrainage scolaire / NaN**	POLYTECH ANGERS
	4A / Semestre 7	UE 7-1
	12h TD	Formation Générale

Compétences développées	(C.1)	apply scientific and technical knowledge
	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Keywords: Sports ; Scientific mediation ; NaN

Prerequisites: None

Objectives:

Sport: Physical and sports education courses help train future engineers, promote their physical and mental balance, facilitate their integration, strengthen the team spirit and the dynamics of the school. Being able to work as a team, communicate, build relationships of trust, be healthy and resist stress are qualities that are required of future engineers. The proposed sports activities involve new motor acquisitions, individual and collective strategies, and an adaptation to the effort. These elements contribute to development and are additional assets for their training. Our missions are to participate in the training of future engineers, to promote the physical and psychic balance of the students, to facilitate the integration of the students of the school, to strengthen the team spirit.

Scientific mediation aims to offer our students to create a link, an exchange, between the scientific / technical world and young students. It is important to note that a special place is given to the social responsibility of our future engineers who must contribute as significantly as possible to the dissemination of knowledge. This specific scenario also allows students who choose this activity to develop their interpersonal skills, to think about the best approach to impart skills and finally to implement elements to ensure that the learner has really progressed. The students involved in this action start by following training in scientific mediation which they then put into practice by sponsoring a group of young students during the robotics trophies. This national meeting puts teams of young students in competition around scientific and technical challenges.

NaN: This is an interdisciplinary, inter-institution program on the theme of Digital Arts-Sciences. This program is supported by the Research-Training-Innovation program in Pays de la Loire as the winner of the call for projects "innovative initial training". Since 2017, the workshop takes the form of a time weekly (Thursday afternoon, from 2:00 p.m. to 5:00 p.m.) of experiments and collective work led and supervised jointly by teachers from ESAD TALM and Polytech Angers. It brings together an average of twenty students, half registered at ESAD TALM Angers (having chosen the workshop from the TALM grids) and the other half registered at Polytech Angers. The work carried out by the students is presented during events: exhibitions at the Musée des Beaux-Arts d'Angers (in 2018 and 2019), installation at the Jean Lurçat museum in 2018, conference performed at the Quai in 2019, exhibition within the Lycée Joachim du Bellay in Angers in 2019.

Contents:
Specific actions are implemented during participation in one of the following three components:
- the practice of team and individual sports
- or scientific mediation
- or the NaN workshop

Evaluation:
Continuous assessment (100%)

SAGI	**Responsabilité globale et prévention des risques professionnels**	POLYTECH ANGERS
	4A / Semestre 7	UE 7-1
	12h TD	Formation générale

Compétences développées	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Keywords: occupational health and safety, occupational risks, ergonomic, occupational psychology, musculo skeltal disorder, psychosocial risks, single document

Prerequisites: Business organization, rules and regulation

Objectives :
This module is constructed on the base of the referential BES&ST «Bases Essentielles en Santé et Sécurité au Travail» formalised in 2005 (Inrs). It is intended to give to any future engineer essential skills in order to integrate occupational hygiene within all of his/her professional activities.

- **Identify in any working organization the human, social, economic and legal issues of occupational hygiene**
  - Regulatory and normative context, responsibilities
  - Internal and external actors of occupational hygiene
  - Occupational hygiene indicators and sources of information
- **Integrate occupational hygiene in the management of its activities and projects**
  - Vocabulary and definitions - Identify hazardous situations
  - Take into account the human factor at work including physical, physiological, cognitive and psychological dimensions, and the working reality
  - Identify et assess risks: a priori and a posteriori
  - Ergonomics, tools and methods
  - « Unique document » for risks assessment: methods and issue
  - Risks prevention – Prevention principles
- **Contribute to occupational hygiene management**
  - Occupational hygiene management and integrated management system, management commitment
  - Safety culture - Reflection on Lean Management: which issue for health at work?

Programme : Tutorials
- Practice and study on concrete cases based on videos, photos and if possible role-playing, evaluation of working situations (human and technical)
- Calculation, analyses and interpretationion of occupational hygiene indicators
- Analysis of the different dimensions of an occupational accident : causal tree method
- Identification and risks assessment : « unique document » construction and action plan

Evaluation : 100% Continuous assessment

Learning outcomes : Integration of occupational hygiene in its professional activity

Bibliography :
- Sources d'information en santé et sécurité au travail, L. Laborde, B. Berlioz, M. Ferreira, *Techniques de l'ingénieur, collection Sante et sécurité au poste de travail, article se3950*, octobre 2008.
- Le guide de la sécurité au travail - Les outils du responsable, B. Péribère, *Ed. AFNOR*, 218 p., 2013.
- www.inrs.fr; www.anact.fr; www.travail-et-securite.fr

![logo]	**Vision industrielle et traitement d'images**	POLYTECH' ANGERS
SAGI	4A / Semester 7	UE 7.2
	1h20 CM – 9h20 TP24 – 13h20 TP16	Sciences de l'ingénieur
Compétences développées	(C.1) apply scientific and technical knowledge (S.7) design and operate embedded, mobile systems and/or robotics equipment (S.9) apply the procedural and object-oriented programming paradigms	

Responsable : Jean-Baptiste Fasquel

Keywords : Acquisition, Digital images, Image processing, Classification

Prerequisites : Sensors, Algorithms and Programming Fundamentals

Objectives : Knowledge of classical applications encountered in machine vision, including the architecture of machine vision systems (from image acquisition to content explotation).

Content :
- Applications
- Architecture of a vision system : sensor, lighting, data transfert, analysis.
- Image structure, video
- Basic tools : histogram, linear and non-linear filtering, connected components, object recognition (feature engineering, machine learning)
- Tutorial classes : segmentation, denoising, object recognition (shape descriptors, local descriptors, classification)
- Labs with an industrial camera (collaboration with a firm working in the field on industrial vision and automation)

Evaluation : written examination

Bibliographie :
Digital Image Processing (3rd Edition), R. C. Gonzalez, R. E. Woods, 2007
Computer and Machine Vision : Theory, Algorithms, Practicalities (4th edition), E.R. Davies, 2012

	Enterprise Resource Planning (ERP)	POLYTECH ANGERS
SAGI	4A / Semester 7	UE 7.2 Sciences de l'ingénieur
	4h CM – 16h TP24	

Compétences développées	(S.1) control industrial processes (S.3) develop supervision and traceability tools (S.4) master the tools and methods for monitoring automation projects (S.12) master the tools and methods of project follow-up in computer science (S.15) manage databases in different environments (C.1) apply scientific and technical knowledge (C.2) adapt to the specific requirements of the company and society (economic, societal, environmental)

Responsable: Stéphane Crépet

Keywords: ERP, Information System, Management

Prerequisites: Information System

Objectives: This course is designed to provide the student with a thorough understanding of both the role that Enterprise Resource Planning Systems (ERPs) play in an organization and the challenging task of managing the Information Systems (IS) function. During the semester, concrete problems, coming from the world of the company, will allow the student to understand the challenges and the interest of these software packages. The objective is to have, for the student, a visibility on the expectations of a PGI and in particular to explore the interaction, through an ERP, between the various departments of a company dependencies, and other data models. Develops a working relational database for a realistic application.

Program:
1. Understand a business information system
2. Understand the different IS dimensions :
    a. Technical dimension
    b. Organizational dimension
    c. Managerial dimension
3. Understand the different IS elements :
    a. Steering system
    b. Decision-making system
    c. Operational system
4. Understand the articulation of the IS with the corporate strategy (IS Governance - IS project management)

Examination: Written examination

Bibliography:
[1] Waldner, Jean-Baptiste (1992). Principles of Computer Integrated Manufacturing. Chichester: John Wiley & Sons Ltd. ISBN 0-471-93450-X.
[2] Waldner, Jean-Baptiste (1990). Les nouvelles perspectives de la production. Paris: DUNOD BORDAS. ISBN 978-2-04-019820-6.
[3] Lequeux, Jean-Louis (2008). Manager avec les ERP, Architecture Orientée Services (SOA). Paris: EDITIONS D'ORGANISATION. ISBN 978-2-212-54094-9.

	Algorithmique avancée et complexité	POLYTECH' ANGERS
SAGI	4A / Semester 7	UE 7.2
	8h CM – 16h TP24	Sciences de l'ingénieur
Compétences développées	(C.1) apply scientific and technical knowledge	

Responsable :   Philippe Declerck

Keywords: Numerical analysis, precision, memory execution time, complexities

Prerequisites: Basis in computer science, Scilab

Objectives:
The aim is to highlight the basic difficulties which can be found in computer science for any used language. The questions can be as follows: The capacity for a computer to make a simple addition; The capacity to treat a real number; The possibility that a software ends.

Program:
- Initiation to state automata (connected to the course "progWeb")
- Raising awareness of the numerical problems in computer science
- Arithmetic operations of the computer
- Execution time and complexities

Examination: Continuous

Bibliography:
- Les super-calculateurs de Météo France
- Thomas H. Cormen, Algorithmes notions de base, Collection Dunod, BU 62 255 COR,
- C. Froidevaux, M-C. Gaudel, M. Soria, Types de données et algorithmes, EdiScience International, 1994, BU 62 255 FRO
- Cours Béatrice Duval & Igor Stéphan, Structures de données et algorithmes, UFR Sciences Angers, 2012/2013.
- Cormen, Leiserson, Rivest, Introduction à l'algorithmique, Collection Dunod, BU 62 255 COR

	Conferences	POLYTECH ANGERS
SAGI	4A / Semester7	UE 7.2
	32h	Sciences de l'ingénieur

Compétences développées	(C.1)	apply scientific and technical knowledge
	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Responsable : Laetitia Perez

Key-words: Conferences, industrial issues, engineering missions

Prerequisite: Lessons from the "Control engineering and Computer Engineering" department

Goals:

The speakers at conferences are mostly industrial, but sometimes academics (French or foreign) are invited to lead a conference on a particularly relevant topic.

The areas covered are varied. They can obviously highlight the themes of control engineering (connected factory, PLC security, etc.) as well as computer engineering (AI, deep learning, etc.). The teaching team is also vigilant to go beyond the purely scientific and technical framework and subjects such as innovation, sustainable development, ecological transition, growth, corporate social responsibility, management, ethics, deontology even history could be discussed during these conferences.

More specifically, in order to reinforce the adequacy between specific lessons ("cyber physical systems", "cyber security", "HCI-VR") and the expectations of the professional world, industrial speakers are invited.

	Industrial networks	POLYTECH° ANGERS
SAGI	4A / Semester 7	UE 7.3
	5h20 CM - 8h TP24 - 18h40 TP16	Automatique & automatisation
Compétences développées	(S.1) control industrial processes (C.1) apply scientific and technical knowledge	

Responsable : Rémy Guyonneau

Keywords : Local Area Networks, Industrial Networks, Programmable Logic Controller (PLC)

Prerequisites : PLC programming, Norm for state functional charts (Grafcet)

Objectives : To present concepts and standards for industrial networks. First general theoretical notions are presented. Then, three examples are detailed: the Profinet network and the CAN and ModBus buses. Several practical works enable the students to use those networks. The documents of this course are available here: https://gitlab.u-angers.fr/cours/industrial_network_student

Program :
General introduction to networks and industrial networks (efficiency, logical and physical topologies, OSI model) ;
Semaphore principle (synchonization of PLCs) ;
Profinet Network (Configuration of a network between three PLCs and remote I/O with TIP Portal software) ;
CAN Bus (Serial Bus widely used, in the car industry for instance), reading and processing frames with an oscilloscope ;
Modbus TCP/IP protocol (Master/Slaves mode, SCADA systems, TCP/IP, …).

Labs :
- Automation of a robotized transfer chain (3 Siemens PLCs - Profinet network with TIA Portal software) ;
- Reverse-Ingeneering over a "black box" with a CAN interface (electrical frame reading with an oscilloscope);
- Management of a remote monitoring system with Modbus TCP/IP (in python language).

Examination : Written examinations (tests and final examination) and labs evaluation (devotion, achievements and reports).

Bibliography :
- Siemens Technical documentation
- BOSCH CAN specification 2.0, 1991
- MODBUS Application Protocol Specification V1.1b3, 2012

	SCADA systems	POLYTECH ANGERS
SAGI	4A / Semester 7	UE 7-3
	4h CM – 8h TP24 – 8h TP16	Automatique & Automatisation

Compétences développées	(S.1) control industrial processes (S.3) develop supervision and traceability tools (S.6) control and operate industrial robots (S.7) design and operate embedded, mobile systems and/or robotics equipment (C.1) apply scientific and technical knowledge

Responsable : Sébastien Lahaye

Keywords: automated systems, supervisory control and data acquisition (scada)

Prerequisites: Automatismes industriels (UE5-3), Réseaux industriels (UE7-3), or equivalent

Objectives: Prepare students to become a privileged interlocutor, or even a member, of an automation engineering and design office, able to interact with other offices, suppliers and/or customers.

Outline:
1. Introduction to SCADA systems
- Brief history and definition
- Place and role inside the production monitoring and control system
- Anatomy of a SCADA system
- Software solution and protocols
2. Design of SCADA software using commercial packages
- General principles
- Design of graphic interfaces and animation of graphic depictions
- Implementation of embedded programs
- Communications with automated systems
- Loggings
- Deployment and administration

Examination : continuous assessment (written tests / laboratories)

References :
- *Fondements du pilotage des systèmes de production*, P. Pujo, J.P. Kieffer, Hermès Science, Lavoisier, 2002
- *Méthodes du pilotage des systèmes de production*, P. Pujo, J.P. Kieffer, Hermès Science, Lavoisier, 2002
- Présentation du MES : Pilotage et suivi des fabrications pensés comme un système intégré, Philippe ALLOT, Techniques de l'ingénieur, 2011
- Supervision homme-machine, Jacky MONTMAIN, Techniques de l'ingénieur, 2005

	Traceability	POLYTECH ANGERS
SAGI	4A / Semester 7	UE 7-3
	12h TD	Automatique & Automatisation
Compétences développées	(S.1) control industrial processes (S.3) develop supervision and traceability tools (C.1) apply scientific and technical knowledge (C.2) adapt to the specific requirements of the company and society (economic, societal, environmental)	

Responsable : Stéphane Crépet

Keywords: Planification, Production, stock/inventory, quality control

Prerequisites: programmable logic controller

Objectives: Managing the traceability of manufacturing production is a very important issue for the productive apparatus of an industrialized country. This management stems from the observation that industrial process is not always perfect and that error can occurs, despite progress of development methods. Traceability management brings together methodologies and technical solutions to industrialize the traceability of production and make optimum use of it. This course presents the issues and the contexts of application by type of industry of this management. Next, it details the major features included in production traceability. It describes the real situations and possible technical solutions to implement this management.

Program :

1. Production traceability: issues and areas of application
   a. Challenges of production traceability
   b. Application Sectors
2. Overview of possible solutions
   a. Paper Traceability
   b. Computerization
3. Trends

Evaluation : 100% CC

References:

[1] VIRUEGA Jean-Luc. – Tracabilité : Outils, méthodes et pratiques. Éditions d'Organisation 2005.

SAGI	**Génie logiciel**	POLYTECH ANGERS
	4A / Semester 7	UE 7.4
	5h20 CM – 18h40 TP24	Génie Informatique

Compétences développées	(S.10)	develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.)
	(S.12)	master the tools and methods of project follow-up in computer science
	(C.1)	apply scientific and technical knowledge
	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)

Responsable : Nicolas Delanoue

Keyworks :   Software development, UML, unit testing, UML, Git

Prerequisites :   Object oriented programming

Objectives : Generalities regarding the software development process, including development methods (V cycle, agile methods,…) and related activities (requirements, specifications, conception, coding, testing, deployement). Introduction to modeling with UML, unit testing, source code management (versioning)

Content:
- Generalities :
- Actors, activities, life cycle
- Development methodology : standard predictive/linear methods and agile ones (in particular Scrum).
- Some good practices : modeling with UML, unit testing et versioning
- Labs :
- Modeling from specifications ou from an existing code (restricted to class, object, package and sequence diagrams)
- Implementation of unit tests from an existing code.
- Source code management with GIT

Evaluation : written examination

References:
OOP de Coad press
UML de Booch, Rumbaugh, Jacobson

	Oriented object programming in C++	POLYTECH ANGERS
SAGI	4A / Semester 7	UE 7.4
	12h TP24 – 12h TP16	Génie Informatique
Compétences développées	(S.9) apply the procedural and object-oriented programming paradigms (C.1) apply scientific and technical knowledge	

Responsable: Bertrand Cottenceau

Keywords: Object Oriented Programming, C++, classes

Prerequisite: C language and an OO language (C# or Java)

This lecture aims at giving an introduction to the C++ language used as an object oriented language. Students are assumed to have basics in another object oriented language (C# or Java) and some skills in C language, in particular the notion of pointer must be known.
The syntax to write user-defined classes and to re-use classes with inheritance is presented.
Some STL classes are introduced (vector<T>, list<T>, string) as well as the definition of user-defined operators.

All examples are written in the context of console applications.

Outline:
Automatic vs dynamic allocation
References in C++
Syntax for classes (methods, constructors, destructor)
User-defined operators
Re-use classes to create new classes
Initialization list (constructors)
Copy constructor
Operator =
STL : string, vector<T> et list<T>

Examination: written exams and labs

Bibliography:

- "Programmer en langage C++", Delannoy, Eyrolles
- "Pont entre C et C++" P.N. Lapointe, Addison-Wesley
- "Comprendre et utiliser C++ pour programmer objets", Clavel Trillaud Veillon, Masson

SAGI	Unix server Administration	POLYTECH ANGERS
	4A / Semester 7	UE 7.4
	4h CM – 16h TP24	Génie informatique

Compétences développées	(S.13)	manage computer networks (infrastructure, services, control and command functions)
	(S.14)	administer computer servers
	(S.16)	implement and develop tools in the context of IT security
	(C.1)	apply scientific and technical knowledge
	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)

Responsable : Mehdi Lhommeau

Keywords : Linux/UNIX , LDAP, SAMBA, SNMP, NFS, NIS, DOCKER

Prerequisites :

Objectives :
Students will learn how networking is implemented on UNIX/Linux Systems. Students will learn to install and configure network applications including NFS, SNMP, SAMBA, Docker and domain systems such as NIS and LDAP.

Program :

- Boot and shutdown UNIX processes
- *Network File System (NFS) :* File system sharing over the network; Remote Procedure Call (RPC) service; NFS server and client sides; NFS installation and configuration; static mount and automount configurations;
- *Network Information Service (NIS)* : Centralized authentication systems; sharing user and host information over the network; NIS server and client sides; NIS installation and configuration; compatibility mode; netgroups; security issues.
- *Integrating Linux and Windows* : Elements of Windows networking: NetBIOS, SMB/CIFS protocols, Domain Controller; Samba server on Linux for centralized Windows logon, file sharing; Samba client; Samba installation and configuration; accessing Windows file system from Linux and vice versa.
- *Docker* : Containers implementation
- *Lightweight Directory Access Protocol (LDAP) :* Overview of Unix Authentication and Naming services; introduction to LDAP: domain component (dc), organizational unit (ou), common names (cn), schemas, ldif format, services, ports and commands; Server and client sides; OpenLDAP installation and configuration; LDAP applications.

Evaluation : Written exam

References:

> **UNIX and Linux System Administration Handbook**, 4th edition by Evi Nemeth, Garth Snyder, et. al. ISBN: 0131480057

	Programmation JAVA	POLYTECH ANGERS
SAGI	4A / Semester 7	UE 7.4
	32h TP24	Génie Informatique

Developed skills	(S.9)	apply the procedural and object-oriented programming paradigms
	(S.10)	develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.)
	(C.1)	apply scientific and technical knowledge

Responsable :   Bertrand Cottenceau

Keywords: Java – object-oriented programming – N-tier architecture - JDBC (Java Database Connectivity) - microservice

Prerequisites: C Programming (UE6-2)

Objectives: Acquire intermediate knowledge of the Java language which is widely used in the industry and the services.

Program:
- Java introduction (similar to C#)
- Management of databases with the API JDBC: main steps in the exploitation of a database.
- Layered architectures : introduction to the Spring framework.
- Implementing a microservice using Spring Boot

Examination : 2 applications coded in limited time

Bibliography / Webography:

http://tahe.developpez.com/java/cours

SAGI	**Database administration**	POLYTECH ANGERS
	4A / Semestre 7	UE 7-4
	8h CM – 8h TD	Génie Informatique

Compétences développées	(S.10)	develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.)
	(S.13)	manage computer networks (infrastructure, services, control and command functions)
	(S.14)	administer computer servers
	(S.15)	manage databases in different environments
	(S.16)	implement and develop tools in the context of IT security
	(C.1)	apply scientific and technical knowledge
	(C.2)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Responsable: Tarek Talbi

Keywords: ORACLE, Security, PL/SQL

Prerequisites: UE 5-3

Goals: This course is designed to give students a firm foundation in basic administration of Oracle Database. In this class, students learn how to install and maintain Oracle Database. Students gain a conceptual understanding of the Oracle database architecture and how its components work and interact with one another. Students learn how to create an operational database and properly manage the various structures in an effective and efficient manner including performance monitoring, database security, user management, and backup/recovery techniques. The lesson topics are reinforced with structured hands-on practices.

Program:
- Software installation and the creation of new databases.
- An in-depth exploration of the database architecture, including memory, process and data structures, and the management of those structures.
- Management of database files.
- Specialized facilities intended to maximize performance of enterprise-scale transactional applications, such as the shared SQL and PL/SQL cache, the result cache, the database buffer cache, and other similar components.
- Management of security policies and procedures, including administration of user accounts, roles, privileges and profiles.
- Performance monitoring, problem troubleshooting, and resolving lock and conflict issues.
- Using the Oracle Enterprise Manager and SQL interfaces for administration tasks.
- A primer on backup and recovery structures and strategies.

Examination: written examination

Bibliography:
[1]   Burleson, Donald, 2010. *Oracle Tuning: The Definitive Reference*. Rampant Techpress, 1200p.
[2]   Corrigan, Peter and Gurry, Mark, 1996. *Oracle Performance Tuning*. O'Reilly Media, 950p.

SAGI	**IT security**	POLYTECH ANGERS
	4A / Semester 7	UE 7.4
	5h20 CM – 10h40 TD	Génie Informatique
Compétences développées	(S.10) develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.) (S.13) manage computer networks (infrastructure, services, control and command functions) (S.14) administer computer servers (S.16) implement and develop tools in the context of IT security (C.1) apply scientific and technical knowledge (C.2) adapt to the specific requirements of the company and society (economic, societal, environmental)	

Responsable : Alain Godon

Keywords : LINUX, NETWORKING, SYSTEM, CRYPTOGRAPHY, SQL OSINT, SOFTWARE PROGRAMMING

Prerequisites : C Language, PHP, Linux User, Linux Admin

Objectives : Learn about stakes of security and technical views

Content :
- Stakes of security
- WEB vulnerabilities
- Buffer overflow
- Secure tools

Examination : 100% CC

Syllabus
SAGI – S8

Version anglaise - Aout 2022

Responsable : L. Autrique

Semestre 8   340 H/E

	H/E	H CM	H TD	H TP24	H TP16
UE 8-1 Formation Générale	**100**				
Anglais	24		24		
Allemand/Espagnol/Français	12		12		
Jeu d'entreprise	24	9.33	14.67		
Sport / Parrainage scolaire / Atelier NaN	12		12		
Management des équipes et Planification opérationnelle	28		28		
UE 8-2 Automatique & Automatisation	**96**				
Commande des procédés *	20			20	
Optimisation	24	6.67	17.33		
Robotique mobile *	24				24
Temps réel & Informatique embarquée *	28	14.67	10.67	2.67	
UE 8-3 Génie informatique	**52**				
Réalité virtuelle *	20	4		4	12
Programmation JAVA J2EE	32	8		24	
UE 8-4 Projet *	**92**				
Projet *	92				
UE 8-5 Stage					
Stage (3 mois)					

(*) taught in English

	English	POLYTECH ANGERS
SAGI	4A / Semester 8	UE 8-1
	24h TD	Formation Générale

Compétences développées	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Level B2 from the CEFR

Objectives:
Validating TOEIC minimum score to graduate as an Engineer.
Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
Cross-cultural skills: knowledge of international environment

Language proficiency level groups are reorganized according to the TOEIC test scores.

Programme:
- Practising oral and written communication skills.
- Strengthening grammar skills.
- Regular practise of pronunciation and word stress.
- Communication skills in companies.
- Political, economic and social news
- Presenting industrial projects.

Evaluation:
Continuous assessment (100%)

Learning outcomes :
- The student can speak about a technical issue related to his/her field of expertise.
- The student can infer and understand gist, purpose and details in a spoken document related to a general or technical topic.
- The student can infer and understand gist, purpose and details in a written document related to a general or technical topic.
- The student can speak and write in a clear and fairly complex language.

SAGI	**Foreign Languages: German or Spanish or French**	POLYTECH ANGERS
	4A / Semester 8	UE 8-1
	12h TD	Formation Générale
Compétences développées	(C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Prerequisites: Basic oral and written communication skills

Objectives:

Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction

Cross-cultural skills: knowledge of international environment

Organization of Language proficiency levels whenever it is possible.

The target for the advanced group is CEFR B2 or C1; A2 or B1 for the intermediate group.

A certification in German/Spanish is recommended for advanced students in final year.

Programme:

Oral and written communication skills
Communication skills in Companies
Political, economic and social news

Evaluation:

100% Continuous assessment

Learning outcomes:

Intermediate groups

- The student can speak for a few minutes on a topical issue or a topic of personal interest.
- The student can take part in a conversation on simple topics that can be related to his/her personal interests.

Advanced groups

- The student can read an article or listen to a programme in a standard language and comment on it.
- The student car write an abstract and a report in German/Spanish
- The student can make an oral presentation on professional topics
- The student can argue and justify his/her point of view fluently

	Buisness Games	POLYTECH ANGERS
SAGI	4A / Semester 8	UE 8-1
	24h TD	Formation générale

Compétences développées	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Keywords: Challenges, Financial balance, Treasury, profitability, Teams, multidisciplinary

Prerequisites: Fundamentals in management, marketing, human resources, R&D, business strategy, inventory management, project management and corporate finance.

Objectives: In the continuity of the financial analysis course, develop an understanding of the operational and financial management of an international group in a competitive environment that is constantly evolving through the practice of a serious game.

Evaluation:

Continuous monitoring via enterprise game challenges

The performance of participants is measured and compared by both operational and financial indicators, including net income, market shares, return on capital, earnings per share, capacity utilization rates and employee productivity.

The overall performance of the teams is measured by the return to shareholders, which consolidates all the key success factors into a synthetic indicator that can be used to compare the teams.

Oral presentation

Sources

Cesim Global Challenges

SAGI	Sport / Parrainage scolaire		POLYTECH ANGERS
	4A / Semester 8		UE 8.1
	12h TD		Formation générale
Compétences développées	(C.1) apply scientific and technical knowledge (C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)		

Keywords: Sports ; Scientific mediation ; NaN

Prerequisites: None

Objectives:

Sport: Physical and sports education courses help train future engineers, promote their physical and mental balance, facilitate their integration, strengthen the team spirit and the dynamics of the school. Being able to work as a team, communicate, build relationships of trust, be healthy and resist stress are qualities that are required of future engineers. The proposed sports activities involve new motor acquisitions, individual and collective strategies, and an adaptation to the effort. These elements contribute to development and are additional assets for their training. Our missions are to participate in the training of future engineers, to promote the physical and psychic balance of the students, to facilitate the integration of the students of the school, to strengthen the team spirit.

Scientific mediation aims to offer our students to create a link, an exchange, between the scientific / technical world and young students. It is important to note that a special place is given to the social responsibility of our future engineers who must contribute as significantly as possible to the dissemination of knowledge. This specific scenario also allows students who choose this activity to develop their interpersonal skills, to think about the best approach to impart skills and finally to implement elements to ensure that the learner has really progressed. The students involved in this action start by following training in scientific mediation which they then put into practice by sponsoring a group of young students during the robotics trophies. This national meeting puts teams of young students in competition around scientific and technical challenges.

NaN: This is an interdisciplinary, inter-institution program on the theme of Digital Arts-Sciences. This program is supported by the Research-Training-Innovation program in Pays de la Loire as the winner of the call for projects "innovative initial training". Since 2017, the workshop takes the form of a time weekly (Thursday afternoon, from 2:00 p.m. to 5:00 p.m.) of experiments and collective work led and supervised jointly by teachers from ESAD TALM and Polytech Angers. It brings together an average of twenty students, half registered at ESAD TALM Angers (having chosen the workshop from the TALM grids) and the other half registered at Polytech Angers. The work carried out by the students is presented during events: exhibitions at the Musée des Beaux-Arts d'Angers (in 2018 and 2019), installation at the Jean Lurçat museum in 2018, conference performed at the Quai in 2019, exhibition within the Lycée Joachim du Bellay in Angers in 2019.

Contents:
Specific actions are implemented during participation in one of the following three components:
- the practice of team and individual sports
- or scientific mediation
- or the NaN workshop

Evaluation:
Continuous assessment (100%)

	Management des équipes et planification opérationnelle	POLYTECH ANGERS
SAGI	4A / Semester 8	UE 8-1
	28h TD	Formation générale

Compétences développées	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Keywords:
- Team management - Leadership
- Project management, needs analysis, planning, project management and management, project closure and evaluation

Prerequisites: Knowledge of a company

Objectives:

Team management: Understand the challenges of «team management».
Acquire the relational fundamentals within a team.
Know and develop leadership skills.

Project planning: The objective of this module is to make students aware of the concepts and tools of project management through scenarios, ongoing exchanges with the teacher from the definition and framing of a project, its planning and management until the project is completed and evaluated.

Program:

Team management:
- Leadership - Role of the manager - Mission- Objectives - Values.
- Human and managerial skills of the manager - Styles and types of authority
- Motivation - Assertiveness.
- Conflict management.

Project planning:
- Session 1: General
- Session 2: Preparation phase – needs analysis and project launch
- Session 3: Build and Plan – Project Preparation and Task and Activity Planning Phase
- Session 4: Driving and Piloting – Project Delivery and Project Team Facilitation Phase
- Session 5: Close and evaluate – Finalization phase of the experience capitalization project

Examination : 100% during classes - situational assessments

Bibliography :
- « Le guide du manager d'équipe » - Jean Louis VIARGUES - Ed. d'Organisation – 2001.
- « Encadrer et motiver une équipe » - Arthur PELL - Ed. les Echos – 2000.
- « Autodiagnostic des styles de management » - Dominique CHALVIN - Ed. ESF-EME -1990.
- « Management situationnel » - Dominique TISSIER - Ed. INSEP – 2011.
- « Motiver ses collaborateurs » - Anne BRUCE, James S.PEPITONE - Ed. Maxima – 2002.
- « La dynamique des équipes » - Olivier DEVILLARD - Ed. d'Organisation – 2000.
- « Les responsables porteurs de sens » - Vincent LEENHARDT - Ed. INSEP – 1992.
- « Le kit du manager opérationnel » - Pierre THEPAUT - Ed. d'Organisation – 1998.
- « Le manager est un psy » - Eric ALBERT, Jean Luc EMERY - Ed. d'Organisation – 1998.
- « Comment manager son équipe » - Denis RIBIERRE - Ed. Masson – 2002.
- « L'essentiel de la gestion de projet » – Aim, Roger (Gualino 2016).

SAGI	**Process control**	POLYTECH ANGERS
	4A / Semester 8	UE 8.2
	20h TP24	Automatique & Automatisation

Compétences développées	(S.1)	control industrial processes
	(S.2)	model and analyze continuous or discrete dynamic systems
	(C.1)	apply scientific and technical knowledge

Responsable: Laetitia Perez

Keywords: Control theory, identification, industrial process

Prerequisites: Control theory in preparatory classes and previous UE 6-3

Objectives: Industrial applications will be investigated in order to exhibit implementation in realistic configurations. The main goal is to discuss with students about the attractivity of automatic control in industrial context.

Program:
Lecture will be divided in several parts in order to investigate process control taking into account numerous industrial requirements. Theoretical aspects will be briefly described in accordance with engineering purposes. The following processes will be studied:

- Situation 1 : Mining process
  - *Delay system*
  - *Electronic device for control purpose*
  - *Stability and Routh criterion*
- Situation 2 : Temperature control in a wind tunnel
  - *Electronic device for control purpose*
  - *Bode graph*
  - *Controller improvments*
- Situation 3 : Stabilization of an offshore platform
  - *State representation*
  - *Stability*
  - *Proportional controller*
- Situation 4 : Control of a magnetic tape
  - *MIMO system*
  - *State representation and feedback*

Evaluation : 100% continuous assessment (written examination)

Bibliography :

E. Boillot, *Asservissements et régulations continus*, ed. Technip, Paris, pp. 207, 2000.

R. Husson, *Problèmes résolus d'automatique,* ed. Ellipses, Paris, pp. 255, 2005.

M. Ksouri, P. Borne, *Régulation industrielle, problèmes résolus*, ed. Technip, Paris, 1997.

P. Prouvost, *Automatique (contrôle et régulation)*, ed. Dunod, Paris, pp. 319, 2004.

F. Rotella, I. Zambettakis, *Automatique élémentaire: de l'analyse des systèmes à la régulation*, ed. Hermes Lavoisier, Paris, pp. 484, 2008.

S.M. Savaresi, M. Tanelli, *Active braking control systems design for vehicles,* ed. Springer,   pp. 254, 2010.

C. Sueur, P. Vanheeghe, P. Borne, *Automatique des systèmes continus*, ed. Technip, Paris, pp. 178, 1997.

	Optimisation	POLYTECH ANGERS
SAGI	4A / Semester 8	UE 8.2
	6h40 CM – 17h20 TD	Automatique & Automatisation
Compétences développées	(C.1) apply scientific and technical knowledge	

Responsable: Philippe Declerck

Keywords:

Linear Programming, Integer Linear Programming, modelling, Fourier-Motzkin algorithm, Simplex algorithm, Branch-and-Bound approach.

Objectives:

In this course, the optimization problem consists in finding the minimum or the maximum of a linear function, named objective function, of several variables which are real numbers or integers, have to satisfy linear constraints. Another aim is the modelling of practical examples which can be solved by the presented approaches.

Program:

>   Introduction to the optimisation
>   Linear Programming (Fourier-Motzkin, Simplex)
>   Integer Linear Programming
>   Modelling of practical examples

Examination:

Continuous

Bibliography:

J.-C. Culioli, Introduction à l'optimisation. Ellipses 1994.
A. Schrijver, Theory of linear and integer programming. John Wiley and Sons, 1987.
C. Guéret, C. Prins, M. Sevaux. Programmation linéaire, Eyrolle, 2000.

	Mobile robotics	POLYTECH ANGERS
SAGI	4A / Semester 8	UE 8.2
	24h TP16	Automatique & Automatisation

Compétences développées	(S.5)	model, analyze and predict robots behavior.
	(S.6)	control and operate industrial robots
	(S.9)	apply the procedural and object-oriented programming paradigms
	(C.1)	apply scientific and technical knowledge

Responsable: Rémy Guyonneau

Keywords: UGV (Unmanned Ground Vehicle), Localization, Path Planning, Exploration...

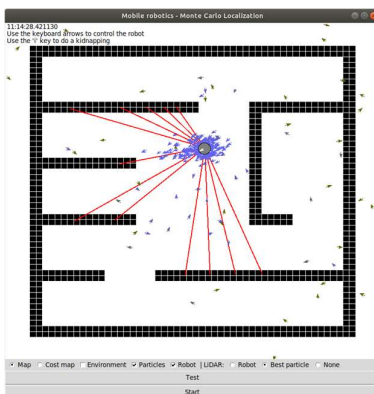**Requirements:** Python programming

Courses Objectives: To present an overview of mobile robotics issues and solutions, mainly for Unmanned Ground Vehicle. This module mainly focuses on navigation issues while the robot is moving in its environment (localization, mapping and path planning).

Course agenda: The course is presented as a set of labs, each one focusing on a common problem in mobile robotics (localization, path planning, shortest path, exploration...). The objective for the students is to implement a solution on a simulator (Python) - MonteCarlo Localization, RRT, A*, frontier exploration...
The robot considered on the simulator is a differential ground robot (two driving wheels and a caster wheel) equipped with a LiDAR sensor.
Each lab work starts with a presentation of the problem and its solution that the students will have to implement. A basic framework, including the simulator and the graphical interface (Python3 + Tkinter) is given to the students for each lab work.

Evaluation: The student achievements and the source code are evaluated.
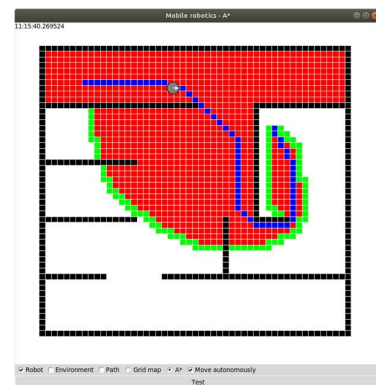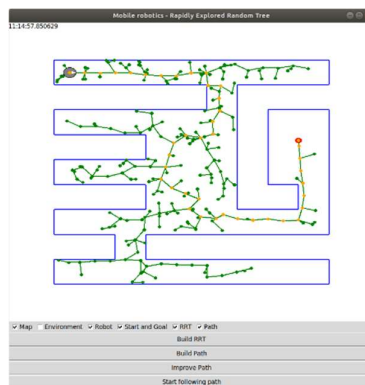
SAGI	Real time, embedded software	POLYTECH ANGERS
	4A / Semester 8	UE 8.2
	14h40 CM – 10h40 TD – 2h40 TP16	Automatique & Automatisation

Compétences développées	(S.1)	control industrial processes
	(S.6)	control and operate industrial robots
	(S.7)	design and operate embedded, mobile systems and/or robotics equipment
	(C.1)	apply scientific and technical knowledge

Responsable : Mehdi Lhommeau

Keywords : Scheduling, Synchronization, Mutual Exclusion, Unix/Linux, Xenomai

Prerequisites : C Language Course

Objectives : The monitoring and control of physical processes and systems are increasingly performed by computers. These real-time embedded systems must satisfy stringent timing and reliability constraints in addition to functional correctness requirements. For example, a word processor on a desktop machine pauses while the user is typing, it is merely annoying. In the case of a heavy machine controller, it could be catastrophic. This class will cover features typically found in real-time and embedded systems with those found in more traditional computer systems. Topics will include scheduling, synchronization, memory management, and architectural features of real-time and embedded systems

Program :

    Introduction to real-time and Embedded systems
    Scheduling techniques
    In-depth study of Rate-Monotonic Scheduler (RMS), EDF, LLF, and other schedulers
    Synchronization & mutual exclusion (real-time and non-real-time)
    Programming language and operating systems support (C, Linux, Xenomai)

Examination : Exam

Bibliography :

[1] Bonnet C., Demeure I., *Introduction aux systèmes temps réel*, Hermes, 1999.
[2] Dorseuil A., Pillot P., *Le Temps réel en milieu industriel*, Dunod, 1991.
[3] Li Q., Yao C., *Real-Time Concepts for embedded Systems*, CMPBooks, 2000.
[4] Bouzefrane S., *Les systèmes d'exploitation*, Dunond, 2003.
[5] Mellichamp D.-A., *Real-time computing*, New York : Van Nostrand Reinhold editors, 1983

	Virtual Reality	POLYTECH ANGERS
SAGI	4A / Semester 8	UE 8.3
	4h CM – 4h TP24 – 12h TP12	Computer science
Compétences développées	(S.10) develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.) (S.11) know the tools of augmented reality and immersive multimedia (C.1) apply scientific and technical knowledge	

Lecturer: Paul Richard

Keywords: virtual reality, animation techniques, physics modeling, collision detection, dynamic rendering, inverse kinematics.

Prerequis: Human-computer interaction & virtual reality, C# langage

Objective: deepen knowledge in virtual reality: advanced animation techniques, development of 3D real-time applications (Unity3D). Deepen the aspects relating to physical modeling and dynamic rendering (collision detection, behavior, optimization). Interaction with joint systems and inverse kinematics.

Program: Advanced virtual reality
                 Procedural animation techniques
             Joint systems and inverse kinematics
             Physics modeling and dynamic rendering

Evaluation: continuous assessment

Bibliography:

- Enhancing Interaction in Mixed Reality: The Impact of Modalities and Interaction Techniques on the User Experience in Augmented and Virtual Reality
- Augmented Reality with Unity AR Foundation: A practical guide to cross-platform AR development with Unity 2020 and later versions
- Hands-On Unity 2021 Game Development: Create, customize, and optimize your own professional games from scratch with Unity 2021, 2nd Edition, Nicolas Alejandro Borromeo Packt Publishing
- Learning C# by Developing Games with Unity 2021: Kickstart your C# programming and Unity journey by building 3D games from scratch, 6th Edition   , Harrison Ferrone
- C# Game Programming Cookbook for Unity 3D (English Edition), Jeff W. Murray, 2e Édition

	Programmation JAVA J2EE	POLYTECH ANGERS
SAGI	4A / Semester 8	UE 8.3
	1h20 CM – 30h40 TP24	Génie informatique
Compétences développées	(S.9) apply the procedural and object-oriented programming paradigms (S.10) develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.) (C.1) apply scientific and technical knowledge	

Responsable: Nicolas Delanoue

Keywords: Java EE - oriented programming object - layered architectures - Java Persistence Api (JPA) - Java Server Faces (JSF) - Enterprise Java Beans (EJB3) - Spring - web services

Prerequisites: Object oriented programming II (JAVA, Part 1) (UE 8-2A)

Objectives: Acquire intermediate knowledge in web development with Java and frameworks such as JSF, Spring, EJB3

Program:
- Introduction to JPA (Java Persistence API), the object-relational mapping, JPA interface methods, Spring / JPA integration in layered architectures.
- Introduction to EJB (Enterprise Java Bean), EJB / JPA integration in layered architectures.
- Client - Server applications with web services.
- Introduction to JSF framework (Java Server Faces) to develop web applications.

Examination: 1 mini-project, 1 final written exam

Bibliography / Webography:
- Java Persistence with Hibernate, Christian Bauer and Gavin King, Manning publications
- PDF written course: http://tahe.developpez.com/java/jpa
- Java EE 5, Antonio Gonçalves, Eyrolles publications
- Java Server Faces, Chris Schalk et Ed Burns, Mc Graw-Hill pub

SAGI	**Project**	POLYTECH ANGERS
	4A / Semestre 8	UE 8-4
	92 heures	Projet

Compétences développées	(S.4)	master the tools and methods for monitoring automation projects
	(S.8)	master the tools and methods for monitoring robotic projects
	(S.12)	master the tools and methods of project follow-up in computer science
	(C.1)	apply scientific and technical knowledge

Responsable: Laetitia Perez

Key words: educational project, group work, professional project, applications

Prerequisite: those required for the project of each group of students

Goals:

This project is carried out in groups of 2 to 3 students supervised by one or more members of the teaching team.

The teaching team propose numerous specific subjects related to the context of control engineering, automated systems and computer engineering. These allow students to apply the knowledge introduced during the courses and to implement project management methods. The projects are built pedagogically and intermediate results are required and discussed with supervisors.

Contents:

For the 4A-SAGI, a specific action is carried out to refine the professional project of each student and make the most of the skills acquired during the training.

Some projects previously proposed …

- Web site Security Challenge
- Mobile robots in warehouses
- « Culture au futur »
- E-co-ologic
- Rescue drone
- Web Explorer 2020 Productys
- Dobot Magician
- Facial recognition
- Ball Balancing Robot
- Robot Epson (4 axes)
- Level regulation
- Perceive RV
- Virtual Germination
- Virtual Supermarket
- Augmented guitar

Evaluation: written report, evaluation of the progress of the work, feedback requested from students (project, device, presentation ...)

	Internship	POLYTECH ANGERS
SAGI	4A / Semester 8	UE 8-5
		Stage

Compétences développées	(S.4) master the tools and methods for monitoring automation projects (S.8) master the tools and methods for monitoring robotic projects (S.12) master the tools and methods of project follow-up in computer science (C.1) apply scientific and technical knowledge (C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Responsable: Laetitia Perez

Presentation

The 4th year internship is the first specialty internship. This internship is an essential part to refine the professional project. It must allow the student:
- to exercise their capacities of autonomy, creativity, organization, relationship and critical thinking
- to put into practice and deepen their knowledge in one or more areas covered during their university course
- to improve their skills of synthesis, written expression and communication through the internship report and oral presentation;
- to have professional experience, industrial contacts and prepare for life in a company.

Organisation

The internship is supervised by an internship supervisor within the company and a teaching tutor from Polytech Angers.
- The internship supervisor: he is the privileged contact in the host company. It can assist in the search for information. It gives the rules to be respected within the organization. It is also up to the internship supervisor to assess the student's behavior and involvement.
- The teaching tutor: he is the contact person within Polytech Angers. If there is a problem, he has to be informed as soon as possible. Its role is to advise and support the student for the smooth running of the internship.

Evaluation :

The evaluation is based on: professional achievement in the company, quality of the written report and the defense. The first part (internship assignment) is essentially assessed on the basis of an opinion issued by the internship supervisor. The latter measures the qualities, skills, adaptation and development of the intern during the internship. The last two parts are evaluated by the jury (defense) and the teaching tutor (report).

Syllabus
SAGI – S9

Version Aout 2022

Responsable : L. Autrique

Semestre 9   520 h

	H/E	H CM	H TD	H TP24	H TP16
UE 9-1 Formation Générale	**84**				
Anglais	16		16		
Espagnol / Allemand / Français	12		12		
Intégration dans le monde professionnel	16		16		
Droit du travail	12		12		
RSE et Ethique	12		12		
Maitrise des couts projets	12		12		
Evènement sportif commun	4				
UE 9-2 Sciences de l'ingénieur	**136**				
Innovation *	16		16		
Propriété industrielle & Brevets	12		12		
Machine learning *	28	1.33		26.67	
Vision avancée *	16	1.33		14.67	
Objets connectés et liaisons sans fils	20	2.67		1.33	16
Développement Durable en SAGI	16	4		8	4
Conférences *	28	28			
UE 9-3 Génie informatique	**84**				
Programmation mobile	32				32
Génie logiciel *	16	1.33		14.67	
Gestion de projets informatique	16		16		
Programmation WEB HTML5	20			20	
UE 9-4-1 Voie d'approfondissement Systèmes cyber-physiques *	**116**				
Automatique avancée *	20			20	
Robotique industrielle *	32		20		12
Supervision industrielle *	24			24	
Simulation des systèmes à événements discrets *	24		16		8
Challenge industriel *	16			16	
UE 9-4-2 Voie d'approfondissement IHMRV *	**116**				
Immersion et techniques d'interaction *	24			24	
Multi-modalité et interaction haptique *	20			20	
Animation et simulation comportementale *	32			32	
Outils et techniques de modélisation *	24			24	
Challenge industriel *	16			16	
UE 9-4-3 Voie d'approfondissement Cyber-sécurité *	**116**				
Réseau et architectures *	24			12	12
Cryptologie appliquée *	20			20	
Sécurité informatique *	32			32	
Administration serveurs Unix *	20			20	
Veille / R&D *	20			20	
UE 9-5 Projet	**100**				
Projet *	100				

(*) taught in English

SAGI	**Anglais**	POLYTECH ANGERS
	5A / Semester 9	UE 9-1
	16h TD	Formation Générale

Compétences développées	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Keywords: Communication skills, Cross-cultural skills, Professional Environment

Required: TOEIC validation

Objectives:
- Meeting the requirements of the CEFR (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of international environment
- Good command of oral techniques

Programme:
   Team work skills
   Presenting techniques for the final industrial project presentation (focusing on
      pronunciation, fluency, idiomatic expressions, etc…)
   Job/internship interview training
   Abstract writing

Evaluation:
Continuous assessment (Written and spoken)

Learning outcomes:
The student can carry out a job/internship interview.
The student can make a professional oral presentation on a long-term project (5th year industrial project)
The student can write a professional report, an abstract, a professional e-mail and a personal profile.

SAGI	**Foreign Languages : German or Spanish or French**	POLYTECH° ANGERS
	5A / Semester 9	UE 9-1
	12h TD	Formation Générale
Compétences développées	(C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Keywords: Communication skills, Cross-cultural skills, Professional Environment, Certification

Prerequisites: B1-B2 level on listening and comprehension skills

Objectives:
- Meeting the requirements of the CEFRL (Common European Framework of Reference for Languages): oral and written comprehension, oral and written expression, interaction
- Cross-cultural skills: knowledge of German-speaking countries
- Preparation to an external certification

Programme: Training placement tests
Professional writing (abstract, report, e-mail)
Advanced grammar review

Evaluation: Self assessment with placement tests

Learning outcomes: Running meetings
Advanced grammar skills

	Employability	POLYTECH ANGERS
SAGI	5A / Semester 9	UE 9-1
	16h TD	Formation Générale

Compétences développées	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Keywords: job, employability, hiring, integration, professional watch

Prerequisites: none

Objectives:
- Provide keys to facilitate the professional integration of students upon graduation
- Define your use profile
- Knowing how to value yourself

Program:

1. Prospective method
   . positioning of Polytech Angers students in terms of evolving trends
   . projections

2. The keys to integration into a team:
   . know yourself and have clear objectives to communicate
   . exchange of experiences on the fundamentals (codes, social life...)

3. Focus on skills
   . Evaluation of the individual skills of his speciality based on the expectations of the CTI
   . Convince in 3 minutes for an integration (professional or project)

4. Digital identity
   . Digital capsule to know everything
   . Audit of your online presence to be ranked at the top of the search list

Examination: 100% continuous assessment

Bibliography:
- Stéphanie Assante, Les 16 grands types de personnalité - Le MBTI, Dangle Editions, 17 octobre 2012.
- Christophe BLAZQUEZ, Samir ZAMOUM , Développez votre identité numérique, GERESO ÉDITION, 2019.
- Axelle Larroumet, « Quels talents ! », Ed. Diagonart, 2012.
- Isabelle Rouhan en collaboration avec Clara-Doïna Schmelck, Les métiers du futur, First éditions. 2019.

SAGI	**Employment law**	POLYTECH° ANGERS
	5A / Semestre 9	UE 9-1
	12 h TD	Formation générale

Compétences développées	(C.2)	s'adapter aux exigences propres de l'entreprise et de la société (économique, sociétale, environnementale)
	(C.3)	prendre en compte la dimension organisationnelle, personnelle et culturelle (entreprendre et innover, travailler en contexte international et multiculturel, se connaître, s'auto-évaluer, gérer ses compétences)

Keywords: Labour code, employment contract, Collective Agreements, justice

Prerequisites: None

Objectives:
- Knowing labour law is essential; either you are worker or employer. Nobody can ignore it.
- Labour legislation is in constant discussion. It is therefore important to understand the legal, economic and social issues

Programm:
• Introduction to labor law
• Justice in labor law
• Labor Inspections
• Job offer and maintenance
• The employment contract (from the signature to the termination of the employment contract)
• The rights and duties of the parties (employee / employers)
• Union representatives
• Payroll and exam preparation
• The 2020 novelties

Evaluation:
Table examination with practical case

Learning outcomes:
The student has understood the meaning of law and is able to read and understand a court decision

References:
- Code du travail , ed.Dalloz

- RAY Jean-Emmanuel, « Droit du travail, Droit vivant 2017 », Ed Liaisons, 25ème édition 2016

SAGI	**RSE et Ethique**	POLYTECH ANGERS
	5A / Semestre 9	UE 9.1
	12h TD	Formation Générale

Compétences développées	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3) an	take into account the organizational, personal and cultural dimension (innovate, work in international and multicultural context, know oneself, self-evaluate, manage one's skills)

Responsable: N. Faisant

Keywords: social responsibility, environment, societal issues, business, skills, ethics, dilemma, values, training, engineer.

Prerequisites: none

Objectives:
- To integrate the impacts of corporate social responsibility internally and externally
- To position oneself
- Know how to promote yourself

Program:
1. *Corporate Social Responsibility (CSR) = an imperative*
   . CSR to give more meaning to work and innovate
   https://fr.slideshare.net/Amorosx/lb-emergence-croissancedurablexavier-amoros
   . Tools to involve employees and stakeholders in a CSR approach CSR to give more meaning to work and innovate.
   https://fr.slideshare.net/Altamire/matinale-rse-altamiremfqm2015toolight
2. *Definition of ethics: societal approach and IESF's ethical charter for engineers.*
   - the engineer in society
   - the engineer and his skills
   - the engineer and his job
   - the engineer and his missions
   - comparison with the ethical charter for engineers in Belgium https://www.fabi.be/l-ingenieur-charte
3. *Ethics and the digital world: definition and legal approach*
4. *Ethics in everyday life*
   Actions to choose from :
   A. The commitment of the citizen-engineer in society: carrying out an "honest engineer" project (organising a blood donation, developing artistic skills with children in difficulty, setting up an artistic and cultural week on the theme of "art and science", going to meet sick children, running to collect vaccine doses, etc.)
   B. To be a creative scientist with an open mind and the ability to question oneself: through the history of technology, the sociology of work and geopolitics, the student is led to weave links between his or her future profession as an engineer and the associated activities, considered in their historical, sociological and geopolitical context.
   C. To be a relevant, honest, tolerant and fair professional: zetetics workshop (art of rational doubt). The student is brought to rub shoulders with critical analysis in a concrete way, seeking to distinguish scientific content from pseudo-scientific content, to detect lies with a commercial or propaganda aim, or to prevent the intrusion into the scientific method of ideologies such as racism or creationism.
   D. To be an efficient, vigilant, forward-looking, rigorous and reactive leader: a force for proposals for the school and/or training Actions au choix : https://www.innovation-pedagogique.fr/article245.html

Assessment: 100% continuous assessment

Bibliography: NF ISO 26000 Novembre 2010, AFNOR.

SAGI	**Maitrise des couts projets**	POLYTECH' ANGERS
	5A / Semestre 9	UE 9-1
	12h TD	Formation générale

Compétences développées	(S.4)	master the tools and methods for monitoring automation projects
	(S.8)	master the tools and methods for monitoring robotic projects
	(S.12)	master the tools and methods of project follow-up in computer science
	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Keywords: Market, investment, budget, cost

Prerequisites: financial analysis

Objectives: Be able to calculate the financial profitability of an industrial project and to monitor and control the costs of this project.

Program:
- Introduction
- Partie 1 : Analysis and diagnosis
    - external environment : the PESTLE model
    - industry : the PORTER strenghts
    - market : the SWOT and the success factors analysis
    - firm : the SBU and the BCG matrix
- Partie 2 : Investment
    - fundamentals
    - actualization
        - NPV
        - IRR
- Partie 3 : Budget and financing plan
    - budget
        - definition and utility
        - building
        - operations vs cash flow
    - financing plan
        - operational cash flows
        - funding
- Partie 4 : Costs and profitability
    - full costs
    - partial costs
        - variable costs
        - fixed costs
    - break even

Examination: Continuous assessment (100%)

References :
- Stratégique – Gerry JOHNSON, Kevan SCHOLES, Frédéric FRERY – Ed. PEARSON (10ème édition) – 2017
- Contrôle de gestion DCG 11 Manuel & applications – Ed. Dunod 2017
- Décision d'investissement (incertitude et information) – P. PIGET – Ed. Economica 2019
- Construire et défendre son budget – C. SELMER – Ed. Dunod 2014

SAGI	**Evènement sportif commun**	POLYTECH ANGERS
	5A / Semester 9	UE 9.1
	4h	Formation générale
Compétences développées	(C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Keywords: Physical and Sports Education

Prerequisites: None

Objectives:

Physical education and sports activities contribute to the training of future engineers, promote their physical and psychological balance, facilitate their integration, and strengthen team spirit and the school's dynamic. Being able to work in a team, to communicate, to establish relationships of trust, to be in good health and to resist stress, are qualities that are required of future engineers.

The student is expected to be active in the practice of the activity, requiring a real commitment, both physical (the "Doing") and reflective (the "How to do"), and a cultural relationship to the activity. The physical investment will be made in mastering the management of one's physical and psychological integrity, and that of others (muscular, cardio-respiratory and articular warm-ups, respect for elementary safety criteria).

	Innovation	POLYTECH ANGERS
SAGI	5A / Semestre 9	UE 9.2
	16h TD	Sciences de l'ingénieur

Compétences développées	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Responsable: Anthony Delamarre

Keywords: Innovation approach, creativity Management, Innovation and digital

Prerequisite: introduction to innovation and quality

Goals: Approach the innovation processes in the digital trades. Position the SAGI engineer in relation to the innovative developments in his field and introduce methods of innovation to upgrade his knowledge and practices.

Programm:
Definitions
  Why innovate?
  Innovation: product / service or process?
  Common definition (OSLO manual, pahl and beitzh, ...)
Components of innovation
  The need, the idea, the means (human technological)
  The time factor: life cycle and control of inertia of change "
  Nature, degree and intensity of innovation
Risks to innovate
  Technological risk
  Market risk
  Strategic risk
  Human risk
Innovation typology
  The fields of innovation (incremental / break, value chain, value proposition)
  Innovation approaches (from total secrecy to open innovation)
  Organization and innovation
  Debate: should innovation be framed? Strucuturée? Or free?
  Innovation Cell, Integrated Innovation, Open Innovation: Enterprise Organizational Models
  The innovation cell: model and good practice
Methods of innovation
  Typology of innovation methods
  Classification and 10 methods (Watch, creativity, value analysis, semiotics, trend analysis, problem solving, sociology of consumption, prospective marketing, genealogical anticipation, prospective)
Innovation and digital
  Responsible Innovation of the digital industries: missions, constraints and tools.

Evaluation: CC (100%)

Bibliography:
Boly Vincent, Camargo Mauricio, Morel Laure, *ingénierie de l'innovation*, Hermès science publications-Lavoisier, 2016, 288p.
Cap Gemini, *l'innovation, dernier des processus sauvages,* Edition cap gemini, 2013
Corsi Patrick, Neau Erwann, *les dynamiques de l'innovation*, Hermès science publications-Lavoisier, 2011, 231p.

SAGI	**Propriété industrielle & brevets**	POLYTECH' ANGERS
	5A / Semester 9	UE 9.2
	12h TD	Sciences de l'ingénieur
Compétences développées	(C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Responsable: Anthony Delamarre

Keywords: Industrial property, patent, R&D strategy

Prerequisite: None

Goals: Provide the essential legal background for intellectual property.
Allow the future professional to be able to protect his creations and avoid counterfeits.

Programm:
- Introduction to Industrial Property
  - Definition of the law and positioning of industrial property
  - Definition of concepts of industrial property (patents, trademarks, models)
- A technical engineer's tool: the patent
  - Introduction to industrial property and its place in the life of engineers
  - Criterion of patentability
  - Structure of the patent document and information contained in the patent
- Patent Uses in Industrial Engineering (Patent Life Cycle, Corporate Use)
  - The industrial property strategies (business case study)
  - The brand strategy
  - The model strategy
- Cases studies

Evaluation: terminal examination (100%)

Bibliography:
- MARX, Bernard. La Propriété industrielle : sources et ressources d'informations. ADBS - Nathan, 2000
- DE KERMADEC, Yann. Innover grâce aux brevets. INSEP, 1999
- BREESE, Pierre, KERMADEC, Yann de : La propriété intellectuelle au service de l'innovation. Nathan, 2004
- BREESE, Pierre : Stratégies de propriété industrielle : guide des entreprises innovantes en action. Dunod, 2002
- VAJOU, Michel. Le brevet, un vecteur de valorisation et de veille. Ministère de la Recherche – INPI, 2000

	Machine learning	POLYTECH ANGERS
SAGI	5A / Semester 9	UE 9.2
	1h20 CM – 26h40 TP24	Sciences de l'ingénieur
Compétences développées	(C.1) apply scientific and technical knowledge (S.9) apply the procedural and object-oriented programming paradigms	

Responsable : Mehdi Lhommeau

Keyworks: Machine learning, data mining, classification, big data

Prerequisites : Algorithmics

Objectives : The purpose is to provide to students an introduction to data sciences and, in particular, to data processing. The objective is also to present application examples as well as an overview of the major classes of data processing methods.

Content: The first part focuses on standard classification methods (supervised and unsupervised), as well as on the notion of « big data » with related specificities (data volume, notion of deep learning and convnets). The second part focuses on the practice of standard methods (both unsupervised and supervised), using various kind of datasets. For instance, one can mention clustering algorithms, bayesian classification approaches (statistics), decision tree (and random forest), neural networks.

Evaluation : written examination

References :
Data science : fondamentaux et études de cas, E. Biernat et M. Lutz, 2015

	Vision avancée	POLYTECH ANGERS
SAGI	5A / Semester 9	UE 9.2
	1h20 CM – 14h40 TP24	Sciences de l'ingénieur

Compétences développées	(C.1)	apply scientific and technical knowledge
	(S.7)	design and operate embedded, mobile systems and/or robotics equipment
	(S.9)	apply the procedural and object-oriented programming paradigms
	(S.11)	know the tools of augmented reality and immersive multimedia

Responsable : Nicolas Delanoue

Keyworks : Image processing, projective geometry, registration, pose estimation, intrinsic and extrinsic matrices.

Prerequisites: Computer vision and algorithmics

Objectives : The purpose is to provide to students an introduction to 3D vision, based on projective geometry, registration and image processing, with underlying applications to robotics (e.g. distance measurement) and augmented reality.

Content: One favors a practical approach for discovering these notions (« learn by doing ») : the class is organized around the development of a basic program allowing to manipulate and implement each concept.
More accurately, considered concepts are ::
- The pinhole model and intrinsic matrix.
- Calibration
- Extrinsic matrix and homogeneous coordinates
- Marker detection, registration and automated estimate of the extrinsic matrix
- Application to the estimate of the distance between the camera and a target
- Application to augmented reality (superposition of a virtuel object on a video stream)
- Extension to generic patterns : SURF descriptors and RANSAC-based pose estimation

Evaluation : written examination

References :
Multiple View Geometry », Hartley and Zissermann, 2004

	Objets connectés et liaisons sans fils	POLYTECH° ANGERS
SAGI	5A / Semester 9	UE 9.2
	2h40 CM – 1h20 TP24 – 16h TP16	Sciences de l'ingénieur
Compétences développées	(S.7) design and operate embedded, mobile systems and/or robotics equipment (C.1) apply scientific and technical knowledge	

Responsable : David Langin

Keywords: IoT, sensor, embedded computing, network, MQTT

Requirements: C language, object oriented programming, web server, arduino and raspberry Pi

Objectives: The main objective is to present an overview of IoT. More accurately, the purpose is to provide an overview of the set of existing IoT-based sensors (e.g. biomedical sensors, sensors involved in home automation), of underlying hardware and software architectures, as well as of low bandwidth networks.

Content: After a general presentation of the IoT, labs will allow students to conceive and implement a complete hardware and software architecture : from the sensor to the retrieval of uploaded data. Labs include the data acquisition step, the data upload on a distant server (through a low bandwidth network, with the widely used MQTT communication protocol), data storage and finally data retrieval for further explotation.

SAGI	**Développement Durable en SAGI**	POLYTECH' ANGERS
	5A / Semester 9	UE 9.2
	16h	Sciences de l'ingénieur
Compétences développées	(C.1) apply scientific and technical knowledge (C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)	

Responsable: Mehdi Lhommeau

Key-words: Sustainable Development, Social Responsibilities of Engineers, Automated Systems and Computer Engineering

Prerequisite: Teachings of the "Automated Systems and Computer Engineering" department

Goals:

This subject, adapted to the curriculum of future engineers in "Automation and Computer Science", is part of environmental education, also called education relating to the environment (ERE) or education for sustainable development (EDD). This is an area of training and multidisciplinary educational action which should increase students' understanding of these crucial subjects and make them aware of their responsibilities in a professional setting where they will implement the skills science and technology provided by the teaching team and developed in self-training.

Various professionals from the department's privileged sectors of activity (robotics, IT management, design of special machines, IT engineering, etc.) will be invited to show how the objectives of sustainable development are taken into account in their various missions.

One of the strong points of this teaching will concern "La Fresque du Numérique" in which all students will participate. This is a fun and collaborative half-day workshop with a pedagogy similar to that of "La Fresque du Climat". The aim of this "serious game" is to raise awareness and train participants in the environmental issues of digital technology. This workshop also aims to explain the main lines of the actions to be put in place to evolve towards a more sustainable digital system, then to open discussions between the participants on the subject. A real team building tool, this workshop allows you to come together to learn together. It is primarily intended to be carried out face-to-face, but a remote format is also possible.

Bibliographie / webographie :

- Florence Depoers, Caroline Gauthier, Jean-Pascal Gond, Grégory Schneider-Maunoury, *Le développement durable au coeur de l'entreprise*, Ed. Dunod, seconde édition, 208 pages, 2011.
- Sylvie Faucheux, Christelle Hue, Isabelle Nicolaï, T.I.C. et développement durable, Ed. De Boeck Supérieur, 224 pages, 2010.
- Yvette Veyret, Paul Arnould, *Atlas du développement durable*, Ed. Autrement, 96 pages, 2022.
- Aïcha Yatabary, Le développement durable à l'épreuve de la politique concrète, Ed. L'harmattan, 168 pages, 2022.
- www.fresquedunumerique.org
- http://www.fresqueduclimat.org/

	Conferences	POLYTECH' ANGERS
SAGI	5A / Semester 9	UE 9.2 Sciences de l'ingénieur
	28h	

Compétences développées	(C.1)	apply scientific and technical knowledge
	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)
	(C.3)	take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)

Responsable :   Mehdi Lhommeau

Key-words: Conferences, industrial issues, engineering missions

Prerequisite: Lessons from the "Control engineering and Computer Engineering" department

Goals:

The speakers at conferences are mostly industrial, but sometimes academics (French or foreign) are invited to lead a conference on a particularly relevant topic.

The areas covered are varied. They can obviously highlight the themes of control engineering (connected factory, PLC security, etc.) as well as computer engineering (AI, deep learning, etc.). The teaching team is also vigilant to go beyond the purely scientific and technical framework and subjects such as innovation, sustainable development, ecological transition, growth, corporate social responsibility, management, ethics, deontology even history could be discussed   during   these   conferences.

More specifically, in order to reinforce the adequacy between specific lessons ("cyber physical systems", "cyber security", "HCI-VR") and the expectations of the professional world, industrial speakers are invited.

	Mobile programming	POLYTECH ANGERS
SAGI	5A / Semester 9	**UE 9.3** Génie informatique
	32h TP16	

Compétences développées	(S.9)	apply the procedural and object-oriented programming paradigms
	(S.10)	develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.)
	(S.11)	know the tools of augmented reality and immersive multimedia
	(S.12)	master the tools and methods of project follow-up in computer science
	(C.1)	apply scientific and technical knowledge

Responsable : David Langin

Keywords : Android, Tablet PC/Smartphone

Prerequisite: Java Programming, C programming

Goals:
This course aims to present the programming techniques implemented in the development of mobile applications (Smartphone/Tablet PC). The objective is to learn how to design and implement Android applications for mobile devices. The aim is to learn how to develop a mobile application from scratch, assuming a basic knowledge of Java. A part of the course is dedicated to the handling of Android Studio software. In particular, you will learn how to configure Android Studio, how to work with various activities and how to create simple and intuitive user interfaces. You will also learn how to use frameworks such as Cordova to encapsulate a web application on different mobile operating systems (Android, IOS...).

Program:
-   Getting started with Android Studio
-   Native Java code development under Android
-   Development of user interfaces
-   Implementation of mobility-related functionalities (GPS, ...)
-   How to use Cordova

Evaluation: continuous assessment

Bibliography & Webography:
[1] H. Mondher et H. Sami, "Développer des applications mobiles avec Android Studio - Cours et exercices", 2019, (ISBN 2-34002-554-0)
[2] S. Hébuterne, "Android - Guide de développement d'applications Java pour Smartphones et Tablettes (4e édition)", 2018, (ISBN 2-40901-526-3)

	Génie logiciel	POLYTECH ANGERS
SAGI	5A / Semester 9 1h20 CM – 14h40 TP24	UE 9.3 Génie informatique
Compétences développées	(S.10) develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.) (S.12) master the tools and methods of project follow-up in computer science (C.1) apply scientific and technical knowledge (C.2) adapt to the specific requirements of the company and society (economic, societal, environmental)	

Responsable : Nicolas Delanoue

Keywords: Conception, UML, GRASP and Design patterns

Requirements: Software engineering 1, Object oriented programming and Java

Objectives: The purpose is to provide to students an introduction to best practices for the software conception.

Content: The first part concerns various criteria to be considered before starting programming a software (e.g. choice of the programming language, choice of third party packages, hardware constraints, data serialization). Basic good practices are also introduced, such as GRAPS (« General Responsabilities Assignement Software Patterns ») as well as pattern widely encountered in this domain (architectural patterns and design patterns). The second part concerns labs. Each exercise focuses on a specific issue encountered in software development and deals with the refactorying of an existing, uncorrectly designed, program, including modeling with UML and the integration of the appropriate design pattern.

Evaluation : written examination

SAGI	IT project management	POLYTECH ANGERS
	5A / Semestre 9	UE 9.3 Génie informatique
	16h TD	

Compétences développées	(S.12)	appliquer les outils et les méthodes de suivi de projets en informatique
	(C.1)	mettre en œuvre des connaissances scientifiques et techniques
	(C.2)	s'adapter aux exigences propres de l'entreprise et de la société (économique, sociétale, environnementale)
	(C.3)	prendre en compte la dimension organisationnelle, personnelle et culturelle (entreprendre et innover, travailler en contexte international et multiculturel, se connaître, s'auto-évaluer, gérer ses compétences)

Responsable: Mehdi Lhommeau

Keywords: Quality, Continuous integration, management of bugs and software evolutions.

Requirements: Object oriented programming

Courses Objectives:
Introduction to the management of projects concerning software development, by integrating, for instance, the notion of quality, continuous integration, bug management. Despite aspects regarding time, cost and human resources management, the main objective is to introduce good practices and widely used tools in the field of software development. The purpose is also to integrate some methods and tools using exercises: for instance, this can involve the installation and use of an information system allowing to manage versioning, to automate documentation generation, test running, as well as the management of bugs and evolution requests (« tickets »).

Contents:
- The current developer's job / market / employment
- Jenkins: a first step in continuous integration
- git: the 10 commands you need to know before starting to work
- JS frameworks: Angular / React / Ecosystem
- DevOps - Docker – Node

Evaluation:
Lab and QCM

Bibliography & webography:

[1] P.Y. Cloux, T. Garlot et J. Kohler, "Docker - Pratique des architectures à base de conteneurs: Pratique des architectures à base de conteneurs", 2019, (ISBN 2-10078-970-8)
[2] K. hightower, B. Burns et J. Beda, "Kubernetes : Maîtrisez l'orchestrateur des infrastructures du futur", 2019, (ISBN 2-10078-940-6)
[3] A. Sacquet et C. Rochefolle, "Mettre en oeuvre DevOps - Comment évoluer vers une DSI agile: Comment évoluer vers une DSI agile", 2018, (ISBN 2-10077-905-2)
[4] D. Demaree, "Git par la pratique", 2017, (ISBN 2-21267-441-4)

SAGI	Web development	POLYTECH ANGERS
	5A / Semester 9	UE 9.3
	20h TP24	Génie informatique

Compétences développées	(S.9)	apply the procedural and object-oriented programming paradigms
	(S.10)	develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.)
	(C.1)	apply scientific and technical knowledge

Responsable : Mehdi Lhommeau

Keywords : Javascript, HTML 5, CSS 3, JQUER, Angular, React, Node.JS

Prerequisites : Basic knowledge of programming

Objectives : This course introduces web development based on Html5. The objective of the course is to be able to understand the fundamental concepts of front-end and back-end web development, through practice:

- The front-end will use HTML, CSS, Javascript framework, Angular/Typescript, SVELTE, Vue.js and React languages and technologies ;
- The back-end will use the following languages and technologies: NodeJS, MongoDB, Flask/Python.

Program :

- JQUERY
    - DOM
    - AJAX
    - CANVAS
- NodeJS
    - Introduction
    - Event Loop in Node.js
    - Coding with Socket.io
    - ExpressJS
- AngularJS/TypeScript
- SVELTE
- React
- Flask/Python

Evaluation : Project

References:

[1] Rimelé, R. *HTML 5 - Une référence pour le développeur web*. Eyrolles. 2013
[2] FONTANET, J and LAMBERT, O. - *Node.js - Exploitez la puissance de JavaScript côté serveur*. Editions ENI, 2015
[3] Sarrion, E. - *React.js: LE framework JavaScript de Facebook*, Editions Eyrolles, 2019

	Advanced control	POLYTECH ANGERS
SAGI	5A / Semester 9	UE 9.4.1
	20h TP24	Voie d'approfondissement systèmes cyber physiques
Compétences développées	(S.1) control industrial processes (S.2) model and analyze continuous or discrete dynamic systems (C.1) apply scientific and technical knowledge	

Responsable : Laurent Autrique

Keywords : Control theory, sliding mode controller, robust and optimal control, predictive control, non linear systems

Prerequisites : Control theory (UE 6-3) ; Process control (UE 8-2)

Objectives : Lectures on control theory for complex dynamic systems

Program :
Complex systems will be studied during this lecture dedicated to advanced control. Teacher will present in several parts considered as a whole:
- the investigated process
- the mathematical model
- the theoretical developments for controller design
- an implementation based on Matlab simulink

Sliding mode controller, robust and optimal control, predictive control, non linear systems will be highlighted. Physical systems such as heat exchangers, submarine torpedo, hot air balloon, will be investigated.

Evaluation : 100% continuous assessment based on written examination

Bibliography :
- E.F. Camacho, C. Bordons, *Model predictive control in the process industry*, ed. Spinger, 239 pages, 1995.
- J.P. Corriou, *Process control: theory and applications*, Editions Springer, Londres, 752 pages, 2004.
- L. Jaulin, *Représentation d'état pour la modélisation et la commande des systèmes*, ed. Hermès Lavoisier, Paris, 199 pages, 2005.
- I.D. Landau, *Identification et commande des systèmes*, ed. Hermès, 306 pages, 1988.
- W.S. Levine, *The control handbook*, ed. by CRC Press and IEEE Press, 1548 pages, 1996.
- P. Lopez, A.S. Nouri, *Théorie élémentaire et pratique de la commande par les régimes glissants*, Springer, 336 pages, 2000.
- K. Zhou, J.C. Doyle, K. Glover, *Robust and optimal control*, ed. Prentice Hall, 596 pages, 1996.

	Industrial challenge	POLYTECH ANGERS
SAGI	5A / Semester 9	UE 9.4.1 Voie d'approfondissement systèmes cyber physiques
	16h TP24	

Compétences développées	(S.1) control industrial processes (S.2) model and analyze continuous or discrete dynamic systems (S.3) develop supervision and traceability tools (S.4) master the tools and methods for monitoring automation projects (S.5) model, analyze and predict robots behavior. (S.6) control and operate industrial robots (S.7) design and operate embedded, mobile systems and/or robotics equipment (S.8) master the tools and methods for monitoring robotic projects (C.1) apply scientific and technical knowledge (C.2) adapt to the specific requirements of the company and society (economic, societal, environmental)

Responsable : Laurent Autrique

Keywords: industrial context, engineering problem, collaborative research

Prerequisite: all the courses related to "cyber physical systems"

Goals: Provide to students a context where an industrial partner of the SAGI department submits a complex concrete problem. Students must then work as a team to provide one or more solutions based on their skills. One of the specificities of this challenge lies in the appropriation and then the resolution of a concrete subject in a limited time. One of the objectives is thus to increase their "job" potential in a situation where the engineer must seek his knowledge to respond "quickly" to a client.

Contents: Each year, the educational team discusses with an industrial partner to define the challenge scope. The calendar can be as follows for students enrolled in a school year **n** to **n+1**.
- March **n** to June **n**: choice of industrial partner, research of a problem, writing of specifications, development of calendar
- October **n**: visit of the company, presentation by the industrial partner of the subject to the students, round table.
- November **n**: personal work of students
- December **n**: challenge in configuration 2 8-hour days with dedicated equipment.

Evaluation: during the challenge, quality of the work carried out, relevance of the responses, satisfaction of the industrial partner.

Bibliography: Provided for each challenge by the industrial partner and the educational team in order to be able to suggest lines of thought in order to resolve the problematic of the challenge.

	Robotics	POLYTECH ANGERS
SAGI	5A / Semester 9	UE 9.4.1
	20h TD – 12h TP16	Voie d'approfondissement systèmes cyber physiques

Compétences développées	(S.5) model, analyze and predict robots behavior. (S.6) control and operate industrial robots (S.7) design and operate embedded, mobile systems and/or robotics equipment (C.1) apply scientific and technical knowledge

Responsable : Jean-Louis Boimond

Keywords: Direct geometric model, method of Denavit-Hartenberg, inverse geometric model, workspace, trajectory generation, programming language (Stäubli, Fanuc, Kuka).

Prerequisites: UE Robotique industrielle 3A

Goals: Provide a basis for theoretical and practical knowledge in robotics.
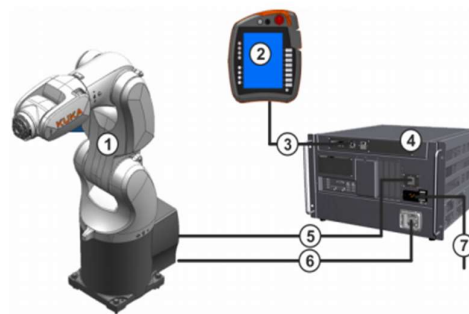
Program:
- Geometric model of a simple chain robot:
    Computation of the direct geometric model
    Method of Denavit-Hartenberg
    Example
    Exercises
    Inversion of the geometric model - Method of Paul
    Multiple solutions - Workspace - Aspects
- Trajectories generation:
    Trajectory between 2 points in the articular space
    Trajectory between several points in the articular space
- Programming of robots Stäubli RX 90, Fanuc LR & ARC Mate 100 IB, Kuka KR3.

Examination: Written examination and laboratories examination.

Bibliography:
1) *Cours de robotique*, J. Gangloff, ENSPS 3A, 221 pages
2) *Robots. Principes et contrôle*, C. Vibet, Ellipses 1987, 207 pages
3) *Robotique. Aspects fondamentaux*, J.-P. Lallemand, S. Zeghloul, Masson 1994, 312 pages
4) *Modélisation et commande des robots*, W. Khalil, G. Lebret, Cours EI3 Automatique de l'ECN 94/95
5) *Introduction to Robotics Mechanics and Control,* 2th edition, J. J. Craig, Addison-Wesley Publishing Company, 1989, 450 pages
6) *Modeling, Identification & Control of Robots*, W. Khalil, E. Dombre, Hermes Penton Science 2002, 480 pages
7) *Robotics Modelling, Planning and Control,* B. Siciliano, L. Sciavicco, L. Villani, G. Oriolo, Springer-Verlag 2009, 632 pages

SAGI	**Simulation of discrete event systems**	POLYTECH ANGERS
	5A / Semester 9	UE 9.4.1
	16h TD – 8h TP16	Voie d'approfondissement systèmes cyber physiques
Compétences développées	(S.1) control industrial processes (S.2) model and analyze continuous or discrete dynamic systems (S.5) model, analyze and predict robots behavior. (S.6) control and operate industrial robots (C.1) apply scientific and technical knowledge	

Responsable : Jean-Louis Boimond

Keywords: Discrete event system, Petri net, language of simulation, Siman-Arena.

Prerequisites: Notion on production systems.

Objectives: Study on the discrete event systems simulation.
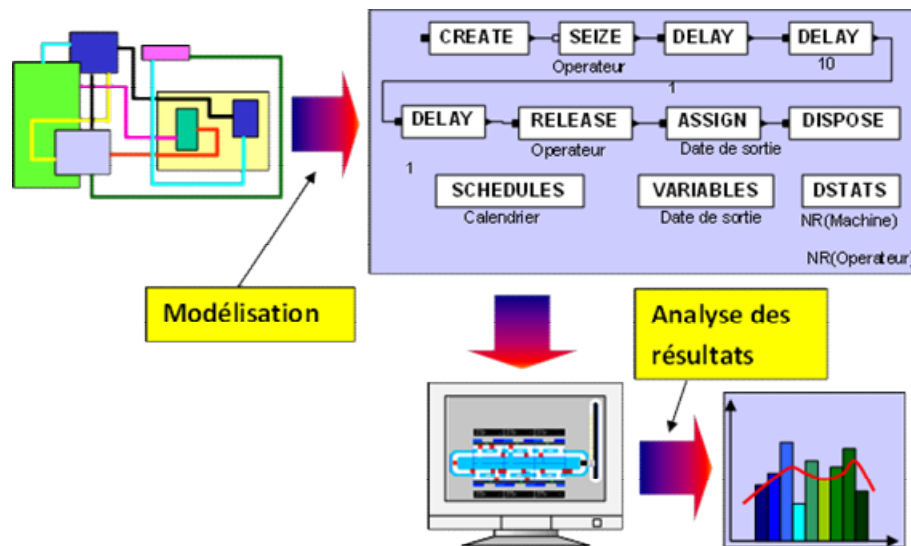
Program:
- Introduction to the simulation,
- Simulation of production systems,
- Recall on probability and statistics,
- Data on system input,
- Verification and validation of models,
- Interpretation of results,
- Basic notions on Petri nets,
- The Siman-Arena simulation language.

Examination:
Written examination.

Bibliography:
Introduction to Simulation Using SIMAN. Second Edition, C. Dennis Pegden, R.E. Shannon, R.P. Sadowski, Ed. Mc Graw-Hill.
Probabilités et statistiques. 3ème édition, A. Ruegg, Presses Polytechniques Romandes.

	SCADA systems	POLYTECH° ANGERS
SAGI	5A / Semester 9	UE 9.4.1
	24h TP24	Systèmes cyberphysiques

Compétence s développées	(S.1)	control industrial processes
	(S.3)	develop supervision and traceability tools
	(S.6)	control and operate industrial robots
	(S.7)	design and operate embedded, mobile systems and/or robotics equipment
	(C.1)	apply scientific and technical knowledge

Responsable : Sébastien Lahaye

Keywords : automated systems, supervisory control and data acquisition (SCADA)

Prerequisites : Automatismes industriels (UE5-2), Réseaux industriels (UE7-3), supervision industrielle 1 (UE7-3), Programmation C# (UE6-4), Programmation Java (UE7-4).

Objectives : Prepare students to become a privileged interlocutor, or even a member, of an automation engineering and design office, able to interact with other offices, suppliers and/or customers.

Outline:
1. Introduction to SCADA systems
2. Communication standards for SCADA systems
    2.1. Challenges and overview of existing solutions
    2.2. OPC standard
        2.2.1. Presentation
        2.2.2. Data Access (DA) specification, implementation with .Net
        2.2.3. Unified Architecture (UA) specification, implementation with Java

Examination : continuous assessment

Bibliography :

Fondements du pilotage des systèmes de production, P. Pujo, J.P. Kieffer, Hermès Science, Lavoisier, 2002
Méthodes du pilotage des systèmes de production, P. Pujo, J.P. Kieffer, Hermès Science, Lavoisier, 2002
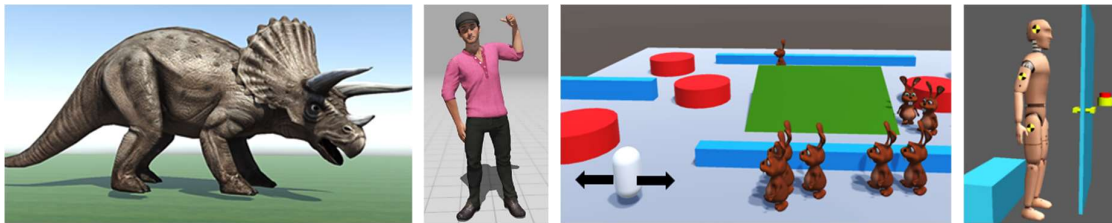*OPC - From Data Access to Unified Architecture*, Jürgen Lange, Frank Iwanitz, Thomas J. Burke, fourth edition, Verlag, 2010
OPC Unified Architecture, Wolfgang Mahnke, Stefan-Helmut Leitner and Matthias Damm, Springer, 2009.
http://www.opcfoundation.org/

SAGI	**Animation and behavioral simulation**	POLYTECH ANGERS
	5A / Semester 9	UE 9.4.2
	32h TP24	IHM & RV

Compétences développées	(S.9) apply the procedural and object-oriented programming paradigms
	(S.10) develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.)
	(S.11) know the tools of augmented reality and immersive multimedia
	(S.12) master the tools and methods of project follow-up in computer science
	(C.1) apply scientific and technical knowledge

Lecturer: Paul Richard

Keywords: 3D interaction techniques, motion capture, real-time animation, animation controller, behavioral simulation, artificial intelligence.

Prerequisites: Interaction homme-machine & Réalité virtuelle (3A), Réalité virtuelle (4A)

Objectives: Apply and deepen their knowledge of real-time animation of virtual entities (humanoids, robots or animals), simulation and behavioral interaction under the Unity3D environment.
1. Be able to integrate and animate complex virtual entities in real time
2. Be able to develop simulations integrating reactive virtual entities
3. Know how to develop simulations integrating autonomous virtual entities

Outline:

Implementation of real-time animation techniques
1. Animation controlled by the user (keyboard / mouse)
2. Animation triggered by proximity (distance / entity)
3. Animation triggered by behavior (gesture / voice)

Implementation of immersive behavioral simulations
1. Behavioral simulation integrating a virtual entity
2. Behavioral simulation integrating several entities
3. Simulation integrating interacting virtual entities

Examination: Continuous assessment

Bibliography:

Learning C# Programming with Unity 3D, Alex Okita, Taylors and Francis (2015)

Getting Started with 3D Animation in Unity: Animate and Control your 3D Characters in Unity, Patrick Félicia (2018).

	Industrial challenge	POLYTECH ANGERS
SAGI	5A / Semester 9	UE 9.4.2
	16h TP24	IHM & RV

Compétences développées	(S.9) apply the procedural and object-oriented programming paradigms (S.10) develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.) (S.11) know the tools of augmented reality and immersive multimedia (S.12) master the tools and methods of project follow-up in computer science (C.1) apply scientific and technical knowledge

Supervisor: Paul Richard
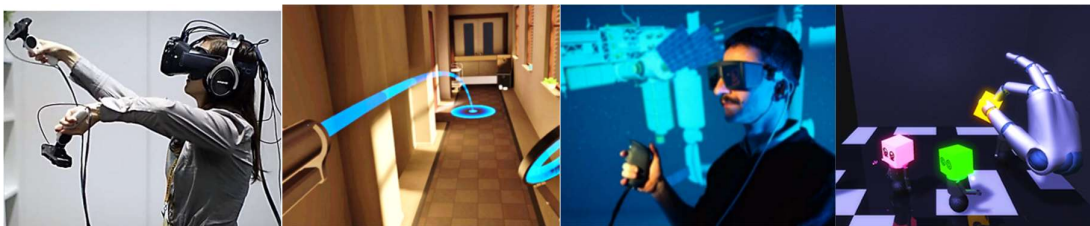
Keywords: virtual reality, 3D interaction techniques, behavioral interfacing, sensory / motor immersion, implementation, application, innovation.

Prerequisites:

Interaction homme-machine & Réalité virtuelle (3A), Réalité virtuelle (4A), Animation et simulation comportementale (5A), Multimodalité et interaction haptique (5A), Immersion et techniques d'interaction (5A).

Objectives: collaborative design and production (all students of the class) of an immersive virtual reality application integrating all the knowledge seen during lessons 3A, 4A and 5A. Offer an innovative, possibly collaborative application (virtual environment integrating several virtual entities in mutual interaction and with the submerged user (s)). Search for industrial partner.

Outline (48h00):

1. Group brainstorming
2. Analysis and distribution of tasks
3. Modeling of software bricks
4. Implementation and unit tests
5. Integration and initial assessment
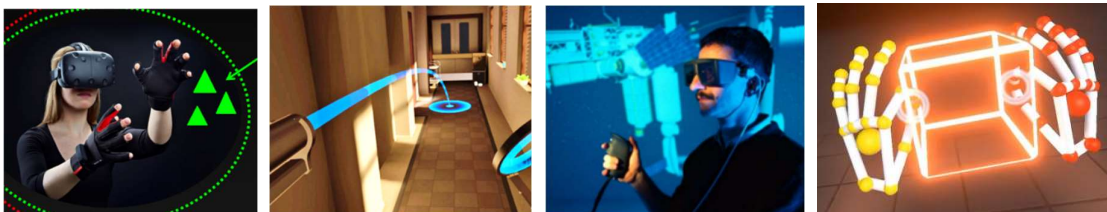6. Correction and delivery of the application

Examination: Continuous assessment

Bibliography:

- *Learning C# Programming with Unity 3D,* Alex Okita*,* Taylors and Francis (2015)
- *Getting Started with 3D Animation in Unity: Animate and Control your 3D Characters in Unity,* Patrick Félicia (2018).
- Human-Computer Interaction (second edition) par Alan Dix, Janet Finlay, Gregory Abowd & Russell Beale. London, UK : Prentice Hall Europe, 1998, 638 p.
- 3D User Interfaces: Theory and Practice, By Doug Bowman, Ernst Kruijff, Joe LaViola, and Ivan Poupyrev, 512 p. Addison Wesley (2004)
- Enhancing Interaction in Mixed Reality: The Impact of Modalities and Interaction Techniques on the User Experience in Augmented and Virtual Reality
- Augmented Reality with Unity AR Foundation: A practical guide to cross-platform AR development with Unity 2020 and later versions
- Hands-On Unity 2021 Game Development: Create, customize, and optimize your own professional games from scratch with Unity 2021, 2nd Edition, Nicolas Alejandro Borromeo Packt Publishing
- Learning C# by Developing Games with Unity 2021: Kickstart your C# programming and Unity journey by building 3D games from scratch, 6th Edition, Harrison Ferrone
- C# Game Programming Cookbook for Unity 3D (English Edition), Jeff W. Murray, 2e Édition

SAGI	**Immersion and 3D interaction techniques**	POLYTECH ANGERS
	5A / Semester 9	UE 9.4.2
	24h TP24	IHM & RV
Compétences développées	(S.9) apply the procedural and object-oriented programming paradigms (S.10) develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.) (S.11) know the tools of augmented reality and immersive multimedia (S.12) master the tools and methods of project follow-up in computer science (C.1) apply scientific and technical knowledge	

Lecturer: Paul Richard

Keywords: virtual reality, interaction techniques, behavioral interfacing, selection, manipulation, navigation, immersion.

Prerequisites: Interaction homme-machine & Réalité virtuelle (3A), Réalité virtuelle (4A)

Objectives:
- Implementation of 3D interaction techniques (selection, manipulation, navigation) and development of immersive applications under the Unity3D environment
- Being able to design and implement basic 3D interaction techniques
- Know how to develop immersive applications based on virtual reality headsets

Outline:
    Analysis of interaction and immersive devices
        1. Systems based on virtual reality headsets (HMD)
        2. Projection-based systems (CAVE)
    Analysis, modeling and implementation of 3D interaction techniques
        1. Techniques for selecting and manipulating virtual objects
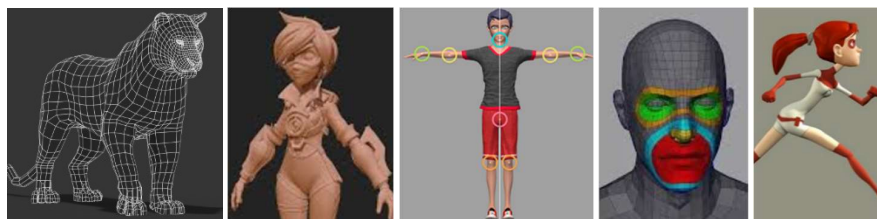   2. Navigation / locomotion techniques in virtual environment

Examination: Continuous assessment

Bibliography:
- *Learning C# Programming with Unity 3D,* Alex Okita, Taylors and Francis (2015)
- *Getting Started with 3D Animation in Unity: Animate and Control your 3D Characters in Unity,* Patrick Félicia (2018).
- Human-Computer Interaction (second edition) par Alan Dix, Janet Finlay, Gregory Abowd & Russell Beale. London, UK : Prentice Hall Europe, 1998, 638 p.
- 3D User Interfaces: Theory and Practice, By Doug Bowman, Ernst Kruijff, Joe LaViola, and Ivan Poupyrev, 512 p. Addison Wesley (2004)
- Enhancing Interaction in Mixed Reality: The Impact of Modalities and Interaction Techniques on the User Experience in Augmented and Virtual Reality
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- Hands-On Unity 2021 Game Development: Create, customize, and optimize your own professional games from scratch with Unity 2021, 2nd Edition, Nicolas Alejandro Borromeo Packt Publishing
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	Tools and 3D modeling techniques	POLYTECH ANGERS
SAGI	5A / Semester 9	UE 9.4.2
	24h TP24	IHM & RV

Compétences développées	(S.10) develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.) (S.11) know the tools of augmented reality and immersive multimedia (S.12) master the tools and methods of project follow-up in computer science (C.1) apply scientific and technical knowledge

Responsable: Paul Richard

Keywords: 3D modeling, 3D model, polygon, level of detail, 3D rendering, texturing, UV mapping, rigging, animation.

Prerequisites: none

Objectives:
- To know the modeling tools used in 3D computer graphics. Understand the basic problems and techniques of 3D modeling and animation. Export and use of static or animated models in the Unity3D environment.
- Being able to model and export a static 3D model for Unity3D
- Being able to animate, export and exploit a 3D character under Unity3D

Outline:　　　Modeling and exploitation of a 3D model (3DS Max)
　　　　　　1. Modeling and optimization of a 3D object
　　　　　　2. Texture mapping and UV mapping
　　　　　　3. Export and use of a 3D model under Unity3D
　　　　　　Modeling, animation and exploitation of a 3D character
　　　　　　1. Modeling under 3DS max of a 3D character
　　　　　　2. Animation under 3DS max of a 3D character
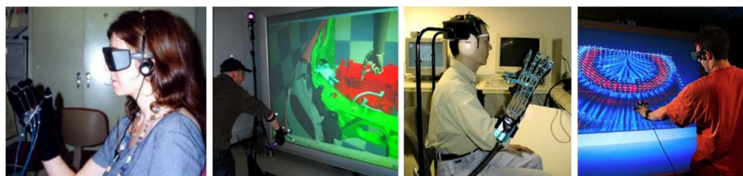　　　　　　3. Export, import and use of a 3D character in Unity3D

Examination : Continuous assessment

Bibliography :

- *Learning C# Programming with Unity 3D,* Alex Okita*,* Taylors and Francis (2015)
- *Getting Started with 3D Animation in Unity: Animate and Control your 3D Characters in Unity,* Patrick Félicia (2018).
- Human-Computer Interaction (second edition) par Alan Dix, Janet Finlay, Gregory Abowd & Russell Beale. London, UK : Prentice Hall Europe, 1998, 638 p.
- 3D User Interfaces: Theory and Practice, By Doug Bowman, Ernst Kruijff, Joe LaViola, and Ivan Poupyrev, 512 p. Addison Wesley (2004)
- Enhancing Interaction in Mixed Reality: The Impact of Modalities and Interaction Techniques on the User Experience in Augmented and Virtual Reality
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	Multimodality and haptic interaction	POLYTECH' ANGERS
SAGI	5A / Semester 9	UE 9.4.2
	20h TP24	IHM & RV

Compétences développées	(S.9) apply the procedural and object-oriented programming paradigms (S.10) develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.) (S.11) know the tools of augmented reality and immersive multimedia (S.12) master the tools and methods of project follow-up in computer science (C.1) apply scientific and technical knowledge

Lecturer: Paul Richard

Keywords: virtual reality, 3D interaction techniques, voice command / speech synthesis, multimodality, haptic interaction, sensory substitution.

Prerequisites: Interaction homme-machine & Réalité virtuelle 1 (3A), Réalité virtuelle (4A)

Objectives: In-depth knowledge of multimodal interaction (entry and exit)
General knowledge of haptic interfaces (tactile and kinesthetic)
Knowledge of the characteristics of haptic perception and rendering
Be able to propose and develop a multimodal haptic application

Outline: Concepts and characteristics of multimodal interaction
Concepts and theoretical approaches to multimodality
Multimodality in input (fusion) and output (fission)
Integration of haptics for multimodal feedback
Sensory substitution and informational redundancy
Design and integration of force feedback interfaces
Mechanical architectures of force feedback interfaces
Classification of tactile and force feedback interfaces
Optimal integration of force feedback interfaces
Development of an application with haptic feedback

Examination: continuous assessment

Bibliography:
- *Learning C# Programming with Unity 3D,* Alex Okita, Taylors and Francis (2015)
- *Getting Started with 3D Animation in Unity: Animate and Control your 3D Characters in Unity,* Patrick Félicia (2018).
- Human-Computer Interaction (second edition) par Alan Dix, Janet Finlay, Gregory Abowd & Russell Beale. London, UK : Prentice Hall Europe, 1998, 638 p.
- 3D User Interfaces: Theory and Practice, By Doug Bowman, Ernst Kruijff, Joe LaViola, and Ivan Poupyrev, 512 p. Addison Wesley (2004)
- Enhancing Interaction in Mixed Reality: The Impact of Modalities and Interaction Techniques on the User Experience in Augmented and Virtual Reality
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	Unix system administration	POLYTECH ANGERS
SAGI	5A / Semester 9	UE 9.4.3
	20h TP24	Cyber security

Compétences développées	(S.13)	manage computer networks (infrastructure, services, control and command functions)
	(S.14)	administer computer servers
	(S.16)	implement and develop tools in the context of IT security
	(C.1)	apply scientific and technical knowledge
	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)

Responsable : Alain Godon

Keywords :
VIRTUALIZATION, AUTOMATION, UNIX, DEVOP

Prerequisites :
GNU/Linux (UE 5.3), Networking (UE 5.3), Unix Administration (UE 7.4), Cyber security (UE 7.4)

Objectives :
In addition to 4A SAGI Course, It is focused on virtualization and containerization system and show how to improve and have good secured systems by using logging system, intrusions detectors and make some ethical pentests.

Outline:
System virtualization: VMware, VirtualBox
System containerization: Docker, Kubernetes
Intrusion detection System: Wazuh, system logs, syslog and ELK export
Automation: Ansible/puppet
Day to day Devop task
Forensics

Examination :
100% Continuous assessment.

Bibliography :
https://opensource.com/resources/virtualization
https://www.edureka.co/blog/chef-vs-puppet-vs-ansible-vs-saltstack/

	Applied Cryptology	POLYTECH ANGERS
SAGI	5A / Semester 9	UE 9.4.3 Cyber Security
	20h TP24	
Compétences développées	(S.9) apply the procedural and object-oriented programming paradigms (S.16) implement and develop tools in the context of IT security (C.1) apply scientific and technical knowledge	

Responsable : Alain Godon

Keywords :
RSA, GPG, HTTPS

Prerequisites :
Cyber security (UE 7.4)

Objectives :
Computer security makes extensive use of concepts derived from cryptology, and many protocols are based on it. This course allows to scan these concepts through the implementation of various indispensable tools.

Outline:
Symmetric and asymmetric encryption
Diffie-Hellman, RSA, AES, SHA algorithms
Hash functions, signature, integrity check
Confidentiality and data integrity :
        encrypted containers
        encryption of communications (email, web, dns ...)

Examination :
100% Continuous assessment

SAGI	**Network architecture**	POLYTECH ANGERS
	5A / Semester 9	UE 9.4.3
	12h TP24 – 12h TP16	Cyber security

Compétences développées	(S.13)	manage computer networks (infrastructure, services, control and command functions)
	(S.14)	administer computer servers
	(S.16)	implement and develop tools in the context of IT security
	(C.1)	apply scientific and technical knowledge
	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)

Responsable : Alain Godon

Keywords :
VLAN, VPN, FIREWALL, ROUTING,

Prerequisites :
Computing network (UE 5.3)

Objectives :
This course is an EI3 course's extension (Computing network), with a focus on all TCP/IP aspects as well as complex conception of local or wide network architecture. Virtualization and containerization for modern network is also a key concept for this course.

Outline:
Internet global architecture (routing, DNS, protocols)
Architecture and protection of local networks : VLAN, VXLan, routing
Firewall : Layer 3 vs 7, Stateless vs Statefull
Concept of virtual networks (VPC, Overlay)

Examination :
100% Continuous assessment.

Bibliography :

https://blog.wescale.fr/2018/02/15/les-reseaux-doverlay-principes-et-fonctionnement/
https://en.wikipedia.org/wiki/Routing
https://www.pfsense.org/
https://storj.io/
https://ceph.io/

	IT security risks	POLYTECH ANGERS
SAGI	5A / Semester 9	UE 9.4.3 Cyber security
	32h TP24	

Compétences développées	(S.10)	develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.)
	(S.13)	manage computer networks (infrastructure, services, control and command functions)
	(S.14)	administer computer servers
	(S.16)	implement and develop tools in the context of IT security
	(C.1)	apply scientific and technical knowledge
	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)

Responsable : Alain Godon

Keywords :
CISO, PROTECTION, DRP, BCP, OSINT

Prerequisites :
Cyber security (UE 7.4)

Objectives :
This course is a follow up about IT security 4A SAGI with a deep focus on concept such as software and hardware firewall and by managing IT security risk in accordance with the latest standards. It will emphasis all aspect about cyber security threats and ways to protect professional as well as personal data.

Outline:
IT Risks : CTO and RSSI (fr)
Programming best practices and main security flaw (top 10 OWASP)
Ethical Hacking (white hat)
IT response plan and data protection
Authenticate, Authorize, Accounting (AAA)
Legal aspects and laws.
RGPD (fr)
Data Backup.
IT Governance
OSINT

Examination :

100% Continuous assessment

Bibliography :
https://en.wikipedia.org/wiki/Internet_security

![SAGI logo]	**Watch / R&D**	POLYTECH ANGERS
SAGI	5A / Semester 9	UE 9.4.3
	20h TP24	Cyber Security

Compétences développées	(S.10)	develop applications within the framework of software engineering (best practices, reliability, cost rationalization, monitoring, etc.)
	(S.13)	manage computer networks (infrastructure, services, control and command functions)
	(S.14)	administer computer servers
	(S.16)	implement and develop tools in the context of IT security
	(C.1)	apply scientific and technical knowledge
	(C.2)	adapt to the specific requirements of the company and society (economic, societal, environmental)

Responsable : Alain Godon

Keywords :
Network, System

Prerequisites :
None

Objectives :
Training in the search for information on emerging technologies

Outline:
Design of a network architecture
Implementation of a multi-station architecture

Examination :
100% Continuous assessment

	Project	
SAGI	5A / Semester 9	UE 9-5
	100 heures	Projet

Compétences développées	(S.4)	master the tools and methods for monitoring automation projects
	(S.8)	master the tools and methods for monitoring robotic projects
	(S.12)	master the tools and methods of project follow-up in computer science
	(C.1)	apply scientific and technical knowledge

Responsable : Mehdi Lhommeau

Key words: educational project, group work, professional project, applications

Prerequisite: those required for the project of each group of students

Goals:

This project is carried out in groups of 2 to 3 students supervised by one or more members of the teaching team.

The teaching team propose numerous specific subjects related to the context of control engineering, automated systems and computer engineering. These allow students to apply the knowledge introduced during the courses and to implement project management methods. The projects are built pedagogically and intermediate results are required and discussed with supervisors.

Contents:

For the 5A-SAGIs, special attention is paid to autonomy, the implementation of the engineering know-how to resolve a complex situation, the management of collaborative work and the rendering which must be professional type.
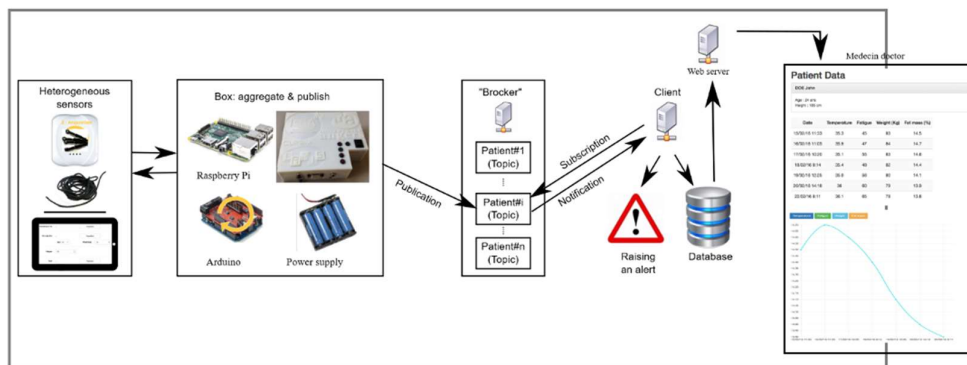
Some projects previously proposed …
– Stabilization by reaction wheel
– Immersive virtual reality game
– IoT-based homemade box for healthcare
– Remote controlled car using a leap motion
– Kuka Robot
– Spying in buildings by IR camera
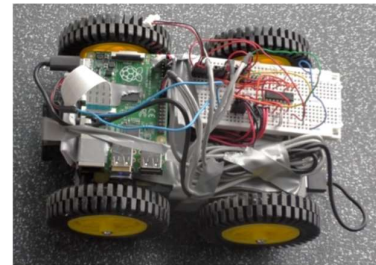
Evaluation: written report, evaluation of the progress of the work, feedback requested from students (project, device, presentation ...)

Syllabus
SAGI – S10

Version Aout 2022

Responsable : L. Autrique

Semestre 10

	H/E	H CM	H TD	H TP24	H TP16
UE 10-1 Stage					
Stage (5 mois)					

	Internship		POLYTECH° ANGERS
	5A / Semester 10		UE 10-1
SAGI			Stage
Compétences développées	(S.4) master the tools and methods for monitoring automation projects (S.8) master the tools and methods for monitoring robotic projects (S.12) master the tools and methods of project follow-up in computer science (C.1) apply scientific and technical knowledge (C.2) adapt to the specific requirements of the company and society (economic, societal, environmental) (C.3) take into account the organizational, personal and cultural dimension (innovate, work in an international and multicultural context, know oneself, self-evaluate, manage one's skills)		

Responsable: Mehdi Lhommeau

The 5th year internship is the second specialty internship. It normally precedes entry into working life. For this reason, it must be in line with the professional project of the students. This internship is an essential element to enrich interviews with future recruiters. It must allow the student:
- to exercise their capacities of autonomy, creativity, organization, relationship and critical thinking
- to put into practice and deepen their knowledge in one or more areas covered during their university course
- to improve their skills of synthesis, written expression and communication through the internship report and oral presentation;
- to have professional experience, industrial contacts and prepare for life in a company.

Organisation

The internship is supervised by an internship supervisor within the company and a teaching tutor from Polytech Angers.
- The internship supervisor: he is the privileged contact in the host company. It can assist in the search for information. It gives the rules to be respected within the organization. It is also up to the internship supervisor to assess the student's behavior and involvement.
- The teaching tutor: he is the contact person within Polytech Angers. If there is a problem, he has to be informed as soon as possible. Its role is to advise and support the student for the smooth running of the internship.

Evaluation

The evaluation is based on: professional achievement in the company, quality of the written report and the defense. The first part (internship assignment) is essentially assessed on the basis of an opinion issued by the internship supervisor. The latter measures the qualities, skills, adaptation and development of the intern during the internship. The last two parts are evaluated by the jury (defense) and the teaching tutor (report).