INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

FIMI

Domaine Scientifique de la DOUA - Bât. A. de Saint-Exupéry
27, avenue Jean Capelle - 69621 VILLEURBANNE

ANNEE : 1ère année / 1st year - 60 ECTS

SEMESTRE : 1er semestre / 1st semester - 30 ECTS

PARCOURS : Parcours classique / standard track - 30 ECTS

UE : systèmes Mécaniques et outils Logiciels / Mechanical system and software tools - 3 ECTS

EC : Systèmes et Outils Logiciels / Sytems and Software Tools - 1 ECTS

EC : Conception mécanique 1 / Mechanical design 1 - 2 ECTS

UE : Physique et Chimie / Physics and Chemistry - 10 ECTS

EC : Architecture de la matière / Architecture of matter - 3 ECTS

EC : Mécanique et Electricité 1 / Mechanics and Electricity 1 - 7 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 12 ECTS

EC : Informatique et Société Numérique 1 / Informatics and numerical society 1 - toto ECTS

EC : Mathématiques S1 / Maths 1 - 7 ECTS

EC : Outils mathématiques et numériques pour l'ingénieur(e) 1 / Mathematical and Numerical Tools for Engineering 1 - * ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Cultures. Sciences. Sociétés 1 / Cultures, Sciences, Societies 1 - undefined ECTS

PARCOURS : Parcours AMERINSA / AMERINSA track - 30 ECTS

UE : systèmes Mécaniques et outils Logiciels / Mechanical system and software tools - 3 ECTS

EC : Systèmes et Outils Logiciels / Sytems and Software Tools - 1 ECTS

EC : Conception mécanique 1 / Mechanical design 1 - 2 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 12 ECTS

EC : Outils mathématiques et numériques pour l'ingénieur(e) 1 / Mathematical and Numerical Tools for Engineering 1 - * ECTS

EC : Informatique et Société Numérique 1 / Informatics and numerical society 1 - toto ECTS

EC : Mathématiques S1 AM1 / Maths 1 - 7 ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Cultures. Sciences. Sociétés 1 / Cultures, Sciences, Societies 1 - undefined ECTS

UE : Physique et Chimie / Physics and Chemistry - 10 ECTS

EC : Architecture de la matière / Architecture of matter - 3 ECTS

EC : Mécanique et Electricité 1 / Mechanics and Electricity 1 - 7 ECTS

PARCOURS : Parcours ASINSA / ASINSA track - 30 ECTS

UE : systèmes Mécaniques et outils Logiciels / Mechanical system and software tools - 3 ECTS

EC : Systèmes et Outils Logiciels / Sytems and Software Tools - 1 ECTS

EC : Conception mécanique 1 / Mechanical design 1 - 2 ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Cultures. Sciences. Sociétés 1 / Cultures, Sciences, Societies 1 - undefined ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 12 ECTS

EC : Outils mathématiques et numériques pour l'ingénieur(e) 1 / Mathematical and Numerical Tools for Engineering 1 - * ECTS

EC : Informatique et Société Numérique 1 / Informatics and numerical society 1 - toto ECTS

EC : Mathématiques S1 / Maths 1 - 7 ECTS

UE : Physique et Chimie / Physics and Chemistry - 10 ECTS

EC : Architecture de la matière / Architecture of matter - 3 ECTS

EC : Mécanique et Electricité 1 / Mechanics and Electricity 1 - 7 ECTS

PARCOURS : Parcours EURINSA / EURINSA track - 30 ECTS

UE : systèmes Mécaniques et outils Logiciels / Mechanical system and software tools - 3 ECTS

EC : Systèmes et Outils Logiciels / Sytems and Software Tools - 1 ECTS

EC : Conception mécanique 1 / Mechanical design 1 - 2 ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Cultures. Sciences. Sociétés 1 / Cultures, Sciences, Societies 1 - undefined ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 12 ECTS

EC : Outils mathématiques et numériques pour l'ingénieur(e) 1 / Mathematical and Numerical Tools for Engineering 1 - * ECTS

EC : Informatique et Société Numérique 1 / Informatics and numerical society 1 - toto ECTS

EC : Mathématiques S1 EU1 / Maths 1 - 7 ECTS

UE : Physique et Chimie / Physics and Chemistry - 10 ECTS

EC : Architecture de la matière / Architecture of matter - 3 ECTS

EC : Mécanique et Electricité 1 / Mechanics and Electricity 1 - 7 ECTS

PARCOURS : Parcours SCAN / SCAN track - 30 ECTS

UE : systèmes Mécaniques et outils Logiciels / Mechanical system and software tools - 3 ECTS

EC : Systèmes et Outils Logiciels / Sytems and Software Tools - 1 ECTS

EC : Conception mécanique 1 / Mechanical design 1 - 2 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 12 ECTS

EC : Outils mathématiques et numériques pour l'ingénieur(e) 1 / Mathematical and Numerical Tools for Engineering 1 - * ECTS

EC : Mathématiques S1 SCAN1 / Maths 1 - 7 ECTS

EC : Informatique et Société Numérique 1 / Informatics and numerical society 1 - toto ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Cultures. Sciences. Sociétés 1 / Cultures, Sciences, Societies 1 - undefined ECTS

UE : Physique et Chimie / Physics and Chemistry - 10 ECTS

EC : Mécanique et Electricité 1 / Mechanics and Electricity 1 - 7 ECTS

EC : Architecture de la matière / Architecture of matter - 3 ECTS

PARCOURS : Parcours INSAVENIR1 /INSAVENIR1 track - 30 ECTS

UE : Physique et Chimie / Physics and Chemistry - 8 ECTS

EC : Chimie 1 / Chemistry 1 - 4 ECTS

EC : Physique 1 / Physics 1 - 4 ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Cultures. Sciences. Sociétés 1 / Cultures, Sciences, Societies 1 - 2 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 9 ECTS

EC : Mathématiques S1 AV1 / Maths 1 - undefined ECTS

EC : Outils mathématiques et numériques pour l'ingénieur(e) 1 / Mathematical and Numerical Tools for Engineering 1 - * ECTS

EC : Informatique et Société Numérique 1 / Informatics and numerical society 1 - undefined ECTS

UE : Systèmes Mécaniques et L'énergie / Mechanical tools and Energy - 8 ECTS

EC : projet S1 / project S1 - undefined ECTS

EC : Conception mécanique 1 / Mechanical design 1 - * ECTS

PARCOURS : Parcours Sportifs Haut Niveau / High Level Sport track - 20 ECTS

UE : systèmes Mécaniques et outils Logiciels / Mechanical system and software tools - 3 ECTS

EC : Systèmes et Outils Logiciels / Sytems and Software Tools - 1 ECTS

EC : Conception mécanique 1 / Mechanical design 1 - 2 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 8 ECTS

EC : Outils mathématiques et numériques pour l'ingénieur(e) 1 / Mathematical and Numerical Tools for Engineering 1 - * ECTS

EC : Mathématiques S1 SHN0 / Maths 1 - 4 ECTS

EC : Informatique et Société Numérique 1 / Informatics and numerical society 1 - * ECTS

UE : Humanités / Humanities - 2 ECTS

UE : Physique et Chimie / Physics and Chemistry - 7 ECTS

EC : Architecture de la matière / Architecture of matter - 3 ECTS

EC : Physique 1 / Physics 1 - 4 ECTS

SEMESTRE : 2ème semestre / 2nd semester - 30 ECTS

PARCOURS : Parcours classique / standard track - 30 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 10 ECTS

EC : Mathématiques S2 FC-AS-EU / Maths 2 - 5 ECTS

EC : Informatique et Société Numérique 2 / Informatics and numerical society 2 - toto ECTS

EC : Outils mathématiques et numériques pour l'ingénieur(e) 2 / Mathematical and Numerical Tools for Engineering 2 - * ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 4 ECTS

EC : Conception mécanique 2 / Mechanical design 2 - undefined ECTS

EC : Enjeux de la Transition Ecologique 1 / Sustainable Development 1 - 2 ECTS

UE : Physique et Chimie / Physics and Chemistry - 12 ECTS

EC : Transformations chimiques en solution aqueuse / Lab work Chemistry 1st year - 2 ECTS

EC : Thermodynamique générale / Thermodynamics - 4 ECTS

EC : Mécanique et Electricité 2 / Mechanics and Electricity 2 - 6 ECTS

UE : Humanités / Humanities - 4 ECTS

EC : Connaissance de l'entreprise / Company knowledge - * ECTS

PARCOURS : Parcours AMERINSA / AMERINSA track - 30 ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 4 ECTS

EC : Conception mécanique 2 / Mechanical design 2 - undefined ECTS

EC : Enjeux de la Transition Ecologique 1 / Sustainable Development 1 - 2 ECTS

UE : Physique et Chimie / Physics and Chemistry - 12 ECTS

EC : Mécanique et Electricité 2 / Mechanics and Electricity 2 - 6 ECTS

EC : Transformations chimiques en solution aqueuse / Lab work Chemistry 1st year - 2 ECTS

EC : Thermodynamique générale / Thermodynamics - 4 ECTS

UE : Humanités / Humanities - 4 ECTS

EC : Civilisation Latino-Américaine / Latin-American Civilization - undefined ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 10 ECTS

EC : Outils maths et numériques pour l'ingénieur(e) 2 - * ECTS

EC : Informatique et Société Numérique 2 / Informatics and numerical society 2 - toto ECTS

EC : Mathématiques S2 AM1 AM1 / Maths 2 - 5 ECTS

PARCOURS : Parcours ASINSA / ASINSA track - 30 ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 4 ECTS

EC : Conception mécanique 2 / Mechanical design 2 - undefined ECTS

EC : Enjeux de la Transition Ecologique 1 / Sustainable Development 1 - 2 ECTS

UE : Physique et Chimie / Physics and Chemistry - 12 ECTS

EC : Mécanique et Electricité 2 / Mechanics and Electricity 2 - 6 ECTS

EC : Transformations chimiques en solution aqueuse / Lab work Chemistry 1st year - 2 ECTS

EC : Thermodynamique générale / Thermodynamics - 4 ECTS

UE : Humanités / Humanities - 4 ECTS

EC : Théâtre - Écriture et Jeu / Theater - writing and playing - undefined ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 10 ECTS

EC : Mathématiques S2 FC-AS-EU / Maths 2 - 5 ECTS

EC : Outils maths et numériques pour l'ingénieur(e) 2 - * ECTS

EC : Informatique et Société Numérique 2 / Informatics and numerical society 2 - toto ECTS

PARCOURS : Parcours EURINSA / EURINSA track - 30 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 10 ECTS

EC : Mathématiques S2 FC-AS-EU / Maths 2 - 5 ECTS

EC : Outils maths et numériques pour l'ingénieur(e) 2 - * ECTS

EC : Informatique et Société Numérique 2 / Informatics and numerical society 2 - toto ECTS

UE : Physique et Chimie / Physics and Chemistry - 12 ECTS

EC : Mécanique et Electricité 2 / Mechanics and Electricity 2 - 6 ECTS

EC : Transformations chimiques en solution aqueuse / Lab work Chemistry 1st year - 2 ECTS

EC : Thermodynamique générale / Thermodynamics - 4 ECTS

UE : Humanités / Humanities - 4 ECTS

EC : Connaissance de l'Europe / Knowledge of Europe - undefined ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 4 ECTS

EC : Conception mécanique 2 / Mechanical design 2 - undefined ECTS

EC : Enjeux de la Transition Ecologique 1 / Sustainable Development 1 - 2 ECTS

PARCOURS : Parcours SCAN / SCAN track - 30 ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 4 ECTS

EC : Conception mécanique 2 / Mechanical design 2 - undefined ECTS

EC : Enjeux de la Transition Ecologique 1 / Sustainable Development 1 - 2 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 10 ECTS

EC : Outils maths et numériques pour l'ingénieur(e) 2 - * ECTS

EC : Informatique et Société Numérique 2 / Informatics and numerical society 2 - toto ECTS

EC : Mathématiques S2 SCAN2 / Maths 2 - 5 ECTS

UE : Humanités / Humanities - 4 ECTS

EC : Projets scientifiques transversaux / Transversal scientific projets - undefined ECTS

UE : Physique et Chimie / Physics and Chemistry - 12 ECTS

EC : Transformations chimiques en solution aqueuse / Lab work Chemistry 1st year - 2 ECTS

EC : Thermodynamique générale / Thermodynamics - 4 ECTS

EC : Mécanique et Electricité 2 / Mechanics and Electricity 2 - 6 ECTS

PARCOURS : Parcours INSAVENIR1 /INSAVENIR1 track - 30 ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 5 ECTS

EC : Enjeux de la Transition Ecologique 1 / Sustainable Development 1 - 2 ECTS

EC : Conception mécanique 2 / Mechanical design 2 - undefined ECTS

UE : Physique et Chimie / Physics and Chemistry - 11 ECTS

EC : Chimie 2 / Chemistry 2 - 1 ECTS

EC : Thermodynamique générale / Thermodynamics - 5 ECTS

EC : Physique 2 / Physics 2 - 5 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 9 ECTS

EC : Mathématiques S2 AV1 / Maths 2 - undefined ECTS

EC : Informatique et Société Numérique 2 / Informatics and numerical society 2 - undefined ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Cultures. Sciences. Sociétés 2 / Cultures, Sciences, Societies 2 - 2 ECTS

PARCOURS : Parcours Sportifs Haut Niveau / High Level Sport track - 21 ECTS

UE : Physique et Chimie / Physics and Chemistry - 6 ECTS

EC : Transformations chimiques en solution aqueuse / Lab work Chemistry 1st year - 2 ECTS

EC : Physique 2 / Physics 2 - 4 ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Connaissance de l'entreprise / Company knowledge - * ECTS

EC : Cultures. Sciences. Sociétés 2 / Cultures, Sciences, Societies 2 - 2 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 8 ECTS

EC : Outils maths et numériques pour l'ingénieur(e) 2 - * ECTS

EC : Informatique et Société Numérique 2 / Informatics and numerical society 2 - * ECTS

EC : Mathématiques S2 SHN0 / Maths 2 - 4 ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 2 ECTS

EC : Conception mécanique 2 / Mechanical design 2 - undefined ECTS

ANNEE : 2ème année / 2nd year - 60 ECTS

SEMESTRE : 1er semestre / 1st semester - 30 ECTS

PARCOURS : Parcours Sportifs Haut Niveau / High Level Sport track - 20 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 5 ECTS

EC : Informatique et Société Numérique / Informatics and numerical society - undefined ECTS

EC : Mathématiques / Maths - 4 ECTS

UE : Physique et Chimie / Physics and Chemistry - 6 ECTS

EC : Chimie / Chemistry - 3 ECTS

EC : Physique / Physics - 3 ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 4 ECTS

EC : Enjeux de la Transition Ecologique 2 / Sustainable Development 2 - 2 ECTS

EC : Conception-Prototypage / Concept-Prototyping - _ ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Stage / Internship - * ECTS

EC : Cultures. Sciences. Sociétés 3 / Cultures, Sciences, Societies 3 - 2 ECTS

PARCOURS : Parcours classique / standard track - 30 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 8 ECTS

EC : Informatique et Société Numérique 3 / Informatics and numerical society 3 - toto ECTS

EC : Mathématiques 3 / Maths 3 - 5 ECTS

UE : Physique et Chimie / Physics and Chemistry - 8 ECTS

EC : Physique : Electromagnetisme / Physics: Electromagnetism - 5 ECTS

EC : Chimie / Chemistry - 3 ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 9 ECTS

EC : Conception-Prototypage / Concept-Prototyping - _ ECTS

EC : Mécanique des systèmes 1 / System Mechanics 1 - 3.00 ECTS

EC : Enjeux de la Transition Ecologique 2 / Sustainable Development 2 - 2 ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Cultures. Sciences. Sociétés 3 / Cultures, Sciences, Societies 3 - 2 ECTS

PARCOURS : Parcours AMERINSA / AMERINSA track - 30 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 8 ECTS

EC : Informatique et Société Numérique 3 / Informatics and numerical society 3 - toto ECTS

EC : Mathématiques 3 / Maths 3 - 5 ECTS

UE : Physique et Chimie / Physics and Chemistry - 8 ECTS

EC : Physique : Electromagnetisme / Physics: Electromagnetism - 5 ECTS

EC : Chimie / Chemistry - 3 ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Cultures. Sciences. Sociétés 3 / Cultures, Sciences, Societies 3 - undefined ECTS

EC : Civilisation - Projets 1 / Civilisation - projects 1 - undefined ECTS

EC : langue et culture allemande 1 / German language and culture 1 - undefined ECTS

EC : CUlture et IDentité Européenne 1 / European culture and identity 1 - undefined ECTS

EC : Langue et Civilisation Espagnoles 1 / Spanish language and civilisation 1 - undefined ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 9 ECTS

EC : Conception-Prototypage / Concept-Prototyping - _ ECTS

EC : Mécanique des systèmes 1 / System Mechanics 1 - 3.00 ECTS

EC : Enjeux de la Transition Ecologique 2 / Sustainable Development 2 - 2 ECTS

PARCOURS : Parcours ASINSA / ASINSA track - 30 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 8 ECTS

EC : Informatique et Société Numérique 3 / Informatics and numerical society 3 - toto ECTS

EC : Mathématiques 3 / Maths 3 - 5 ECTS

UE : Physique et Chimie / Physics and Chemistry - 8 ECTS

EC : Physique : Electromagnetisme / Physics: Electromagnetism - 5 ECTS

EC : Chimie / Chemistry - 3 ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 9 ECTS

EC : Enjeux de la Transition Ecologique 2 / Sustainable Development 2 - 2 ECTS

EC : Conception-Prototypage / Concept-Prototyping - _ ECTS

EC : Mécanique des systèmes 1 / System Mechanics 1 - 3.00 ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Cultures. Sciences. Sociétés 3 / Cultures, Sciences, Societies 3 - undefined ECTS

PARCOURS : Parcours EURINSA / EURINSA track - 30 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 8 ECTS

EC : Informatique et Société Numérique 3 / Informatics and numerical society 3 - toto ECTS

EC : Mathématiques 3 / Maths 3 - 5 ECTS

UE : Physique et Chimie / Physics and Chemistry - 8 ECTS

EC : Physique : Electromagnetisme / Physics: Electromagnetism - 5 ECTS

EC : Chimie / Chemistry - 3 ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 9 ECTS

EC : Conception-Prototypage / Concept-Prototyping - _ ECTS

EC : Mécanique des systèmes 1 / System Mechanics 1 - 3.00 ECTS

EC : Enjeux de la Transition Ecologique 2 / Sustainable Development 2 - 2 ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Cultures. Sciences. Sociétés 3 / Cultures, Sciences, Societies 3 - undefined ECTS

EC : Civilisation - Projets 1 / Civilisation - projects 1 - undefined ECTS

EC : langue et culture allemande 1 / German language and culture 1 - undefined ECTS

EC : CUlture et IDentité Européenne 1 / European culture and identity 1 - undefined ECTS

EC : Langue et Civilisation Espagnoles 1 / Spanish language and civilisation 1 - undefined ECTS

PARCOURS : Parcours SCAN / SCAN track - 30 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 8 ECTS

EC : Informatique et Société Numérique 3 / Informatics and numerical society 3 - toto ECTS

EC : Mathématiques 3 / Maths 3 - 5 ECTS

UE : Physique et Chimie / Physics and Chemistry - 8 ECTS

EC : Physique : Electromagnetisme / Physics: Electromagnetism - 5 ECTS

EC : Chimie / Chemistry - 3 ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 9 ECTS

EC : Conception-Prototypage / Concept-Prototyping - _ ECTS

EC : Mécanique des systèmes 1 / System Mechanics 1 - 3.00 ECTS

EC : Enjeux de la Transition Ecologique 2 / Sustainable Development 2 - 2 ECTS

UE : Humanités / Humanities - 5 ECTS

EC : Cultures. Sciences. Sociétés 3 / Cultures, Sciences, Societies 3 - undefined ECTS

PARCOURS : Parcours Sportifs Haut Niveau / High Level Sport track - 21 ECTS

UE : Physique et Chimie / Physics and Chemistry - 6 ECTS

EC : Thermodynamique 1 / Thermodynamics 1 - 2 ECTS

EC : Physique 3 / Physics 3 - 4 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 7 ECTS

EC : Informatique et Société Numérique 3 / Informatics and numerical society 3 - toto - comme a dit Sophie ECTS

EC : Mathématiques 3 / Maths 3 - 5 ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 5 ECTS

EC : Mécanique des systèmes 1 / System Mechanics 1 - 3.00 ECTS

EC : Conception-Prototypage / Concept-Prototyping - _ ECTS

UE : Humanités / Humanities - 3 ECTS

SEMESTRE : 2ème semestre / 2nd semester - 30 ECTS

PARCOURS : Parcours Sportifs Haut Niveau / High Level Sport track - 20 ECTS

UE : Enseignement transversal : Projet pluridisciplinaire d'initiation à l'ingénierie / Pluridisciplinary Training Courses in Engineering - 10 ECTS

EC : L'énergie sous toutes ses formes / Energy in all forms - * ECTS

EC : Prototype et industrialisation / Prototype and industrialisation - undefined ECTS

EC : Mécatronique et robotique / Mechatronics and robotics - undefined ECTS

EC : Bio-ingénierie, Matériaux Polymères Biosourcés et Environnement / Bio-engineering, Biobased Polymer Materials and Environment - 10 ECTS

EC : L'Ingénierie pour le Sport, l'Art et la Santé : analyse et optimisation / Engineering for Sport, Art and Health: analysis and optimization - undefined ECTS

EC : Architecture Matérielle, Logicielle et Réseau pour les Données Capteurs / Hardware, Software and Network Architectures for Sensors Data - - ECTS

EC : Imagerie Industrielle et Médicale / Industrial and Medical Imaging - undefined ECTS

EC : Modélisation Numérique pour l'Ingénieur / Numerical Modeling for Engineers - undefined ECTS

UE : Humanités / Humanities - 2 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 5 ECTS

EC : Mathématiques / Maths - 3 ECTS

EC : Informatique et Société Numérique / Informatics and numerical society - undefined ECTS

UE : Physique / Physics - 3 ECTS

EC : Physique / Physics - 3 ECTS

PARCOURS : Parcours classique / standard track - 30 ECTS

UE : Physique et Mécanique / Physics and Mechanics - 6 ECTS

EC : Mécanique des systèmes 2 / System Mechanics 2 - 2.00 ECTS

EC : Physique : Ondes / Physics: waves - 4 ECTS

UE : Humanités / Humanities - 7 ECTS

EC : Stage / Internship - * ECTS

EC : Cultures. Sciences. Sociétés 4 / Cultures, Sciences, Societies 4 - 2 ECTS

UE : Enseignement transversal : Projet pluridisciplinaire d'initiation à l'ingénierie / Pluridisciplinary Training Courses in Engineering - 10 ECTS

EC : L'énergie sous toutes ses formes / Energy in all forms - * ECTS

EC : Prototype et industrialisation / Prototype and industrialisation - undefined ECTS

EC : Mécatronique et robotique / Mechatronics and robotics - undefined ECTS

EC : Bio-ingénierie, Matériaux Polymères Biosourcés et Environnement / Bio-engineering, Biobased Polymer Materials and Environment - 10 ECTS

EC : L'Ingénierie pour le Sport, l'Art et la Santé : analyse et optimisation / Engineering for Sport, Art and Health: analysis and optimization - undefined ECTS

EC : Architecture Matérielle, Logicielle et Réseau pour les Données Capteurs / Hardware, Software and Network Architectures for Sensors Data - - ECTS

EC : Imagerie Industrielle et Médicale / Industrial and Medical Imaging - undefined ECTS

EC : Modélisation Numérique pour l'Ingénieur / Numerical Modeling for Engineers - undefined ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 7 ECTS

EC : Mathématiques 4 / Maths 4 - 5 ECTS

EC : Informatique et Société Numérique 4 / Informatics and numerical society 4 - toto ECTS

PARCOURS : Parcours AMERINSA / AMERINSA track - 30 ECTS

UE : Physique et Mécanique / Physics and Mechanics - 6 ECTS

EC : Mécanique des systèmes 2 / System Mechanics 2 - 2.00 ECTS

EC : Physique : Ondes / Physics: waves - 4 ECTS

UE : Humanités / Humanities - 7 ECTS

EC : Stage / Internship - * ECTS

EC : Langue et Civilisation Espagnoles 2 / Spanish language and civilisation 2 - undefined ECTS

EC : langue et culture allemande 2 / German language and culture 2 - undefined ECTS

EC : CUlture et IDentité Européenne 2 / European culture and identity 2 - undefined ECTS

EC : Civilisation - Projets 2 / Civilisation - projects 2 - undefined ECTS

EC : Cultures. Sciences. Sociétés 4 / Cultures, Sciences, Societies 4 - undefined ECTS

UE : Enseignement transversal : Projet pluridisciplinaire d'initiation à l'ingénierie / Pluridisciplinary Training Courses in Engineering - 10 ECTS

EC : L'énergie sous toutes ses formes / Energy in all forms - * ECTS

EC : Prototype et industrialisation / Prototype and industrialisation - undefined ECTS

EC : Mécatronique et robotique / Mechatronics and robotics - undefined ECTS

EC : Bio-ingénierie, Matériaux Polymères Biosourcés et Environnement / Bio-engineering, Biobased Polymer Materials and Environment - 10 ECTS

EC : L'Ingénierie pour le Sport, l'Art et la Santé : analyse et optimisation / Engineering for Sport, Art and Health: analysis and optimization - undefined ECTS

EC : Architecture Matérielle, Logicielle et Réseau pour les Données Capteurs / Hardware, Software and Network Architectures for Sensors Data - - ECTS

EC : Imagerie Industrielle et Médicale / Industrial and Medical Imaging - undefined ECTS

EC : Modélisation Numérique pour l'Ingénieur / Numerical Modeling for Engineers - undefined ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 7 ECTS

EC : Mathématiques 4 / Maths 4 - 5 ECTS

EC : Informatique et Société Numérique 4 / Informatics and numerical society 4 - toto ECTS

PARCOURS : Parcours ASINSA / ASINSA track - 30 ECTS

UE : Physique et Mécanique / Physics and Mechanics - 6 ECTS

EC : Mécanique des systèmes 2 / System Mechanics 2 - 2.00 ECTS

EC : Physique : Ondes / Physics: waves - 4 ECTS

UE : Humanités / Humanities - 7 ECTS

EC : Stage / Internship - * ECTS

EC : Cultures. Sciences. Sociétés 4 / Cultures, Sciences, Societies 4 - undefined ECTS

UE : Enseignement transversal : Projet pluridisciplinaire d'initiation à l'ingénierie / Pluridisciplinary Training Courses in Engineering - 10 ECTS

EC : L'énergie sous toutes ses formes / Energy in all forms - * ECTS

EC : Prototype et industrialisation / Prototype and industrialisation - undefined ECTS

EC : Mécatronique et robotique / Mechatronics and robotics - undefined ECTS

EC : Bio-ingénierie, Matériaux Polymères Biosourcés et Environnement / Bio-engineering, Biobased Polymer Materials and Environment - 10 ECTS

EC : L'Ingénierie pour le Sport, l'Art et la Santé : analyse et optimisation / Engineering for Sport, Art and Health: analysis and optimization - undefined ECTS

EC : Architecture Matérielle, Logicielle et Réseau pour les Données Capteurs / Hardware, Software and Network Architectures for Sensors Data - - ECTS

EC : Imagerie Industrielle et Médicale / Industrial and Medical Imaging - undefined ECTS

EC : Modélisation Numérique pour l'Ingénieur / Numerical Modeling for Engineers - undefined ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 7 ECTS

EC : Mathématiques 4 / Maths 4 - 5 ECTS

EC : Informatique et Société Numérique 4 / Informatics and numerical society 4 - toto ECTS

PARCOURS : Parcours EURINSA / EURINSA track - 30 ECTS

UE : Physique et Mécanique / Physics and Mechanics - 6 ECTS

EC : Mécanique des systèmes 2 / System Mechanics 2 - 2.00 ECTS

EC : Physique : Ondes / Physics: waves - 4 ECTS

UE : Humanités / Humanities - 7 ECTS

EC : Stage / Internship - * ECTS

EC : Langue et Civilisation Espagnoles 2 / Spanish language and civilisation 2 - undefined ECTS

EC : langue et culture allemande 2 / German language and culture 2 - undefined ECTS

EC : CUlture et IDentité Européenne 2 / European culture and identity 2 - undefined ECTS

EC : Civilisation - Projets 2 / Civilisation - projects 2 - undefined ECTS

EC : Cultures. Sciences. Sociétés 4 / Cultures, Sciences, Societies 4 - undefined ECTS

UE : Enseignement transversal : Projet pluridisciplinaire d'initiation à l'ingénierie / Pluridisciplinary Training Courses in Engineering - 10 ECTS

EC : L'énergie sous toutes ses formes / Energy in all forms - * ECTS

EC : Prototype et industrialisation / Prototype and industrialisation - undefined ECTS

EC : Mécatronique et robotique / Mechatronics and robotics - undefined ECTS

EC : Bio-ingénierie, Matériaux Polymères Biosourcés et Environnement / Bio-engineering, Biobased Polymer Materials and Environment - 10 ECTS

EC : L'Ingénierie pour le Sport, l'Art et la Santé : analyse et optimisation / Engineering for Sport, Art and Health: analysis and optimization - undefined ECTS

EC : Architecture Matérielle, Logicielle et Réseau pour les Données Capteurs / Hardware, Software and Network Architectures for Sensors Data - - ECTS

EC : Imagerie Industrielle et Médicale / Industrial and Medical Imaging - undefined ECTS

EC : Modélisation Numérique pour l'Ingénieur / Numerical Modeling for Engineers - undefined ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 7 ECTS

EC : Mathématiques 4 / Maths 4 - 5 ECTS

EC : Informatique et Société Numérique 4 / Informatics and numerical society 4 - toto ECTS

PARCOURS : Parcours SCAN / SCAN track - 30 ECTS

UE : Physique et Mécanique / Physics and Mechanics - 6 ECTS

EC : Mécanique des systèmes 2 / System Mechanics 2 - 2.00 ECTS

EC : Physique : Ondes / Physics: waves - 4 ECTS

UE : Enseignement transversal : Projet pluridisciplinaire d'initiation à l'ingénierie / Pluridisciplinary Training Courses in Engineering - 10 ECTS

EC : L'énergie sous toutes ses formes / Energy in all forms - * ECTS

EC : Prototype et industrialisation / Prototype and industrialisation - undefined ECTS

EC : Mécatronique et robotique / Mechatronics and robotics - undefined ECTS

EC : Bio-ingénierie, Matériaux Polymères Biosourcés et Environnement / Bio-engineering, Biobased Polymer Materials and Environment - 10 ECTS

EC : L'Ingénierie pour le Sport, l'Art et la Santé : analyse et optimisation / Engineering for Sport, Art and Health: analysis and optimization - undefined ECTS

EC : Architecture Matérielle, Logicielle et Réseau pour les Données Capteurs / Hardware, Software and Network Architectures for Sensors Data - - ECTS

EC : Imagerie Industrielle et Médicale / Industrial and Medical Imaging - undefined ECTS

EC : Modélisation Numérique pour l'Ingénieur / Numerical Modeling for Engineers - undefined ECTS

UE : Humanités / Humanities - 7 ECTS

EC : Stage / Internship - * ECTS

EC : Cultures. Sciences. Sociétés 4 / Cultures, Sciences, Societies 4 - undefined ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 7 ECTS

EC : Mathématiques 4 / Maths 4 - 5 ECTS

EC : Informatique et Société Numérique 4 / Informatics and numerical society 4 - toto ECTS

PARCOURS : Parcours Sportifs Haut Niveau / High Level Sport track - 18 ECTS

UE : Humanités / Humanities - 4 ECTS

EC : Cultures. Sciences. Sociétés 2 / Cultures, Sciences, Societies 2 - 2 ECTS

UE : Physique et Chimie / Physics and Chemistry - 6 ECTS

EC : Physique 4 / Physics 4 - 4 ECTS

EC : Thermodynamique 2 / Thermodynamics 2 - 2 ECTS

UE : Mathématiques et Numérique / Maths and numerical science - 4 ECTS

- EC : Mathématiques 4 / Maths 4 - 2 ECTS
- EC : Informatique et Société Numérique 4 / Informatics and numerical society 4 - * ECTS

UE : systèmes Mécaniques et Environnement / Environment and Mechanical system - 4 ECTS

- EC : Mécanique des systèmes 2 / System Mechanics 2 - 2.00 ECTS
- EC : Enjeux de la Transition Ecologique 1 / Sustainable Development 1 - 2 ECTS

IDENTIFICATION

CODE : FIMI-1-S1-EC-SOL-TF-SH
ECTS : 1

HOURS

Cours :	2h
TD :	12h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	15h
Travail personnel :	14h
Total :	29h

ASSESMENT METHOD

Continuous monitoring

TEACHING AIDS

Various supports (Poly, slideshows, TD subjects, corrections), all available on the establishment's educational platform: Moodle.

TEACHING LANGUAGE

French
English

CONTACT

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M. RIVANO Hervé :
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AIMS

Targeted Learning Outcomes (AAv):

AAv0.1: At the end of S1, students are able to write a scientific report using basic office software functions.

AAv0.2: At the end of S1, students are able to independently conduct digital intelligence to develop their digital literacy, particularly through Pix courses.

CONTENT

* Spreadsheets:
+ 2 Tools: LibreOffice Calc and Excel
+ Elementary skills : formulas, relative/absolute references
+ Graph plots : relevant choice, regressions, error bars
+ GRG Solver

* Word processor :
+ 2 tools: Word and HedgeDoc (Markdown)
+ Elementary skills: style sheet, models, figures, references, tables of contents
+ Latex equations

* General culture :
+ INSA digital environment
+ Architecture of a computer
+ Operating system
+ Security
+ Bash command line
+ Environmental impact of digital

In particular, some Pix courses are used to prepare or complete homework themes.

BIBLIOGRAPHY

Computer science and digital sciences, Dowek et al., Eyrolles editions (2012) - chapters 7, 10, 13, 14, 15 and 18.

PRE-REQUISITES

Know how to use a computer.

IDENTIFICATION

CODE : FIMI-1-S1-EC-CO-TF-SH
ECTS : 2

HOURS

Cours :	0h
TD :	28h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	30h
Travail personnel :	20h
Total :	50h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French
English

CONTACT

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laurent.jarrier@insa-lyon.fr

Mme FOURMEAU Marion :
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AIMS

AAv. 1. Analyze and explain the operation of a simple mechanical system based on an overall drawing, a perspective, a digital model or the actual system.
AAv. 2. Explain technological choices in the context of a system.
AAv. 3. use a 3D modeler to create or modifier simple parts, assemblies and drawings.
AAv. 4. produce geometric views of simple parts by drawing on paper.

CONTENT

- Be able to read a definition drawing and an assembly drawing
- Be able to sketch a definition drawing of a single part (on paper)
- Be able to build a 3D model of a part using a CAD software and the definition drawing
- Be able to identify standard mechanical elements

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE : FIMI-1-S1-EC-CH-TF-SH
ECTS : 3

HOURS

Cours :	12h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	41h
Travail personnel :	35h
Total :	76h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Lecture and tutorial handouts.
First Cycle Moodle interface: all lecture tutorial documents, schedule and organization, MCQS, examination questions and answers in French and in English.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Express the relationships between quantities characteristic of the structure of an atom (quantum numbers, orbitals and quantified energy levels) in the form of formulae or graphical representations (Grotrian diagram, atomic orbitals)

Characterise chemical entities by exploiting spectral data
- by identifying the origin of radiation
- by using radiation (filtered or not) to produce other radiation.

Establish the electronic structure of an atom by linking it to the periodic table and to the physico-chemical properties of atoms (electronegativity, radius, ionisation energy)

Analyse the valence electronic layer of atoms (including atomic orbitals, hybridised or not) within a chemical entity
- by deducing its geometric properties (shape of buildings, angles) and its reactivity (mesomerism, multiple bonds, electron delocalisation).
- calculating degrees of oxidation to determine the oxidation-reduction properties of chemical entities.
- by analysing the physicochemical interactions between chemical entities (dipole moments, hydrogen bonding) to deduce properties (temperatures of change of state, polarity).

Apply the perfect crystal model to chemical structures (atoms, chemical entities) in order to deduce geometrical properties in 3 dimensions (symmetries, coordination, tangency, reduced coordinates, size and shape of insertion sites), and physical characteristics (lattice parameters, density, compactness) and structural characteristics (composition).

CONTENT

The engineering student will work and be assessed on the following themes:
- The quantum mechanical model of the atom
- Undulatory model of the atom
- The electronic configuration of a polyelectronic atom
- Periodic classification of elements
- Physical properties of elements
- X-ray spectroscopy
- Molecular / atomic / ionic bonds and interactions
- Architectures of crystallized solids

BIBLIOGRAPHY

- Chimie Générale : S.S. Zumdahl (Ed. De Boeck Université)
- Cours de Chimie-Physique et Exercices résolus de Chimie-Physique : P. Arnaud (Ed. Dunod)
- Chimie I, 1ère année PCSI, collection H Prépa (Chapitres 1 à 4) (Ed. Hachette)
- Chimie II, 1ère année PCSI, collection H Prépa (Chapitre 7) (Ed. Hachette)
- Introduction à la Science des Matériaux : W. Kurz, J.P. Mercier, G. Zambelli (Ed. Presses
Polytechniques Romandes)
- Chemical bonding: M.J. Winter (Oxford Chemistry Primers)
- http://chimie.net.free.fr/index2.htm (site opened on 14th October 2024)

PRE-REQUISITES

Chemistry and physics knowledge from secondary school (5th, Junior and Final years of high school) about atomic structure and the phases of matter.

IDENTIFICATION

CODE : FIMI-1-S1-EC-PH-FC
ECTS : 7

HOURS

Cours :	14h
TD :	44h
TP :	22h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	84h
Travail personnel :	90h
Total :	174h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

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M. Leguay Pierre-Marie :
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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Apply the different stages of the methodology for solving a simple open problem.
AAv.2 Formulate a literal expression and check its consistency.
AAv.3 Express accurately a numerical result with its unit, its uncertainty using the appropriate number of significant figures and in any system of units.
AAv.4 Construct and use a graphical representation of physical quantities.
AAv.5 Calculate the moments of forces with respect to a point or an axis and project forces onto axes to solve a statics problem and determine a position of equilibrium or the expression of a force, justifying the steps.
AAv.6 Solve a kinematic problem to study a rectilinear, circular or any other kind of movement, using either a graph (to obtain information about the movement) or analytical expressions in the Cartesian, cylindrical or Frenet basis.
AAv.7 Make a circuit from a diagram and vice versa, and model a 1st order continuous or transient electrical circuit.
AAv.8 Determine currents, voltages and energy quantities in a 1st order continuous or transient circuit from the characteristics of the components.
AAv.9 Apply the concepts seen in static mechanics and DC/transient electricity in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis.

CONTENT

- Introduction to the scientific approach
- Measurements and uncertainties
- Introduction to energy
- Electricity in continuous and transient regimes
- Mechanics: statics of the solid and kinematics

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors¿), statistics (average and standard deviation), data and functions plots.
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.

Informatics and numerical society 1

IDENTIFICATION

CODE : FIMI-1-S1-EC-ISN-TF
ECTS : toto

HOURS

Cours :	5h
TD :	31h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	37h
Travail personnel :	25h
Total :	62h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Course handouts
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes :
AAv1.1 : At the end of S1, students will be able to analyze a given Python program, describe its execution on example data and identify any problems.
AAv1.2 : At the end of S1, students will be able to write a program and simple python func-tions to solve a simple problem, while respecting good development practices.
AAv1.3 : At the end of S1, students will be able to use and adapt a number of basic algorithms to solve known simple problems.
AAv1.4 : At the end of S1, students will be able to select and use simple encodings and data structures adapted to the problem at hand (int, string, Boolean, 1D/2D lists, float), exploiting the concept of mutability where necessary.

CONTENT

1 - Algorithms and programming: notion of algorithm and program; primitive data types and typed expressions; variables and assignment instructions; functions.

2 - Conditional instructions, multiple alternatives

3 - Different types of iterative instructions

4 - Application of fundamental concepts to numerical sequences and numerical calculation

5 - Introduction to methods and modular programming: use of libraries; definition and use of functions; passing parameters; visibility of parameters and variables in a program

6 - Introduction to non-primitive types and data structures: lists

BIBLIOGRAPHY

PRE-REQUISITES

none

IDENTIFICATION

CODE : FIMI-1-S1-EC-MA-FC-AS
ECTS : 7

HOURS

Cours :	28h
TD :	52.5h
TP :	0h
Projet :	0h
Evaluation :	3.5h
Face à face pédagogique :	84h
Travail personnel :	90h
Total :	174h

ASSESMENT METHOD

Continuous evaluation :
- test 1 : duration 1,5 h, coefficient 1,5.
- test 2: duration 2 h, coefficient 2.
- final test: duration 3h, coefficient 3.

Concepts studied throughout the semester have to be known as prerequisite for future evaluations.

TEACHING AIDS

Online document under Moodle.

TEACHING LANGUAGE

French

CONTACT

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AIMS

AAv1.1 – Master the basics of logical reasoning (implication, equivalence, counterexample, proof by contradiction) and formal language to write rigorous proofs.
AAv1.2 – Identify common functions (polynomials, trigonometric, ln, exp, etc.), their properties (domain, parity, periodicity, limits), and compare their behavior at infinity.
AAv1.3 – Perform basic algebraic calculations: notable identities, factorizations, trigonometry, absolute value, powers, sums, and the binomial theorem.
AAv1.4 – Connect roots (simple or multiple) and polynomial factorization through Euclidean division.
AAv1.5 – Describe the behavior of a polynomial near its roots and at infinity.
AAv1.6 – Determine limits using comparison tools.
AAv1.7 – Compute integrals and find antiderivatives using integration by parts and change of variable.
AAv1.8 – Fully study a real function: domain, variations, limits, roots, extrema, and graph.
AAv1.9 – Solve linear systems using Gaussian elimination.
AAv1.10 – Identify vector subspaces in standard spaces ($\mathbb{R}^n$, $\mathbb{R}[X]$, $F(\mathbb{R},\mathbb{R})$).
AAv1.11 – Check whether a set of vectors is linearly independent/dependent and whether it forms a basis.
AAv1.12 – Find the dimension and a basis of a vector space, and express a vector in that basis.
AAv1.13 – Compute the rank of a set of vectors and a basis of the space it spans using row-echelon form.
AAv1.14 – Find the rank, image, kernel, and matrix of a linear map given analytically or through the image of a basis.
AAv1.15 – Test whether a linear map is injective, surjective, or bijective, especially using the rank theorem.

CONTENT

One-variable functions calculus with few repetitions from high school curriculum (Math Speciality).
Linear Algebra.

To be continued in the second semester.

BIBLIOGRAPHY

Azoulay-Avignant : Mathématiques (Ediscience)
Guinin-Aubonnet-Joppin : Précis de Mathématiques (Bréal)
Thuillier-Belloc : Mathématiques (Masson)
Lemberg: Bien commencer ses études en mathématiques (Vuibert)
Balac-Sturm : Algèbre et Analyse 1ère année et Exercices de 1ère année (PPUR)

PRE-REQUISITES

Complete curriculum of a European scientific high school.

IDENTIFICATION

CODE : FIMI-1-S1-EC-OMNI-FC
ECTS : *

HOURS

Cours :	11h
TD :	25h
TP :	6h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	43.5h
Travail personnel :	30h
Total :	73.5h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Lecture notes and exercices textbook, specific content of lanes available on Moodle.

TEACHING LANGUAGE

French

CONTACT

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AIMS

CONTENT

Vectors
Complex numbers
Differential calculus
Linear differential equations with constant coefficients
Curves, surfaces, coordinates systems

BIBLIOGRAPHY

PRE-REQUISITES

High school abilities.

IDENTIFICATION

CODE : FIMI-1-S1-EC-CSS-FC
ECTS : undefined

HOURS

Cours : 0h
TD : 26h
TP : 0h
Projet : 0h
Evaluation 0.016666666666666666h
Face à face pédagogique : 26.016666666666666h
Travail personnel : 22h
Total : 48.016666666666666h

ASSESMENT METHOD

- A continuous assessment section including the following exercises: presentation of a talk in a small group ("exposé militant")
- A 3-hour exam at the end of the semester (text study followed by a reasoned discussion).

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Humanities framework:
CT2 - WORK, LEARN, EVOLVE IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on one's own, seeking out the necessary resources
2.4 - Exercise one's critical faculties, think for oneself
CT3 - INTERACT WITH OTHERS, WORK WITH TEAMS
3. 1 - Communicate appropriately: convey a message, listen, show empathy, assert one's point of view, debate

3.2 - Situate one's original discourse with explicit references
3. 3 - Communicate non-verbally: posture and gestures
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Apprehend the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions¿
5.2 - Integrate a responsible dimension (deontology, ethics) into their actions; identify, evaluate and anticipate the consequences of their actions and decisions at different levels of scale.

CONTENT

- theme of the semester: the norme
- Notions of rhetoric and argumentation
- Written and oral communication exercises
- Reflections, positions, debates

BIBLIOGRAPHY

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.

PRE-REQUISITES

These are the achievements of secondary education: the ability to appropriate information, correctness of language, logic of thought, intellectual curiosity, the ability to conceptualize a problem and grasp its implications, to reflect...

IDENTIFICATION

CODE : FIMI-1-S1-EC-SOL-TF-SH
ECTS : 1

HOURS

Cours :	2h
TD :	12h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	15h
Travail personnel :	14h
Total :	29h

ASSESMENT METHOD

Continuous monitoring

TEACHING AIDS

Various supports (Poly, slideshows, TD subjects, corrections), all available on the establishment's educational platform: Moodle.

TEACHING LANGUAGE

French
English

CONTACT

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nicolas.stouls@insa-lyon.fr
M. RIVANO Hervé :
herve.rivano@insa-lyon.fr

AIMS

Targeted Learning Outcomes (AAv):

AAv0.1: At the end of S1, students are able to write a scientific report using basic office software functions.

AAv0.2: At the end of S1, students are able to independently conduct digital intelligence to develop their digital literacy, particularly through Pix courses.

CONTENT

* Spreadsheets:
+ 2 Tools: LibreOffice Calc and Excel
+ Elementary skills : formulas, relative/absolute references
+ Graph plots : relevant choice, regressions, error bars
+ GRG Solver

* Word processor :
+ 2 tools: Word and HedgeDoc (Markdown)
+ Elementary skills: style sheet, models, figures, references, tables of contents
+ Latex equations

* General culture :
+ INSA digital environment
+ Architecture of a computer
+ Operating system
+ Security
+ Bash command line
+ Environmental impact of digital

In particular, some Pix courses are used to prepare or complete homework themes.

BIBLIOGRAPHY

Computer science and digital sciences, Dowek et al., Eyrolles editions (2012) - chapters 7, 10, 13, 14, 15 and 18.

PRE-REQUISITES

Know how to use a computer.

IDENTIFICATION

CODE : FIMI-1-S1-EC-CO-TF-SH
ECTS : 2

HOURS

Cours :	0h
TD :	28h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	30h
Travail personnel :	20h
Total :	50h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

AAv. 1. Analyze and explain the operation of a simple mechanical system based on an overall drawing, a perspective, a digital model or the actual system.
AAv. 2. Explain technological choices in the context of a system.
AAv. 3. use a 3D modeler to create or modifier simple parts, assemblies and drawings.
AAv. 4. produce geometric views of simple parts by drawing on paper.

CONTENT

- Be able to read a definition drawing and an assembly drawing
- Be able to sketch a definition drawing of a single part (on paper)
- Be able to build a 3D model of a part using a CAD software and the definition drawing
- Be able to identify standard mechanical elements

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE :FIMI-1-S1-EC-OMNI-FI-SH

ECTS : *

HOURS

Cours :	11h
TD :	25h
TP :	6h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	43.5h
Travail personnel :	30h
Total :	73.5h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Lecture notes and exercices textbook, specific content of lanes available on Moodle.

TEACHING LANGUAGE

French
English

CONTACT

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M. Lame Olivier :
olivier.lame@insa-lyon.fr

AIMS

CONTENT

Vectors
Complex numbers
Differential calculus
Linear differential equations with constant coefficients
Curves, surfaces, coordinates systems

BIBLIOGRAPHY

PRE-REQUISITES

High school abilities.

Informatics and numerical society 1

IDENTIFICATION

CODE : FIMI-1-S1-EC-ISN-TF
ECTS : toto

HOURS

Cours :	5h
TD :	31h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	37h
Travail personnel :	25h
Total :	62h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Course handouts
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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Mme Merveille Odyssée :
odyssee.merveille@insa-lyon.fr

AIMS

Targeted learning outcomes :
AAv1.1 : At the end of S1, students will be able to analyze a given Python program, describe its execution on example data and identify any problems.
AAv1.2 : At the end of S1, students will be able to write a program and simple python func-tions to solve a simple problem, while respecting good development practices.
AAv1.3 : At the end of S1, students will be able to use and adapt a number of basic algorithms to solve known simple problems.
AAv1.4 : At the end of S1, students will be able to select and use simple encodings and data structures adapted to the problem at hand (int, string, Boolean, 1D/2D lists, float), exploiting the concept of mutability where necessary.

CONTENT

1 - Algorithms and programming: notion of algorithm and program; primitive data types and typed expressions; variables and assignment instructions; functions.

2 - Conditional instructions, multiple alternatives

3 - Different types of iterative instructions

4 - Application of fundamental concepts to numerical sequences and numerical calculation

5 - Introduction to methods and modular programming: use of libraries; definition and use of functions; passing parameters; visibility of parameters and variables in a program

6 - Introduction to non-primitive types and data structures: lists

BIBLIOGRAPHY

PRE-REQUISITES

none

IDENTIFICATION

CODE : FIMI-1-S1-EC-MA-AM
ECTS : 7

HOURS

Cours :	28h
TD :	52.5h
TP :	0h
Projet :	0h
Evaluation :	3.5h
Face à face pédagogique :	84h
Travail personnel :	90h
Total :	174h

ASSESMENT METHOD

Continuous evaluation :
- test 1 : duration 1,5 h, coefficient 1.
- test 2: duration 1,5 h, coefficient 1.
- final test: duration 3h, coefficient 2.

Concepts studied throughout the semester have to be known as prerequisite for future evaluations.

TEACHING AIDS

Online document under Moodle.

TEACHING LANGUAGE

French

CONTACT

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AIMS

AAv1.1 – Master the basics of logical reasoning (implication, equivalence, counterexample, proof by contradiction) and formal language to write rigorous proofs.
AAv1.2 – Identify common functions (polynomials, trigonometric, ln, exp, etc.), their properties (domain, parity, periodicity, limits), and compare their behavior at infinity.
AAv1.3 – Perform basic algebraic calculations: notable identities, factorizations, trigonometry, absolute value, powers, sums, and the binomial theorem.
AAv1.4 – Connect roots (simple or multiple) and polynomial factorization through Euclidean division.
AAv1.5 – Describe the behavior of a polynomial near its roots and at infinity.
AAv1.6 – Determine limits using comparison tools.
AAv1.7 – Compute integrals and find antiderivatives using integration by parts and change of variable.
AAv1.8 – Fully study a real function: domain, variations, limits, roots, extrema, and graph.
AAv1.9 – Solve linear systems using Gaussian elimination.
AAv1.10 – Identify vector subspaces in standard spaces ($\mathbb{R}^n$, $\mathbb{R}[X]$, $F(\mathbb{R},\mathbb{R})$).
AAv1.11 – Check whether a set of vectors is linearly independent/dependent and whether it forms a basis.
AAv1.12 – Find the dimension and a basis of a vector space, and express a vector in that basis.
AAv1.13 – Compute the rank of a set of vectors and a basis of the space it spans using row-echelon form.
AAv1.14 – Find the rank, image, kernel, and matrix of a linear map given analytically or through the image of a basis.
AAv1.15 – Test whether a linear map is injective, surjective, or bijective, especially using the rank theorem.

CONTENT

One-variable functions calculus with few repetitions from high school curriculum (Math Speciality).
Linear Algebra.

To be continued in the second semester.

BIBLIOGRAPHY

Azoulay-Avignant : Mathématiques (Ediscience)
Guinin-Aubonnet-Joppin : Précis de Mathématiques (Bréal)
Thuillier-Belloc : Mathématiques (Masson)
Lemberg: Bien commencer ses études en mathématiques (Vuibert)
Balac-Sturm : Algèbre et Analyse 1ère année et Exercices de 1ère année (PPUR)

PRE-REQUISITES

Complete curriculum of a European scientific high school.

Cultures, Sciences and Societies

IDENTIFICATION

CODE : FIMI-1-S1-EC-CSS-FI
ECTS : undefined

HOURS

Cours : 0h
TD : 26h
TP : 0h
Projet : 0h
Evaluation 0.016666666666666666h
Face à face pédagogique : 26.016666666666666h
Travail personnel : 22h
Total : 48.016666666666666h

ASSESMENT METHOD

Either:
- An individual written 'Summary note', and a short essay, coef 1
- A presentation 'Other & Elsewhere' in pairs or in groups of three; the aim is to adopt either a comparative approach (comparing similarities and differences, e.g. two models of town planning) or a reflective approach (how an intellectual and social boundary is constructed and how it evolves, e.g. 'humanity/animality'), with the aim of giving an account of the complexity of a socio-cultural object, coef 1

Or:
- a piece of writing in pairs or in groups of three, of the 'journalistic essay' type, coef 1
- an individual 'reflective essay' type, coef 1

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Humanities reference framework :
CT2 - WORK, LEARN AND DEVELOP INDEPENDENTLY
2.3 - Acquire new skills independently by seeking out the necessary resources
2.4 - Exercise a critical mind, think for oneself
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3.1 - Communicate appropriately: pass on a message, listen, show empathy, assert one's point of view, debate in a reasoned manner, etc.
argued
3.2 - Situate his/her original discourse using explicit references
3.3 - Communicate non-verbally: posture and body language
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.
5.2 - Integrate a responsible dimension (deontology, ethics) into their actions; identify, evaluate and anticipate the consequences of their actions and decisions at different levels of scale.

CONTENT

1/ The year is organised around one theme: Othernesses. It will be explored from different angles (all humanities, literature, even science and the history of science and technology) and will be used as a basis for some of the exercises.
2/ The aim is also to develop intercultural thinking specific to international sections, through these same exercises.
NB: Certain aspects of this programme may be adapted to meet the specific needs of a given international section.

BIBLIOGRAPHY

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.
Handout distributed by the teacher.

PRE-REQUISITES

The prerequisites are the skills acquired in secondary education: the ability to appropriate information, correct use of language, logical thinking, intellectual curiosity, the ability to conceptualise a problem and grasp what is at stake, reflection,…

IDENTIFICATION

CODE : FIMI-1-S1-EC-CH-TF-SH
ECTS : 3

HOURS

Cours :	12h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	41h
Travail personnel :	35h
Total :	76h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Lecture and tutorial handouts.
First Cycle Moodle interface: all lecture tutorial documents, schedule and organization, MCQS, examination questions and answers in French and in English.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Express the relationships between quantities characteristic of the structure of an atom (quantum numbers, orbitals and quantified energy levels) in the form of formulae or graphical representations (Grotrian diagram, atomic orbitals)

Characterise chemical entities by exploiting spectral data
- by identifying the origin of radiation
- by using radiation (filtered or not) to produce other radiation.

Establish the electronic structure of an atom by linking it to the periodic table and to the physico-chemical properties of atoms (electronegativity, radius, ionisation energy)

Analyse the valence electronic layer of atoms (including atomic orbitals, hybridised or not) within a chemical entity
- by deducing its geometric properties (shape of buildings, angles) and its reactivity (mesomerism, multiple bonds, electron delocalisation).
- calculating degrees of oxidation to determine the oxidation-reduction properties of chemical entities.
- by analysing the physicochemical interactions between chemical entities (dipole moments, hydrogen bonding) to deduce properties (temperatures of change of state, polarity).

Apply the perfect crystal model to chemical structures (atoms, chemical entities) in order to deduce geometrical properties in 3 dimensions (symmetries, coordination, tangency, reduced coordinates, size and shape of insertion sites), and physical characteristics (lattice parameters, density, compactness) and structural characteristics (composition).

CONTENT

The engineering student will work and be assessed on the following themes:
- The quantum mechanical model of the atom
- Undulatory model of the atom
- The electronic configuration of a polyelectronic atom
- Periodic classification of elements
- Physical properties of elements
- X-ray spectroscopy
- Molecular / atomic / ionic bonds and interactions
- Architectures of crystallized solids

BIBLIOGRAPHY

- Chimie Générale : S.S. Zumdahl (Ed. De Boeck Université)
- Cours de Chimie-Physique et Exercices résolus de Chimie-Physique : P. Arnaud (Ed. Dunod)
- Chimie I, 1ère année PCSI, collection H Prépa (Chapitres 1 à 4) (Ed. Hachette)
- Chimie II, 1ère année PCSI, collection H Prépa (Chapitre 7) (Ed. Hachette)
- Introduction à la Science des Matériaux : W. Kurz, J.P. Mercier, G. Zambelli (Ed. Presses
Polytechniques Romandes)
- Chemical bonding: M.J. Winter (Oxford Chemistry Primers)
- http://chimie.net.free.fr/index2.htm (site opened on 14th October 2024)

PRE-REQUISITES

Chemistry and physics knowledge from secondary school (5th, Junior and Final years of high school) about atomic structure and the phases of matter.

IDENTIFICATION

CODE FIMI-1-S1-EC-PH-AM-AS-EU

ECTS : 7

HOURS

Cours :	14h
TD :	44h
TP :	22h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	84h
Travail personnel :	90h
Total :	174h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

Mme Nychyporuk Tetyana :
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Mme Delmas Agnès :
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M. Raynaud Christophe :
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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Apply the different stages of the methodology for solving a simple open problem.
AAv.2 Formulate a literal expression and check its consistency.
AAv.3 Express accurately a numerical result with its unit, its uncertainty using the appropriate number of significant figures and in any system of units.
AAv.4 Construct and use a graphical representation of physical quantities.
AAv.5 Calculate the moments of forces with respect to a point or an axis and project forces onto axes to solve a statics problem and determine a position of equilibrium or the expression of a force, justifying the steps.
AAv.6 Solve a kinematic problem to study a rectilinear, circular or any other kind of movement, using either a graph (to obtain information about the movement) or analytical expressions in the Cartesian, cylindrical or Frenet basis.
AAv.7 Make a circuit from a diagram and vice versa, and model a 1st order continuous or transient electrical circuit.
AAv.8 Determine currents, voltages and energy quantities in a 1st order continuous or transient circuit from the characteristics of the components.
AAv.9 Apply the concepts seen in static mechanics and DC/transient electricity in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis.

CONTENT

- Introduction to the scientific approach
- Measurements and uncertainties
- Introduction to energy
- Electricity in continuous and transient regimes
- Mechanics: statics of the solid and kinematics

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors ...), statistics (average and standard deviation), data and functions plots.
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.

IDENTIFICATION

CODE : FIMI-1-S1-EC-SOL-TF-SH
ECTS : 1

HOURS

Cours :	2h
TD :	12h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	15h
Travail personnel :	14h
Total :	29h

ASSESMENT METHOD

Continuous monitoring

TEACHING AIDS

Various supports (Poly, slideshows, TD subjects, corrections), all available on the establishment's educational platform: Moodle.

TEACHING LANGUAGE

French
English

CONTACT

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herve.rivano@insa-lyon.fr

AIMS

Targeted Learning Outcomes (AAv):

AAv0.1: At the end of S1, students are able to write a scientific report using basic office software functions.

AAv0.2: At the end of S1, students are able to independently conduct digital intelligence to develop their digital literacy, particularly through Pix courses.

CONTENT

* Spreadsheets:
+ 2 Tools: LibreOffice Calc and Excel
+ Elementary skills : formulas, relative/absolute references
+ Graph plots : relevant choice, regressions, error bars
+ GRG Solver

* Word processor :
+ 2 tools: Word and HedgeDoc (Markdown)
+ Elementary skills: style sheet, models, figures, references, tables of contents
+ Latex equations

* General culture :
+ INSA digital environment
+ Architecture of a computer
+ Operating system
+ Security
+ Bash command line
+ Environmental impact of digital

In particular, some Pix courses are used to prepare or complete homework themes.

BIBLIOGRAPHY

Computer science and digital sciences, Dowek et al., Eyrolles editions (2012) - chapters 7, 10, 13, 14, 15 and 18.

PRE-REQUISITES

Know how to use a computer.

IDENTIFICATION

CODE : FIMI-1-S1-EC-CO-TF-SH
ECTS : 2

HOURS

Cours :	0h
TD :	28h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	30h
Travail personnel :	20h
Total :	50h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French
English

CONTACT

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Mme FOURMEAU Marion :
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AIMS

AAv. 1. Analyze and explain the operation of a simple mechanical system based on an overall drawing, a perspective, a digital model or the actual system.
AAv. 2. Explain technological choices in the context of a system.
AAv. 3. use a 3D modeler to create or modifier simple parts, assemblies and drawings.
AAv. 4. produce geometric views of simple parts by drawing on paper.

CONTENT

- Be able to read a definition drawing and an assembly drawing
- Be able to sketch a definition drawing of a single part (on paper)
- Be able to build a 3D model of a part using a CAD software and the definition drawing
- Be able to identify standard mechanical elements

BIBLIOGRAPHY

PRE-REQUISITES

Cultures, Sciences and Societies

IDENTIFICATION

CODE : FIMI-1-S1-EC-CSS-FI
ECTS : undefined

HOURS

Cours : 0h
TD : 26h
TP : 0h
Projet : 0h
Evaluation 0.016666666666666666h
Face à face pédagogique : 26.016666666666666h
Travail personnel : 22h
Total : 48.016666666666666h

ASSESMENT METHOD

Either:
- An individual written 'Summary note', and a short essay, coef 1
- A presentation 'Other & Elsewhere' in pairs or in groups of three; the aim is to adopt either a comparative approach (comparing similarities and differences, e.g. two models of town planning) or a reflective approach (how an intellectual and social boundary is constructed and how it evolves, e.g. 'humanity/animality'), with the aim of giving an account of the complexity of a socio-cultural object, coef 1

Or:
- a piece of writing in pairs or in groups of three, of the 'journalistic essay' type, coef 1
- an individual 'reflective essay' type, coef 1

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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M. Mihara Norio :
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M. Ligot Damien :
damien.ligot@insa-lyon.fr

AIMS

Humanities reference framework :
CT2 - WORK, LEARN AND DEVELOP INDEPENDENTLY
2.3 - Acquire new skills independently by seeking out the necessary resources
2.4 - Exercise a critical mind, think for oneself
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3.1 - Communicate appropriately: pass on a message, listen, show empathy, assert one's point of view, debate in a reasoned manner, etc.
argued
3.2 - Situate his/her original discourse using explicit references
3.3 - Communicate non-verbally: posture and body language
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.
5.2 - Integrate a responsible dimension (deontology, ethics) into their actions; identify, evaluate and anticipate the consequences of their actions and decisions at different levels of scale.

CONTENT

1/ The year is organised around one theme: Othernesses. It will be explored from different angles (all humanities, literature, even science and the history of science and technology) and will be used as a basis for some of the exercises.
2/ The aim is also to develop intercultural thinking specific to international sections, through these same exercises.
NB: Certain aspects of this programme may be adapted to meet the specific needs of a given international section.

BIBLIOGRAPHY

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.
Handout distributed by the teacher.

PRE-REQUISITES

The prerequisites are the skills acquired in secondary education: the ability to appropriate information, correct use of language, logical thinking, intellectual curiosity, the ability to conceptualise a problem and grasp what is at stake, reflection,…

IDENTIFICATION

CODE :FIMI-1-S1-EC-OMNI-FI-SH

ECTS : *

HOURS

Cours :	11h
TD :	25h
TP :	6h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	43.5h
Travail personnel :	30h
Total :	73.5h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Lecture notes and exercices textbook, specific content of lanes available on Moodle.

TEACHING LANGUAGE

French
English

CONTACT

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M. Lame Olivier :
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AIMS

CONTENT

Vectors
Complex numbers
Differential calculus
Linear differential equations with constant coefficients
Curves, surfaces, coordinates systems

BIBLIOGRAPHY

PRE-REQUISITES

High school abilities.

Informatics and numerical society 1

IDENTIFICATION

CODE : FIMI-1-S1-EC-ISN-TF
ECTS : toto

HOURS

Cours :	5h
TD :	31h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	37h
Travail personnel :	25h
Total :	62h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Course handouts
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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odyssee.merveille@insa-lyon.fr

AIMS

Targeted learning outcomes :
AAv1.1 : At the end of S1, students will be able to analyze a given Python program, describe its execution on example data and identify any problems.
AAv1.2 : At the end of S1, students will be able to write a program and simple python func-tions to solve a simple problem, while respecting good development practices.
AAv1.3 : At the end of S1, students will be able to use and adapt a number of basic algorithms to solve known simple problems.
AAv1.4 : At the end of S1, students will be able to select and use simple encodings and data structures adapted to the problem at hand (int, string, Boolean, 1D/2D lists, float), exploiting the concept of mutability where necessary.

CONTENT

1 - Algorithms and programming: notion of algorithm and program; primitive data types and typed expressions; variables and assignment instructions; functions.

2 - Conditional instructions, multiple alternatives

3 - Different types of iterative instructions

4 - Application of fundamental concepts to numerical sequences and numerical calculation

5 - Introduction to methods and modular programming: use of libraries; definition and use of functions; passing parameters; visibility of parameters and variables in a program

6 - Introduction to non-primitive types and data structures: lists

BIBLIOGRAPHY

PRE-REQUISITES

none

IDENTIFICATION

CODE : FIMI-1-S1-EC-MA-FC-AS
ECTS : 7

HOURS

Cours :	28h
TD :	52.5h
TP :	0h
Projet :	0h
Evaluation :	3.5h
Face à face pédagogique :	84h
Travail personnel :	90h
Total :	174h

ASSESMENT METHOD

Continuous evaluation :
- test 1 : duration 1,5 h, coefficient 1,5.
- test 2: duration 2 h, coefficient 2.
- final test: duration 3h, coefficient 3.

Concepts studied throughout the semester have to be known as prerequisite for future evaluations.

TEACHING AIDS

Online document under Moodle.

TEACHING LANGUAGE

French

CONTACT

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AIMS

AAv1.1 – Master the basics of logical reasoning (implication, equivalence, counterexample, proof by contradiction) and formal language to write rigorous proofs.
AAv1.2 – Identify common functions (polynomials, trigonometric, ln, exp, etc.), their properties (domain, parity, periodicity, limits), and compare their behavior at infinity.
AAv1.3 – Perform basic algebraic calculations: notable identities, factorizations, trigonometry, absolute value, powers, sums, and the binomial theorem.
AAv1.4 – Connect roots (simple or multiple) and polynomial factorization through Euclidean division.
AAv1.5 – Describe the behavior of a polynomial near its roots and at infinity.
AAv1.6 – Determine limits using comparison tools.
AAv1.7 – Compute integrals and find antiderivatives using integration by parts and change of variable.
AAv1.8 – Fully study a real function: domain, variations, limits, roots, extrema, and graph.
AAv1.9 – Solve linear systems using Gaussian elimination.
AAv1.10 – Identify vector subspaces in standard spaces ($\mathbb{R}^n$, $\mathbb{R}[X]$, $F(\mathbb{R},\mathbb{R})$).
AAv1.11 – Check whether a set of vectors is linearly independent/dependent and whether it forms a basis.
AAv1.12 – Find the dimension and a basis of a vector space, and express a vector in that basis.
AAv1.13 – Compute the rank of a set of vectors and a basis of the space it spans using row-echelon form.
AAv1.14 – Find the rank, image, kernel, and matrix of a linear map given analytically or through the image of a basis.
AAv1.15 – Test whether a linear map is injective, surjective, or bijective, especially using the rank theorem.

CONTENT

One-variable functions calculus with few repetitions from high school curriculum (Math Speciality).
Linear Algebra.

To be continued in the second semester.

BIBLIOGRAPHY

Azoulay-Avignant : Mathématiques (Ediscience)
Guinin-Aubonnet-Joppin : Précis de Mathématiques (Bréal)
Thuillier-Belloc : Mathématiques (Masson)
Lemberg: Bien commencer ses études en mathématiques (Vuibert)
Balac-Sturm : Algèbre et Analyse 1ère année et Exercices de 1ère année (PPUR)

PRE-REQUISITES

Complete curriculum of a European scientific high school.

IDENTIFICATION

CODE : FIMI-1-S1-EC-CH-TF-SH
ECTS : 3

HOURS

Cours :	12h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	41h
Travail personnel :	35h
Total :	76h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Lecture and tutorial handouts.
First Cycle Moodle interface: all lecture tutorial documents, schedule and organization, MCQS, examination questions and answers in French and in English.

TEACHING LANGUAGE

French
English

CONTACT

M. Mary Nicolas :
nicolas.mary@insa-lyon.fr

M. Garnier Vincent :
vincent.garnier@insa-lyon.fr

AIMS

Express the relationships between quantities characteristic of the structure of an atom (quantum numbers, orbitals and quantified energy levels) in the form of formulae or graphical representations (Grotrian diagram, atomic orbitals)

Characterise chemical entities by exploiting spectral data
- by identifying the origin of radiation
- by using radiation (filtered or not) to produce other radiation.

Establish the electronic structure of an atom by linking it to the periodic table and to the physico-chemical properties of atoms (electronegativity, radius, ionisation energy)

Analyse the valence electronic layer of atoms (including atomic orbitals, hybridised or not) within a chemical entity
- by deducing its geometric properties (shape of buildings, angles) and its reactivity (mesomerism, multiple bonds, electron delocalisation).
- calculating degrees of oxidation to determine the oxidation-reduction properties of chemical entities.
- by analysing the physicochemical interactions between chemical entities (dipole moments, hydrogen bonding) to deduce properties (temperatures of change of state, polarity).

Apply the perfect crystal model to chemical structures (atoms, chemical entities) in order to deduce geometrical properties in 3 dimensions (symmetries, coordination, tangency, reduced coordinates, size and shape of insertion sites), and physical characteristics (lattice parameters, density, compactness) and structural characteristics (composition).

CONTENT

The engineering student will work and be assessed on the following themes:
- The quantum mechanical model of the atom
- Undulatory model of the atom
- The electronic configuration of a polyelectronic atom
- Periodic classification of elements
- Physical properties of elements
- X-ray spectroscopy
- Molecular / atomic / ionic bonds and interactions
- Architectures of crystallized solids

BIBLIOGRAPHY

- Chimie Générale : S.S. Zumdahl (Ed. De Boeck Université)
- Cours de Chimie-Physique et Exercices résolus de Chimie-Physique : P. Arnaud (Ed. Dunod)
- Chimie I, 1ère année PCSI, collection H Prépa (Chapitres 1 à 4) (Ed. Hachette)
- Chimie II, 1ère année PCSI, collection H Prépa (Chapitre 7) (Ed. Hachette)
- Introduction à la Science des Matériaux : W. Kurz, J.P. Mercier, G. Zambelli (Ed. Presses
Polytechniques Romandes)
- Chemical bonding: M.J. Winter (Oxford Chemistry Primers)
- http://chimie.net.free.fr/index2.htm (site opened on 14th October 2024)

PRE-REQUISITES

Chemistry and physics knowledge from secondary school (5th, Junior and Final years of high school) about atomic structure and the phases of matter.

IDENTIFICATION

CODE FIMI-1-S1-EC-PH-AM-AS-EU

ECTS : 7

HOURS

Cours :	14h
TD :	44h
TP :	22h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	84h
Travail personnel :	90h
Total :	174h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

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Mme Delmas Agnès :
Agnes.delmas@insa-lyon.fr

M. Raynaud Christophe :
christophe.raynaud@insa-lyon.fr

AIMS

Targeted learning outcomes (TLA) :

AAv.1 Apply the different stages of the methodology for solving a simple open problem.
AAv.2 Formulate a literal expression and check its consistency.
AAv.3 Express accurately a numerical result with its unit, its uncertainty using the appropriate number of significant figures and in any system of units.
AAv.4 Construct and use a graphical representation of physical quantities.
AAv.5 Calculate the moments of forces with respect to a point or an axis and project forces onto axes to solve a statics problem and determine a position of equilibrium or the expression of a force, justifying the steps.
AAv.6 Solve a kinematic problem to study a rectilinear, circular or any other kind of movement, using either a graph (to obtain information about the movement) or analytical expressions in the Cartesian, cylindrical or Frenet basis.
AAv.7 Make a circuit from a diagram and vice versa, and model a 1st order continuous or transient electrical circuit.
AAv.8 Determine currents, voltages and energy quantities in a 1st order continuous or transient circuit from the characteristics of the components.
AAv.9 Apply the concepts seen in static mechanics and DC/transient electricity in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis.

CONTENT

- Introduction to the scientific approach
- Measurements and uncertainties
- Introduction to energy
- Electricity in continuous and transient regimes
- Mechanics: statics of the solid and kinematics

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors ...), statistics (average and standard deviation), data and functions plots.
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.

IDENTIFICATION

CODE : FIMI-1-S1-EC-SOL-TF-SH
ECTS : 1

HOURS

Cours :	2h
TD :	12h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	15h
Travail personnel :	14h
Total :	29h

ASSESMENT METHOD

Continuous monitoring

TEACHING AIDS

Various supports (Poly, slideshows, TD subjects, corrections), all available on the establishment's educational platform: Moodle.

TEACHING LANGUAGE

French
English

CONTACT

M. Stouls Nicolas :
nicolas.stouls@insa-lyon.fr
M. RIVANO Hervé :
herve.rivano@insa-lyon.fr

AIMS

Targeted Learning Outcomes (AAv):

AAv0.1: At the end of S1, students are able to write a scientific report using basic office software functions.

AAv0.2: At the end of S1, students are able to independently conduct digital intelligence to develop their digital literacy, particularly through Pix courses.

CONTENT

* Spreadsheets:
+ 2 Tools: LibreOffice Calc and Excel
+ Elementary skills : formulas, relative/absolute references
+ Graph plots : relevant choice, regressions, error bars
+ GRG Solver

* Word processor :
+ 2 tools: Word and HedgeDoc (Markdown)
+ Elementary skills: style sheet, models, figures, references, tables of contents
+ Latex equations

* General culture :
+ INSA digital environment
+ Architecture of a computer
+ Operating system
+ Security
+ Bash command line
+ Environmental impact of digital

In particular, some Pix courses are used to prepare or complete homework themes.

BIBLIOGRAPHY

Computer science and digital sciences, Dowek et al., Eyrolles editions (2012) - chapters 7, 10, 13, 14, 15 and 18.

PRE-REQUISITES

Know how to use a computer.

IDENTIFICATION

CODE : FIMI-1-S1-EC-CO-TF-SH
ECTS : 2

HOURS

Cours :	0h
TD :	28h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	30h
Travail personnel :	20h
Total :	50h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French
English

CONTACT

M. JARRIER Laurent :
laurent.jarrier@insa-lyon.fr

Mme FOURMEAU Marion :
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AIMS

AAv. 1. Analyze and explain the operation of a simple mechanical system based on an overall drawing, a perspective, a digital model or the actual system.
AAv. 2. Explain technological choices in the context of a system.
AAv. 3. use a 3D modeler to create or modifier simple parts, assemblies and drawings.
AAv. 4. produce geometric views of simple parts by drawing on paper.

CONTENT

- Be able to read a definition drawing and an assembly drawing
- Be able to sketch a definition drawing of a single part (on paper)
- Be able to build a 3D model of a part using a CAD software and the definition drawing
- Be able to identify standard mechanical elements

BIBLIOGRAPHY

PRE-REQUISITES

Cultures, Sciences and Societies

IDENTIFICATION

CODE : FIMI-1-S1-EC-CSS-FI
ECTS : undefined

HOURS

Cours : 0h
TD : 26h
TP : 0h
Projet : 0h
Evaluation 0.016666666666666666h
Face à face pédagogique : 26.016666666666666h
Travail personnel : 22h
Total : 48.016666666666666h

ASSESMENT METHOD

Either:
- An individual written 'Summary note', and a short essay, coef 1
- A presentation 'Other & Elsewhere' in pairs or in groups of three; the aim is to adopt either a comparative approach (comparing similarities and differences, e.g. two models of town planning) or a reflective approach (how an intellectual and social boundary is constructed and how it evolves, e.g. 'humanity/animality'), with the aim of giving an account of the complexity of a socio-cultural object, coef 1

Or:
- a piece of writing in pairs or in groups of three, of the 'journalistic essay' type, coef 1
- an individual 'reflective essay' type, coef 1

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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M. Ligot Damien :
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AIMS

Humanities reference framework :
CT2 - WORK, LEARN AND DEVELOP INDEPENDENTLY
2.3 - Acquire new skills independently by seeking out the necessary resources
2.4 - Exercise a critical mind, think for oneself
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3.1 - Communicate appropriately: pass on a message, listen, show empathy, assert one's point of view, debate in a reasoned manner, etc.
argued
3.2 - Situate his/her original discourse using explicit references
3.3 - Communicate non-verbally: posture and body language
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.
5.2 - Integrate a responsible dimension (deontology, ethics) into their actions; identify, evaluate and anticipate the consequences of their actions and decisions at different levels of scale.

CONTENT

1/ The year is organised around one theme: Othernesses. It will be explored from different angles (all humanities, literature, even science and the history of science and technology) and will be used as a basis for some of the exercises.
2/ The aim is also to develop intercultural thinking specific to international sections, through these same exercises.
NB: Certain aspects of this programme may be adapted to meet the specific needs of a given international section.

BIBLIOGRAPHY

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.
Handout distributed by the teacher.

PRE-REQUISITES

The prerequisites are the skills acquired in secondary education: the ability to appropriate information, correct use of language, logical thinking, intellectual curiosity, the ability to conceptualise a problem and grasp what is at stake, reflection,…

IDENTIFICATION

CODE :FIMI-1-S1-EC-OMNI-FI-SH

ECTS : *

HOURS

Cours :	11h
TD :	25h
TP :	6h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	43.5h
Travail personnel :	30h
Total :	73.5h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Lecture notes and exercices textbook, specific content of lanes available on Moodle.

TEACHING LANGUAGE

French
English

CONTACT

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emmanuel.risler@insa-lyon.fr

M. Lame Olivier :
olivier.lame@insa-lyon.fr

AIMS

CONTENT

Vectors
Complex numbers
Differential calculus
Linear differential equations with constant coefficients
Curves, surfaces, coordinates systems

BIBLIOGRAPHY

PRE-REQUISITES

High school abilities.

Informatics and numerical society 1

IDENTIFICATION

CODE : FIMI-1-S1-EC-ISN-TF
ECTS : toto

HOURS

Cours :	5h
TD :	31h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	37h
Travail personnel :	25h
Total :	62h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Course handouts
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes :
AAv1.1 : At the end of S1, students will be able to analyze a given Python program, describe its execution on example data and identify any problems.
AAv1.2 : At the end of S1, students will be able to write a program and simple python func-tions to solve a simple problem, while respecting good development practices.
AAv1.3 : At the end of S1, students will be able to use and adapt a number of basic algorithms to solve known simple problems.
AAv1.4 : At the end of S1, students will be able to select and use simple encodings and data structures adapted to the problem at hand (int, string, Boolean, 1D/2D lists, float), exploiting the concept of mutability where necessary.

CONTENT

1 - Algorithms and programming: notion of algorithm and program; primitive data types and typed expressions; variables and assignment instructions; functions.

2 - Conditional instructions, multiple alternatives

3 - Different types of iterative instructions

4 - Application of fundamental concepts to numerical sequences and numerical calculation

5 - Introduction to methods and modular programming: use of libraries; definition and use of functions; passing parameters; visibility of parameters and variables in a program

6 - Introduction to non-primitive types and data structures: lists

BIBLIOGRAPHY

PRE-REQUISITES

none

IDENTIFICATION

CODE : FIMI-1-S1-EC-MA-EU
ECTS : 7

HOURS

Cours :	28h
TD :	52.5h
TP :	0h
Projet :	0h
Evaluation :	3.5h
Face à face pédagogique :	84h
Travail personnel :	90h
Total :	174h

ASSESMENT METHOD

Continuous evaluation :
- test 1 : duration 1,5 h, coefficient 1,5.
- test 2: duration 1,5 h, coefficient 1,5.
- final test: duration 2h, coefficient 2.

Concepts studied throughout the semester have to be known as prerequisite for future evaluations.

TEACHING AIDS

Online document under Moodle.

TEACHING LANGUAGE

French

CONTACT

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loic.calbert@insa-lyon.fr

AIMS

AAv1.1 – Master the basics of logical reasoning (implication, equivalence, counterexample, proof by contradiction) and formal language to write rigorous proofs.
AAv1.2 – Identify common functions (polynomials, trigonometric, ln, exp, etc.), their properties (domain, parity, periodicity, limits), and compare their behavior at infinity.
AAv1.3 – Perform basic algebraic calculations: notable identities, factorizations, trigonometry, absolute value, powers, sums, and the binomial theorem.
AAv1.4 – Connect roots (simple or multiple) and polynomial factorization through Euclidean division.
AAv1.5 – Describe the behavior of a polynomial near its roots and at infinity.
AAv1.6 – Determine limits using comparison tools.
AAv1.7 – Compute integrals and find antiderivatives using integration by parts and change of variable.
AAv1.8 – Fully study a real function: domain, variations, limits, roots, extrema, and graph.
AAv1.9 – Solve linear systems using Gaussian elimination.
AAv1.10 – Identify vector subspaces in standard spaces ($\mathbb{R}^n$, $\mathbb{R}[X]$, $F(\mathbb{R},\mathbb{R})$).
AAv1.11 – Check whether a set of vectors is linearly independent/dependent and whether it forms a basis.
AAv1.12 – Find the dimension and a basis of a vector space, and express a vector in that basis.
AAv1.13 – Compute the rank of a set of vectors and a basis of the space it spans using row-echelon form.
AAv1.14 – Find the rank, image, kernel, and matrix of a linear map given analytically or through the image of a basis.
AAv1.15 – Test whether a linear map is injective, surjective, or bijective, especially using the rank theorem.

CONTENT

One-variable functions calculus with few repetitions from high school curriculum (Math Speciality).
Linear Algebra.

To be continued in the second semester.

BIBLIOGRAPHY

Azoulay-Avignant : Mathématiques (Ediscience)
Guinin-Aubonnet-Joppin : Précis de Mathématiques (Bréal)
Thuillier-Belloc : Mathématiques (Masson)
Lemberg: Bien commencer ses études en mathématiques (Vuibert)
Balac-Sturm : Algèbre et Analyse 1ère année et Exercices de 1ère année (PPUR)

PRE-REQUISITES

Complete curriculum of a European scientific high school.

IDENTIFICATION

CODE : FIMI-1-S1-EC-CH-TF-SH
ECTS : 3

HOURS

Cours :	12h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	41h
Travail personnel :	35h
Total :	76h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Lecture and tutorial handouts.
First Cycle Moodle interface: all lecture tutorial documents, schedule and organization, MCQS, examination questions and answers in French and in English.

TEACHING LANGUAGE

French
English

CONTACT

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M. Garnier Vincent :
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AIMS

Express the relationships between quantities characteristic of the structure of an atom (quantum numbers, orbitals and quantified energy levels) in the form of formulae or graphical representations (Grotrian diagram, atomic orbitals)

Characterise chemical entities by exploiting spectral data
- by identifying the origin of radiation
- by using radiation (filtered or not) to produce other radiation.

Establish the electronic structure of an atom by linking it to the periodic table and to the physico-chemical properties of atoms (electronegativity, radius, ionisation energy)

Analyse the valence electronic layer of atoms (including atomic orbitals, hybridised or not) within a chemical entity
- by deducing its geometric properties (shape of buildings, angles) and its reactivity (mesomerism, multiple bonds, electron delocalisation).
- calculating degrees of oxidation to determine the oxidation-reduction properties of chemical entities.
- by analysing the physicochemical interactions between chemical entities (dipole moments, hydrogen bonding) to deduce properties (temperatures of change of state, polarity).

Apply the perfect crystal model to chemical structures (atoms, chemical entities) in order to deduce geometrical properties in 3 dimensions (symmetries, coordination, tangency, reduced coordinates, size and shape of insertion sites), and physical characteristics (lattice parameters, density, compactness) and structural characteristics (composition).

CONTENT

The engineering student will work and be assessed on the following themes:
- The quantum mechanical model of the atom
- Undulatory model of the atom
- The electronic configuration of a polyelectronic atom
- Periodic classification of elements
- Physical properties of elements
- X-ray spectroscopy
- Molecular / atomic / ionic bonds and interactions
- Architectures of crystallized solids

BIBLIOGRAPHY

- Chimie Générale : S.S. Zumdahl (Ed. De Boeck Université)
- Cours de Chimie-Physique et Exercices résolus de Chimie-Physique : P. Arnaud (Ed. Dunod)
- Chimie I, 1ère année PCSI, collection H Prépa (Chapitres 1 à 4) (Ed. Hachette)
- Chimie II, 1ère année PCSI, collection H Prépa (Chapitre 7) (Ed. Hachette)
- Introduction à la Science des Matériaux : W. Kurz, J.P. Mercier, G. Zambelli (Ed. Presses
Polytechniques Romandes)
- Chemical bonding: M.J. Winter (Oxford Chemistry Primers)
- http://chimie.net.free.fr/index2.htm (site opened on 14th October 2024)

PRE-REQUISITES

Chemistry and physics knowledge from secondary school (5th, Junior and Final years of high school) about atomic structure and the phases of matter.

IDENTIFICATION

CODE FIMI-1-S1-EC-PH-AM-AS-EU

ECTS : 7

HOURS

Cours :	14h
TD :	44h
TP :	22h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	84h
Travail personnel :	90h
Total :	174h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

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M. Raynaud Christophe :
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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Apply the different stages of the methodology for solving a simple open problem.
AAv.2 Formulate a literal expression and check its consistency.
AAv.3 Express accurately a numerical result with its unit, its uncertainty using the appropriate number of significant figures and in any system of units.
AAv.4 Construct and use a graphical representation of physical quantities.
AAv.5 Calculate the moments of forces with respect to a point or an axis and project forces onto axes to solve a statics problem and determine a position of equilibrium or the expression of a force, justifying the steps.
AAv.6 Solve a kinematic problem to study a rectilinear, circular or any other kind of movement, using either a graph (to obtain information about the movement) or analytical expressions in the Cartesian, cylindrical or Frenet basis.
AAv.7 Make a circuit from a diagram and vice versa, and model a 1st order continuous or transient electrical circuit.
AAv.8 Determine currents, voltages and energy quantities in a 1st order continuous or transient circuit from the characteristics of the components.
AAv.9 Apply the concepts seen in static mechanics and DC/transient electricity in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis.

CONTENT

- Introduction to the scientific approach
- Measurements and uncertainties
- Introduction to energy
- Electricity in continuous and transient regimes
- Mechanics: statics of the solid and kinematics

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors ...), statistics (average and standard deviation), data and functions plots.
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.

IDENTIFICATION

CODE : FIMI-1-S1-EC-SOL-TF-SH
ECTS : 1

HOURS

Cours :	2h
TD :	12h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	15h
Travail personnel :	14h
Total :	29h

ASSESMENT METHOD

Continuous monitoring

TEACHING AIDS

Various supports (Poly, slideshows, TD subjects, corrections), all available on the establishment's educational platform: Moodle.

TEACHING LANGUAGE

French
English

CONTACT

M. Stouls Nicolas :
nicolas.stouls@insa-lyon.fr
M. RIVANO Hervé :
herve.rivano@insa-lyon.fr

AIMS

Targeted Learning Outcomes (AAv):

AAv0.1: At the end of S1, students are able to write a scientific report using basic office software functions.

AAv0.2: At the end of S1, students are able to independently conduct digital intelligence to develop their digital literacy, particularly through Pix courses.

CONTENT

* Spreadsheets:
+ 2 Tools: LibreOffice Calc and Excel
+ Elementary skills : formulas, relative/absolute references
+ Graph plots : relevant choice, regressions, error bars
+ GRG Solver

* Word processor :
+ 2 tools: Word and HedgeDoc (Markdown)
+ Elementary skills: style sheet, models, figures, references, tables of contents
+ Latex equations

* General culture :
+ INSA digital environment
+ Architecture of a computer
+ Operating system
+ Security
+ Bash command line
+ Environmental impact of digital

In particular, some Pix courses are used to prepare or complete homework themes.

BIBLIOGRAPHY

Computer science and digital sciences, Dowek et al., Eyrolles editions (2012) - chapters 7, 10, 13, 14, 15 and 18.

PRE-REQUISITES

Know how to use a computer.

IDENTIFICATION

CODE : FIMI-1-S1-EC-CO-TF-SH
ECTS : 2

HOURS

Cours :	0h
TD :	28h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	30h
Travail personnel :	20h
Total :	50h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French
English

CONTACT

M. JARRIER Laurent :
laurent.jarrier@insa-lyon.fr

Mme FOURMEAU Marion :
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AIMS

AAv. 1. Analyze and explain the operation of a simple mechanical system based on an overall drawing, a perspective, a digital model or the actual system.
AAv. 2. Explain technological choices in the context of a system.
AAv. 3. use a 3D modeler to create or modifier simple parts, assemblies and drawings.
AAv. 4. produce geometric views of simple parts by drawing on paper.

CONTENT

- Be able to read a definition drawing and an assembly drawing
- Be able to sketch a definition drawing of a single part (on paper)
- Be able to build a 3D model of a part using a CAD software and the definition drawing
- Be able to identify standard mechanical elements

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE :FIMI-1-S1-EC-OMNI-FI-SH

ECTS : *

HOURS

Cours :	11h
TD :	25h
TP :	6h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	43.5h
Travail personnel :	30h
Total :	73.5h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Lecture notes and exercices textbook, specific content of lanes available on Moodle.

TEACHING LANGUAGE

French
English

CONTACT

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M. Lame Olivier :
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AIMS

CONTENT

Vectors
Complex numbers
Differential calculus
Linear differential equations with constant coefficients
Curves, surfaces, coordinates systems

BIBLIOGRAPHY

PRE-REQUISITES

High school abilities.

IDENTIFICATION

CODE : FIMI-1-S1-EC-MA-SC
ECTS : 7

HOURS

Cours :	28h
TD :	52.5h
TP :	0h
Projet :	0h
Evaluation :	3.5h
Face à face pédagogique :	84h
Travail personnel :	90h
Total :	174h

ASSESMENT METHOD

2 test of 1h45 (IE1,IE2).
The final grade is : AVERAGE(IE1,IE2).
No final exam (due to projects).

TEACHING AIDS

Course handout (with exercises)

TEACHING LANGUAGE

English

CONTACT

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AIMS

AAv1.1 – Master the basics of logical reasoning (implication, equivalence, counterexample, proof by contradiction) and formal language to write rigorous proofs.
AAv1.2 – Identify common functions (polynomials, trigonometric, ln, exp, etc.), their properties (domain, parity, periodicity, limits), and compare their behavior at infinity.
AAv1.3 – Perform basic algebraic calculations: notable identities, factorizations, trigonometry, absolute value, powers, sums, and the binomial theorem.
AAv1.4 – Connect roots (simple or multiple) and polynomial factorization through Euclidean division.
AAv1.5 – Describe the behavior of a polynomial near its roots and at infinity.
AAv1.6 – Determine limits using comparison tools.
AAv1.7 – Compute integrals and find antiderivatives using integration by parts and change of variable.
AAv1.8 – Fully study a real function: domain, variations, limits, roots, extrema, and graph.
AAv1.9 – Solve linear systems using Gaussian elimination.
AAv1.10 – Identify vector subspaces in standard spaces ($\mathbb{R}^n$, $\mathbb{R}[X]$, $F(\mathbb{R},\mathbb{R})$).
AAv1.11 – Check whether a set of vectors is linearly independent/dependent and whether it forms a basis.
AAv1.12 – Find the dimension and a basis of a vector space, and express a vector in that basis.
AAv1.13 – Compute the rank of a set of vectors and a basis of the space it spans using row-echelon form.
AAv1.14 – Find the rank, image, kernel, and matrix of a linear map given analytically or through the image of a basis.
AAv1.15 – Test whether a linear map is injective, surjective, or bijective, especially using the rank theorem.

CONTENT

One-variable functions calculus with few repetitions from high school curriculum (Math Speciality).
Linear Algebra.

To be continued in the second semester.

BIBLIOGRAPHY

Azoulay-Avignant : Mathématiques (Ediscience)
Guinin-Aubonnet-Joppin : Précis de Mathématiques (Bréal)
Thuillier-Belloc : Mathématiques (Masson)
Lemberg: Bien commencer ses études en mathématiques (Vuibert)
Balac-Sturm : Algèbre et Analyse 1ère année et Exercices de 1ère année (PPUR)

PRE-REQUISITES

Complete curriculum of a European scientific high school.

Informatics and numerical society 1

IDENTIFICATION

CODE : FIMI-1-S1-EC-ISN-TF
ECTS : toto

HOURS

Cours :	5h
TD :	31h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	37h
Travail personnel :	25h
Total :	62h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Course handouts
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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Mme Merveille Odyssée :
odyssee.merveille@insa-lyon.fr

AIMS

Targeted learning outcomes :
AAv1.1 : At the end of S1, students will be able to analyze a given Python program, describe its execution on example data and identify any problems.
AAv1.2 : At the end of S1, students will be able to write a program and simple python func-tions to solve a simple problem, while respecting good development practices.
AAv1.3 : At the end of S1, students will be able to use and adapt a number of basic algorithms to solve known simple problems.
AAv1.4 : At the end of S1, students will be able to select and use simple encodings and data structures adapted to the problem at hand (int, string, Boolean, 1D/2D lists, float), exploiting the concept of mutability where necessary.

CONTENT

1 - Algorithms and programming: notion of algorithm and program; primitive data types and typed expressions; variables and assignment instructions; functions.

2 - Conditional instructions, multiple alternatives

3 - Different types of iterative instructions

4 - Application of fundamental concepts to numerical sequences and numerical calculation

5 - Introduction to methods and modular programming: use of libraries; definition and use of functions; passing parameters; visibility of parameters and variables in a program

6 - Introduction to non-primitive types and data structures: lists

BIBLIOGRAPHY

PRE-REQUISITES

none

Cultures, Sciences and Societies

IDENTIFICATION

CODE : FIMI-1-S1-EC-CSS-FI
ECTS : undefined

HOURS

Cours : 0h
TD : 26h
TP : 0h
Projet : 0h
Evaluation 0.016666666666666666h
Face à face pédagogique : 26.016666666666666h
Travail personnel : 22h
Total : 48.016666666666666h

ASSESMENT METHOD

Either:
- An individual written 'Summary note', and a short essay, coef 1
- A presentation 'Other & Elsewhere' in pairs or in groups of three; the aim is to adopt either a comparative approach (comparing similarities and differences, e.g. two models of town planning) or a reflective approach (how an intellectual and social boundary is constructed and how it evolves, e.g. 'humanity/animality'), with the aim of giving an account of the complexity of a socio-cultural object, coef 1

Or:
- a piece of writing in pairs or in groups of three, of the 'journalistic essay' type, coef 1
- an individual 'reflective essay' type, coef 1

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Humanities reference framework :
CT2 - WORK, LEARN AND DEVELOP INDEPENDENTLY
2.3 - Acquire new skills independently by seeking out the necessary resources
2.4 - Exercise a critical mind, think for oneself
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3.1 - Communicate appropriately: pass on a message, listen, show empathy, assert one's point of view, debate in a reasoned manner, etc.
argued
3.2 - Situate his/her original discourse using explicit references
3.3 - Communicate non-verbally: posture and body language
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.
5.2 - Integrate a responsible dimension (deontology, ethics) into their actions; identify, evaluate and anticipate the consequences of their actions and decisions at different levels of scale.

CONTENT

1/ The year is organised around one theme: Othernesses. It will be explored from different angles (all humanities, literature, even science and the history of science and technology) and will be used as a basis for some of the exercises.
2/ The aim is also to develop intercultural thinking specific to international sections, through these same exercises.
NB: Certain aspects of this programme may be adapted to meet the specific needs of a given international section.

BIBLIOGRAPHY

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.
Handout distributed by the teacher.

PRE-REQUISITES

The prerequisites are the skills acquired in secondary education: the ability to appropriate information, correct use of language, logical thinking, intellectual curiosity, the ability to conceptualise a problem and grasp what is at stake, reflection,…

IDENTIFICATION

CODE : FIMI-1-S1-EC-PH-SC
ECTS : 7

HOURS

Cours :	14h
TD :	44h
TP :	22h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	84h
Travail personnel :	90h
Total :	174h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings. Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

English

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Apply the different stages of the methodology for solving a simple open problem.
AAv.2 Formulate a literal expression and check its consistency.
AAv.3 Express accurately a numerical result with its unit, its uncertainty using the appropriate number of significant figures and in any system of units.
AAv.4 Construct and use a graphical representation of physical quantities.
AAv.5 Calculate the moments of forces with respect to a point or an axis and project forces onto axes to solve a statics problem and determine a position of equilibrium or the expression of a force, justifying the steps.
AAv.6 Solve a kinematic problem to study a rectilinear, circular or any other kind of movement, using either a graph (to obtain information about the movement) or analytical expressions in the Cartesian, cylindrical or Frenet basis.
AAv.7 Make a circuit from a diagram and vice versa, and model a 1st order continuous or transient electrical circuit.
AAv.8 Determine currents, voltages and energy quantities in a 1st order continuous or transient circuit from the characteristics of the components.
AAv.9 Apply the concepts seen in static mechanics and DC/transient electricity in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis.

CONTENT

- Introduction to the scientific approach
- Measurements and uncertainties
- Introduction to energy
- Electricity in continuous and transient regimes
- Mechanics: statics of the solid and kinematics

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors¿), statistics (average and standard deviation), data and functions plots.
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.

IDENTIFICATION

CODE : FIMI-1-S1-EC-CH-TF-SH
ECTS : 3

HOURS

Cours :	12h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	41h
Travail personnel :	35h
Total :	76h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Lecture and tutorial handouts.
First Cycle Moodle interface: all lecture tutorial documents, schedule and organization, MCQS, examination questions and answers in French and in English.

TEACHING LANGUAGE

French
English

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AIMS

Express the relationships between quantities characteristic of the structure of an atom (quantum numbers, orbitals and quantified energy levels) in the form of formulae or graphical representations (Grotrian diagram, atomic orbitals)

Characterise chemical entities by exploiting spectral data
- by identifying the origin of radiation
- by using radiation (filtered or not) to produce other radiation.

Establish the electronic structure of an atom by linking it to the periodic table and to the physico-chemical properties of atoms (electronegativity, radius, ionisation energy)

Analyse the valence electronic layer of atoms (including atomic orbitals, hybridised or not) within a chemical entity
- by deducing its geometric properties (shape of buildings, angles) and its reactivity (mesomerism, multiple bonds, electron delocalisation).
- calculating degrees of oxidation to determine the oxidation-reduction properties of chemical entities.
- by analysing the physicochemical interactions between chemical entities (dipole moments, hydrogen bonding) to deduce properties (temperatures of change of state, polarity).

Apply the perfect crystal model to chemical structures (atoms, chemical entities) in order to deduce geometrical properties in 3 dimensions (symmetries, coordination, tangency, reduced coordinates, size and shape of insertion sites), and physical characteristics (lattice parameters, density, compactness) and structural characteristics (composition).

CONTENT

The engineering student will work and be assessed on the following themes:
- The quantum mechanical model of the atom
- Undulatory model of the atom
- The electronic configuration of a polyelectronic atom
- Periodic classification of elements
- Physical properties of elements
- X-ray spectroscopy
- Molecular / atomic / ionic bonds and interactions
- Architectures of crystallized solids

BIBLIOGRAPHY

- Chimie Générale : S.S. Zumdahl (Ed. De Boeck Université)
- Cours de Chimie-Physique et Exercices résolus de Chimie-Physique : P. Arnaud (Ed. Dunod)
- Chimie I, 1ère année PCSI, collection H Prépa (Chapitres 1 à 4) (Ed. Hachette)
- Chimie II, 1ère année PCSI, collection H Prépa (Chapitre 7) (Ed. Hachette)
- Introduction à la Science des Matériaux : W. Kurz, J.P. Mercier, G. Zambelli (Ed. Presses
Polytechniques Romandes)
- Chemical bonding: M.J. Winter (Oxford Chemistry Primers)
- http://chimie.net.free.fr/index2.htm (site opened on 14th October 2024)

PRE-REQUISITES

Chemistry and physics knowledge from secondary school (5th, Junior and Final years of high school) about atomic structure and the phases of matter.

IDENTIFICATION

CODE : FIMI-1-S1-EC-CH-AV1
ECTS : 4

HOURS

Cours :	12h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	40h
Travail personnel :	40h
Total :	80h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Lecture and tutorial handouts.
First Cycle Moodle interface: all lecture tutorial documents, schedule and organization, MCQS, examination questions and answers in French and in English.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Express the relationships between quantities characteristic of the structure of an atom (quantum numbers, orbitals and quantified energy levels) in the form of formulae or graphical representations (Grotrian diagram, atomic orbitals)

Characterise chemical entities by exploiting spectral data
- by identifying the origin of radiation
- by using radiation (filtered or not) to produce other radiation.

Establish the electronic structure of an atom by linking it to the periodic table and to the physico-chemical properties of atoms (electronegativity, radius, ionisation energy)

Analyse the valence electronic layer of atoms (including atomic orbitals, hybridised or not) within a chemical entity
- by deducing its geometric properties (shape of buildings, angles) and its reactivity (mesomerism, multiple bonds, electron delocalisation).
- calculating degrees of oxidation to determine the oxidation-reduction properties of chemical entities.
- by analysing the physicochemical interactions between chemical entities (dipole moments, hydrogen bonding) to deduce properties (temperatures of change of state, polarity).

Apply the perfect crystal model to chemical structures (atoms, chemical entities) in order to deduce geometrical properties in 3 dimensions (symmetries, coordination, tangency, reduced coordinates, size and shape of insertion sites), and physical characteristics (lattice parameters, density, compactness) and structural characteristics (composition).

CONTENT

The engineering student will work and be assessed on the following themes:
- The quantum mechanical model of the atom
- Undulatory model of the atom
- The electronic configuration of a polyelectronic atom
- Periodic classification of elements
- Physical properties of elements
- X-ray spectroscopy
- Molecular / atomic / ionic bonds and interactions
- Architectures of crystallized solids

BIBLIOGRAPHY

- Chimie Générale : S.S. Zumdahl (Ed. De Boeck Université)
- Cours de Chimie-Physique et Exercices résolus de Chimie-Physique : P. Arnaud (Ed. Dunod)
- Chimie I, 1ère année PCSI, collection H Prépa (Chapitres 1 à 4) (Ed. Hachette)
- Chimie II, 1ère année PCSI, collection H Prépa (Chapitre 7) (Ed. Hachette)
- Introduction à la Science des Matériaux : W. Kurz, J.P. Mercier, G. Zambelli (Ed. Presses Polytechniques Romandes)
- Chemical bonding: M.J. Winter (Oxford Chemistry Primers)
- http://chimie.net.free.fr/index2.htm (site opened on 14th October 2024)

PRE-REQUISITES

Chemistry and physics knowledge from secondary school (5th, Junior and Final years of high school) about atomic structure and the phases of matter.

IDENTIFICATION

CODE : FIMI-1-S1-EC-PH-AV1
ECTS : 4

HOURS

Cours :	11h
TD :	23h
TP :	4h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	40h
Travail personnel :	40h
Total :	80h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Solve a dynamics problem: establish and exploit the differential equation describing motion and the equation of trajectory or the literal expression of a force or moment using a precise methodology.
AAv.2 Use a mechanical energy balance to determine either speeds at a given point, or particular positions, or the expression of forces, or the equation of motion (differential equation or trajectory).
AAv.3 Analyse the stability of an equilibrium position of a mechanical system using either mechanical actions (forces or moments) or potential energy. Study free and forced oscillations around a stable equilibrium position.

CONTENT

Mechanics :
- point dynamics (momentum, Newton's three laws, simple pendulum);
- energy aspects (work and power, kinetic and potential energy, mechanical energy theorem);
- introduction to solid dynamics (translation and rotation around a fixed axis)

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

This course will use the knowledge and know-how acquired in Mathematical and Numerical Tools for Engineers during the first year.
All the notions of physics covered in S1 and S2 of the first year will be considered as acquired.

IDENTIFICATION

CODE : FIMI-1-S1-EC-CSS-AV1
ECTS : 2

HOURS

Cours :	0h
TD :	25h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	25h
Travail personnel :	25h
Total :	50h

ASSESMENT METHOD

- A continuous assessment section including the following exercises: presentation of a talk in a small group ("exposé militant")
- A 3-hour exam at the end of the semester (text study followed by a reasoned discussion).

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Humanities framework:
CT2 - WORK, LEARN, EVOLVE IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on one's own, seeking out the necessary resources
2.4 - Exercise one's critical faculties, think for oneself
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3.1 - Communicate appropriately: convey a message, listen, show empathy, assert one's point of view, debate in a well-argued way

3. 2 - Situate one's original discourse with explicit references
3.3 - Communicate non-verbally: posture and gestures
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.
5.2 - Integrate a responsible dimension (deontology, ethics) into their actions; identify, evaluate and anticipate the consequences of their actions and decisions at different levels of scale.

CONTENT

- Theme of the program: the norm
- Notions of rhetoric and argumentation
- Written and oral communication exercises
- Reflections, positions, debates

BIBLIOGRAPHY

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.

PRE-REQUISITES

Year's achievements AVE0

IDENTIFICATION

CODE : FIMI-1-S1-EC-MA-AV1
ECTS : undefined

HOURS

Cours :	16.5h
TD :	31.5h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	50h
Travail personnel :	50h
Total :	100h

ASSESMENT METHOD

Students are evaluated with written tests during the semester.

TEACHING AIDS

Lecture notes, slideshow, TD topics available on Moodle

TEACHING LANGUAGE

French

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AIMS

Under construction, see the program below.

CONTENT

1. Linear algebra in R^3
2. Reduction of endomorphisms
3. Complements to real analysis: equivalents, recurrence, integrals

BIBLIOGRAPHY

PRE-REQUISITES

Mathematics program of AVE0: linear and asymptotic approximation, polynomials, reciprocal functions, linear algebra, and reduction in R^2.

Calculus program of AVE0: real calculus, trigonometry, complex numbers.

IDENTIFICATION

CODE : FIMI-1-S1-EC-OMNI-AV1
ECTS : *

HOURS

Cours :	4h
TD :	21h
TP :	4h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	30h
Travail personnel :	30h
Total :	60h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Lecture notes and exercices textbook.

TEACHING LANGUAGE

French

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AIMS

CONTENT

Multiple integrals
Scalar and vector fields

BIBLIOGRAPHY

PRE-REQUISITES

High school and insavenir year 0 abilities.

Informatics and numerical society 1

IDENTIFICATION

CODE : FIMI-1-S1-EC-ISN-AV1
ECTS : undefined

HOURS

Cours :	4h
TD :	24.5h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	30h
Travail personnel :	30h
Total :	60h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French

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AIMS

Targeted learning outcomes :

AAv1.1 : At the end of S1, students will be able to analyze a given Python program, describe its execution on example data and identify any problems.

AAv1.2 : At the end of S1, students will be able to write a program and simple python func-tions to solve a simple problem, while respecting good development practices.

AAv1.3 : At the end of S1, students will be able to use and adapt a number of basic algorithms to solve known simple problems.

AAv1.4 : At the end of S1, students will be able to select and use simple encodings and data structures adapted to the problem at hand (int, string, Boolean, 1D/2D lists, float), exploiting the concept of mutability where necessary.

CONTENT

1 - Algorithms and programming: notion of algorithm and program; notion of compilation/ interpretation; primitive data types and typed expressions; variables and assignment instructions; functions.
2 - Conditional instructions, multiple alternatives
3 - Different types of iterative instructions
4 - Application of fundamental concepts to numerical sequences and numerical calculation
5 - Introduction to methods and modular programming: use of libraries; definition and use of functions; passing parameters; visibility of parameters and variables in a program
6 - Introduction to non-primitive types and data structures: lists

BIBLIOGRAPHY

PRE-REQUISITES

none

IDENTIFICATION

CODE : FIMI-1-S1-EC-PR-AV1
ECTS : undefined

HOURS

Cours :	4h
TD :	2h
TP :	8h
Projet :	46h
Evaluation :	0h
Face à face pédagogique :	14h
Travail personnel :	60h
Total :	120h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

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AIMS

CONTENT

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE : FIMI-1-S1-EC-CO-AV1
ECTS : *

HOURS

Cours :	0h
TD :	28h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	30h
Travail personnel :	30h
Total :	60h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French

CONTACT

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AIMS

AAv. 1. Analyze and explain the operation of a simple mechanical system based on an overall drawing, a perspective, a digital model or the actual system.
AAv. 2. Explain technological choices in the context of a system.
AAv. 3. use a 3D modeler to create or modifier simple parts, assemblies and drawings.
AAv. 4. produce geometric views of simple parts by drawing on paper.

CONTENT

- Be able to read a definition drawing and an assembly drawing
- Be able to sketch a definition drawing of a single part (on paper)
- Be able to build a 3D model of a part using a CAD software and the definition drawing
- Be able to identify standard mechanical elements

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE : FIMI-1-S1-EC-SOL-TF-SH
ECTS : 1

HOURS

Cours :	2h
TD :	12h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	15h
Travail personnel :	14h
Total :	29h

ASSESMENT METHOD

Continuous monitoring

TEACHING AIDS

Various supports (Poly, slideshows, TD subjects, corrections), all available on the establishment's educational platform: Moodle.

TEACHING LANGUAGE

French
English

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AIMS

Targeted Learning Outcomes (AAv):

AAv0.1: At the end of S1, students are able to write a scientific report using basic office software functions.

AAv0.2: At the end of S1, students are able to independently conduct digital intelligence to develop their digital literacy, particularly through Pix courses.

CONTENT

* Spreadsheets:
+ 2 Tools: LibreOffice Calc and Excel
+ Elementary skills : formulas, relative/absolute references
+ Graph plots : relevant choice, regressions, error bars
+ GRG Solver

* Word processor :
+ 2 tools: Word and HedgeDoc (Markdown)
+ Elementary skills: style sheet, models, figures, references, tables of contents
+ Latex equations

* General culture :
+ INSA digital environment
+ Architecture of a computer
+ Operating system
+ Security
+ Bash command line
+ Environmental impact of digital

In particular, some Pix courses are used to prepare or complete homework themes.

BIBLIOGRAPHY

Computer science and digital sciences, Dowek et al., Eyrolles editions (2012) - chapters 7, 10, 13, 14, 15 and 18.

PRE-REQUISITES

Know how to use a computer.

IDENTIFICATION

CODE : FIMI-1-S1-EC-CO-TF-SH
ECTS : 2

HOURS

Cours :	0h
TD :	28h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	30h
Travail personnel :	20h
Total :	50h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

AAv. 1. Analyze and explain the operation of a simple mechanical system based on an overall drawing, a perspective, a digital model or the actual system.
AAv. 2. Explain technological choices in the context of a system.
AAv. 3. use a 3D modeler to create or modifier simple parts, assemblies and drawings.
AAv. 4. produce geometric views of simple parts by drawing on paper.

CONTENT

- Be able to read a definition drawing and an assembly drawing
- Be able to sketch a definition drawing of a single part (on paper)
- Be able to build a 3D model of a part using a CAD software and the definition drawing
- Be able to identify standard mechanical elements

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE :FIMI-1-S1-EC-OMNI-FI-SH

ECTS : *

HOURS

Cours :	11h
TD :	25h
TP :	6h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	43.5h
Travail personnel :	30h
Total :	73.5h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Lecture notes and exercices textbook, specific content of lanes available on Moodle.

TEACHING LANGUAGE

French
English

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AIMS

CONTENT

Vectors
Complex numbers
Differential calculus
Linear differential equations with constant coefficients
Curves, surfaces, coordinates systems

BIBLIOGRAPHY

PRE-REQUISITES

High school abilities.

IDENTIFICATION

CODE : FIMI-1-S1-EC-MA-SH
ECTS : 4

HOURS

Cours :	18h
TD :	32h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	53h
Travail personnel :	50h
Total :	103h

ASSESMENT METHOD

2 tests of 1h30 (named IE1 and IE2) and a test of 3h (names DS), and 4 to 5 mini tests of 15 minutes maximum, the average of these tests is named MT.

Coefficient of the 1h30 tests : 2
Coefficient of the 3h test : 4
Coefficient of MT : 1.

Averaging with consideration of excused absences for illness, per semestre :
(2*IE1+2*IE2+4*DS+MT)/9.

The excused absences for sportive reasons will systematically lead to a substitutional test, the teacher will decide what kind.

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

The 1st Semester is entirely dedicated to the study of functions of a real variable started in High School.

It contributes to the following abilities in Engineer School :

C1 - analyse a system or issue
C2 - Exploit a Real or Virtual system Model
C6 - Communicate an analysis, a scientific path, in an argued and logical discussion

In this frame, the student will work and be tested on the following abilities :

C11 - Break down a problem into a set of interacting sub-parts
C15 - Identify issues or action objectives.
C16 - Build a proof.
C25 - Use algebraic and numerical computation techniques.
C54 - Results interpretation
C55 - Make a synthesis of intermediate results in response to questioning.
C62 - Make a reasoned solution respecting a balance between everyday language and symbolic language.

CONTENT

Single real variable calculus.

BIBLIOGRAPHY

(i) Azoulay-Avignant : Mathématiques (Ediscience)
(ii) Guinin-Aubonnet-Joppin : Précis de Mathématiques (Bréal)
(iii) S. Balac, F. Sturm, Algèbre et Analyse, Cours de Mathématiques de première année avec exercices corrigés, Presses Polytechniques et Universitaires Romandes (collection des Sciences Appliquées de l'INSA de Lyon).

PRE-REQUISITES

The French Terminale high-school program.

Informatics and numerical society 1

IDENTIFICATION

CODE : FIMI-1-S1-EC-ISN-SH
ECTS : *

HOURS

Cours :	2h
TD :	11h
TP :	0h
Projet :	0h
Evaluation :	0.016666666666666666h
Face à face pédagogique :	13.016666666666667h
Travail personnel :	10h
Total :	23.016666666666666h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French

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AIMS

Targeted learning outcomes :

AAv0.1: By the end of S1, students will be able to write a scientific report, making appropriate use of the basic functionalities of office automation tools.

AAv0.2 : At the end of S1, students are able to independently conduct a digital watch to develop their digital culture, in particular via Pix courses.

AAv1.1 : At the end of S1, students will be able to analyze a given Python program, describe its execution on example data and identify any problems.

CONTENT

- Digital tools (word, excel, markdown, latex equations)
- Digital literacy (environmental impact, computer architecture, digital hygiene)
- Python conditionals and control structures
- Lists and sequence paths

BIBLIOGRAPHY

PRE-REQUISITES

none

IDENTIFICATION

CODE : FIMI-1-S1-EC-CH-TF-SH
ECTS : 3

HOURS

Cours :	12h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	41h
Travail personnel :	35h
Total :	76h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Lecture and tutorial handouts.
First Cycle Moodle interface: all lecture tutorial documents, schedule and organization, MCQS, examination questions and answers in French and in English.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Express the relationships between quantities characteristic of the structure of an atom (quantum numbers, orbitals and quantified energy levels) in the form of formulae or graphical representations (Grotrian diagram, atomic orbitals)

Characterise chemical entities by exploiting spectral data
- by identifying the origin of radiation
- by using radiation (filtered or not) to produce other radiation.

Establish the electronic structure of an atom by linking it to the periodic table and to the physico-chemical properties of atoms (electronegativity, radius, ionisation energy)

Analyse the valence electronic layer of atoms (including atomic orbitals, hybridised or not) within a chemical entity
- by deducing its geometric properties (shape of buildings, angles) and its reactivity (mesomerism, multiple bonds, electron delocalisation).
- calculating degrees of oxidation to determine the oxidation-reduction properties of chemical entities.
- by analysing the physicochemical interactions between chemical entities (dipole moments, hydrogen bonding) to deduce properties (temperatures of change of state, polarity).

Apply the perfect crystal model to chemical structures (atoms, chemical entities) in order to deduce geometrical properties in 3 dimensions (symmetries, coordination, tangency, reduced coordinates, size and shape of insertion sites), and physical characteristics (lattice parameters, density, compactness) and structural characteristics (composition).

CONTENT

The engineering student will work and be assessed on the following themes:
- The quantum mechanical model of the atom
- Undulatory model of the atom
- The electronic configuration of a polyelectronic atom
- Periodic classification of elements
- Physical properties of elements
- X-ray spectroscopy
- Molecular / atomic / ionic bonds and interactions
- Architectures of crystallized solids

BIBLIOGRAPHY

- Chimie Générale : S.S. Zumdahl (Ed. De Boeck Université)
- Cours de Chimie-Physique et Exercices résolus de Chimie-Physique : P. Arnaud (Ed. Dunod)
- Chimie I, 1ère année PCSI, collection H Prépa (Chapitres 1 à 4) (Ed. Hachette)
- Chimie II, 1ère année PCSI, collection H Prépa (Chapitre 7) (Ed. Hachette)
- Introduction à la Science des Matériaux : W. Kurz, J.P. Mercier, G. Zambelli (Ed. Presses
Polytechniques Romandes)
- Chemical bonding: M.J. Winter (Oxford Chemistry Primers)
- http://chimie.net.free.fr/index2.htm (site opened on 14th October 2024)

PRE-REQUISITES

Chemistry and physics knowledge from secondary school (5th, Junior and Final years of high school) about atomic structure and the phases of matter.

IDENTIFICATION

CODE : FIMI-1-S1-EC-PH-SH
ECTS : 4

HOURS

Cours :	9h
TD :	30.5h
TP :	14h
Projet :	0h
Evaluation :	2.5h
Face à face pédagogique :	56h
Travail personnel :	60h
Total :	116h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Apply the different stages of the methodology for solving a simple open problem.
AAv.2 Formulate a literal expression and check its consistency.
AAv.3 Express accurately a numerical result with its unit, its uncertainty using the appropriate number of significant figures and in any system of units.
AAv.4 Construct and use a graphical representation of physical quantities.
AAv.5 Calculate the moments of forces with respect to a point or an axis and project forces onto axes to solve a statics problem and determine a position of equilibrium or the expression of a force, justifying the steps.
AAv.6 Solve a kinematic problem to study a rectilinear, circular or any other kind of movement, using either a graph (to obtain information about the movement) or analytical expressions in the Cartesian, cylindrical or Frenet basis.
AAv.7 Apply the concepts seen in static mechanics in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis.

CONTENT

- Introduction to the scientific approach
- Measurements and uncertainties
- Introduction to energy
- Mechanics: statics of the solid and kinematics

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, quadratic equations, systems of linear equations, trigonometry, vectors¿), statistics (average and standard deviation), data and functions plots.
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.

IDENTIFICATION

CODE FIMI-1-S2-EC-MA-FC-AS-EU

ECTS : 5

HOURS

Cours :	19.5h
TD :	42h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	64.5h
Travail personnel :	70h
Total :	134.5h

ASSESMENT METHOD

- IE1 : duration 1,5 h, coefficient 1,5.
- IE2 : duration 1,5 h, coefficient 1,5.
- IEF : duration 3h, coefficient 3.

Concepts from the first semestre and seen throughout the semester are necessary to all the evaluations.

TEACHING AIDS

Online documents on Moodle.

TEACHING LANGUAGE

French

CONTACT

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AIMS

AAv2.1 – Study the continuity or the continuous extension of a function at a point.
AAv2.2 – Use properties of continuous functions to prove the existence of certain values (Intermediate Value Theorem, extreme value theorem).
AAv2.3 – Study differentiability at a point and compute derivatives using standard formulas (product, quotient, composition, inverse).
AAv2.4 – Use differentiability to study monotonicity and convexity.
AAv2.5 – Apply the Mean Value Theorem to bound or analyze the sign of expressions.
AAv2.6 – Bound an integral using integration properties (linearity, monotonicity).
AAv2.7 – Use the Fundamental Theorem of Calculus to express and compute an integral from a primitive.
AAv2.8 – Know common Taylor expansions and use them to find the expansion of a function without applying the Taylor formula.
AAv2.9 – Use Taylor expansions for local analysis (tangent, relative position) and asymptotic behavior (limit, equivalent, asymptote).
AAv2.10 – Apply the Taylor-Lagrange formula to estimate the approximation error via bounds.
AAv2.11 – Determine whether two subspaces are supplementary, notably using dimension arguments.
AAv2.12 – Check whether a linear map is a projector and compute its characteristic elements if applicable.
AAv2.13 – Perform basic matrix operations (sum, product, transpose, inverse) when defined.
AAv2.14 – Use the link between matrices and linear maps to compose, raise to a power, or evaluate at a point.
AAv2.15 – Compute the change-of-basis matrix and its inverse.
AAv2.16 – Compute the matrices of an endomorphism in different bases, either directly or via a change of basis.

CONTENT

One-variable functions calculus and linear algebra following the first semester curriculum. Over the whole year :
- Usual functions
- Limits
- Continuity
- Differentiability
- Equivalents
- Taylor expansions
- Polynomials
- Vector spaces
- Linear Maps
- Matrices

BIBLIOGRAPHY

Azoulay-Avignant : Mathématiques (Ediscience)
Guinin-Aubonnet-Joppin : Précis de Mathématiques (Bréal)
Thuillier-Belloc : Mathématiques (Masson)
Lemberg: Bien commencer ses études en mathématiques (Vuibert)
Balac-Sturm : Algèbre et Analyse 1ère année et Exercices de 1ère année (PPUR)

PRE-REQUISITES

PC-S1-MA-**

Informatics and numerical society 2

IDENTIFICATION

CODE : FIMI-1-S2-EC-ISN-TF
ECTS : toto

HOURS

Cours :	3h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	35h
Travail personnel :	35h
Total :	70h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes :

AAv2.1 : At the end of S2, students will be able to follow a simple development method using functional decomposition, including a test plan.

AAv2.2 : At the end of S2, students are able to use iterative and recursive programming on simple cases.

AAv2.3 : At the end of S2, students will be able to develop a small team project in Python ba-sed on given specifications.

AAv2.4 : At the end of S2, students will be able to describe the general operation of a computer network, particularly in the case of loading a Web page.

AAv2.5 : At the end of S2, students are able to discuss a given list of economic, social, political and imaginary issues related to the use of a specific digital technology, in a real-life situation.

CONTENT

1- Functions and séquences
2- 2D lists
3- Mini project
4- Recursivity
5- Networks 101

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-1-S1-EC-ISN

IDENTIFICATION

CODE : FIMI-1-S2-EC-OMNI-FC
ECTS : *

HOURS

Cours :	7h
TD :	15h
TP :	6h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	25h
Total :	54.5h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Lecture notes and exercices textbook, specific content of lanes available on Moodle.

TEACHING LANGUAGE

French

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AIMS

CONTENT

Multiple integrals
Scalar and vector fields

BIBLIOGRAPHY

PRE-REQUISITES

High school and first semester of FIMI abilities.

IDENTIFICATION

CODE : FIMI-1-S2-EC-CO-TF-SH
ECTS : undefined

HOURS

Cours :	0h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	28h
Travail personnel :	20h
Total :	48h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

AAv. 1. Analyze, explain and diagram the operation of a mechanical system based on an overall drawing, perspectives, digital model and/or real system.
AAv. 2. Using 2D and 3D tools, design a mounting or pivot connection according to the rules of the art (MIP/MAP/Jeu), taking into account environmental and mechanical constraints.
AAv. 3. modify an existing mechanical system by applying technological choices while respecting environmental constraints.

CONTENT

- being able to model a simple joint and draw the corresponding normalized symbol (ex: revolute, sliding, ball etc.)
- being able to draw a solution for simple revolute or complete joint on paper
- being able to create the virtual 3D model of a simple system using CAD software and generate 2D sketchs (definition and assambly drawings)

BIBLIOGRAPHY

PRE-REQUISITES

- sketch reading (definition and assembly drawings)
- using main functionnalities of CAD software

IDENTIFICATION

CODE : FIMI-1-S2-EC-ETRE-TF
ECTS : 2

HOURS

Cours :	0h
TD :	19h
TP :	0h
Projet :	8h
Evaluation :	1h
Face à face pédagogique :	20h
Travail personnel :	25h
Total :	53h

ASSESMENT METHOD

Continuous assessment. Three assessments are organized:
- the survey of IPCC work are assessed during the session group presentation (formative or summative, to be specified)
- the introductory project on Life Cycle Life Cycle Assessment project a graded group presentation (summative), including non-quantifiable impacts (Human Sciences)
- activities around anthropocene, living issues and and climate-energy issues give rise to an individual summative.

TEACHING AIDS

Course materials and exercises.
1st Cycle Moodle platform: all course and planning and organization, links to resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

This teaching sequence, in S2, is the first part of a program that will continue throughout the studies, with the aim of training engineers who are aware of the challenges of the ecological transition.

In its February 26, 2020 letter of intent, INSA Lyon stated that "the courses in Sustainable Development and Social Responsibility (SDRS) courses combine the following training objectives :
* in terms of cross-disciplinary skills
* in terms of themes to be addressed: climate change, energy, raw materials resources, and damage to living organisms and human health.

Two cross-cutting themes are addressed: links between science, technology and society, and the dynamics of change.

The targeted learning outcomes are thus :
1) Use a multi-disciplinary body of knowledge to provide reasoned, qualitative and quantitative answers to simple questions on ecological transition issues relating to energy, climate and living organisms.
2) Associate the consequences of different human actions on the planet's habitability, based on planetary limits and other factors.
3) Illustrate (explain) the systemic nature of various socio-ecological issues; integrate the central role of living organisms into the reasoning.
4) Analyze and quantify the environmental and social impacts of different human activities, in particular of a product/system/service; compare different solutions.

CONTENT

The student-engineer will work on and be assessed on the following knowledge:
- Understanding of the main principles of the Anthropocene.
- Introduction to energy and living issues.
- Role of the engineer in the ecological transition.

The sequence will be structured as follows:
- 2h introduction ("Why talk about ecological transition in engineering schools?")
- 8h of lectures and transdisciplinary exercises on planetary limits and the Anthropocene
- 3h on biodiversity with the introduction to the One Health concept
- 5h on climate-energy issues related to IPCC works

The sequence ends with 9h on project on Life Cycle Assessment (LCA) and impact of the products

IMPORTANT: 8 hours of the 28-hour course will be taught by a pair of teachers (Engineering Sciences / Sciences and Humanities), in a "Sciences-Humas" format.

BIBLIOGRAPHY

Atlas of the Anthropocene. F. Gemenne, A. Rankovic, Sciences Po Cartography Workshop
IPCC reports.
IPBES reports.

PRE-REQUISITES

Associated secondary school curricula (2nde, 1ère et Terminale) on sustainable development and social responsibility.
sustainable development and social responsibility.
Climate mural created during 1st year induction week.
The various 1st semester courses (Engineering Sciences and Human Sciences are called upon more in terms of methods (e.g.: drawing up a balance sheet, analysis, restitution...) rather than knowledge.

IDENTIFICATION

CODE : FIMI-1-S2-EC-CH-TF-SH
ECTS : 2

HOURS

Cours :	0h
TD :	6h
TP :	20.5h
Projet :	0h
Evaluation :	2.5h
Face à face pédagogique :	29h
Travail personnel :	20h
Total :	49h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Booklet for practical work in Chemistry 1
Summary sheet for lab reports
Moodle platform chemistry 1st year all sectors

TEACHING LANGUAGE

French
English

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AIMS

Determine the composition of a physico-chemical system at equilibrium as a function of its redox and acid-base properties
- by identifying possible reactions in order to predict the evolution of the system
- by using a body of knowledge and subject-specific tools

Handle appropriate measuring instruments in order to produce reliable experimental measurements
- by implementing a scientific protocol, complying with safety instructions and using appropriate equipment (qualitative vs. quantitative glassware)
- by adapting an experimental protocol to solve a simple problem
- by identifying and quantifying sources of error and uncertainties

Exploit experimental measurements in order to obtain a result with its associated uncertainty
- by establishing the analytical relationships between the quantities of interest and justifying the calculations used
- by clearly presenting the measurements or experimental data (for example: graph or table)
- by using the appropriate method for calculating uncertainties (for example: logarithmic or graphical)

Produce a scientific report of an experimental session on chemical transformations in aqueous solutions
- by justifying the experimental protocol (choice of glassware and/or dilution factor)
- by presenting the results
- by criticising the results

CONTENT

- Introduction to experimental chemistry and quantitative analysis.
The engineering student will learn to use the appropriate measuring instruments correctly in order to prepare a solution with a given concentration, to measure a physical-chemical property by colorimetry, pHmetry or spectrophotometry:
• Weigh a solid,
• Make a dilution using a volumetric glass,
• Measure the volume, pH or absorbance of a solution.

- Study oxidation-reduction and acid-base reactions and determine the composition of a physico-chemical system at equilibrium:
• Identify the possible reaction(s) in order to predict the evolution of the system
• Establish a material balance and the quantitative proportions between the different species, including but not limited to a relationship at equivalence
• Use experimental measurements to obtain a result with its associated uncertainty

BIBLIOGRAPHY

Handouts Chemistry 1 and Thermodynamics
MOODLE Chemistry 1st year platform (all sectors)
Cours de Chimie Physique - Paul Arnaud (ed. Dunod)

PRE-REQUISITES

Laboratory safety, knowledge of glasswork and its use Knowledge of major classes of materials
Redox reaction equilibrium, oxidation number (done in the 1st half)
Notions of strong / weak acid, pKa, buffer solution, colored indicators
Low energy interactions between molecules (polarity, van der Waals bonds, hydrogen bonding) (done in the 1st half)

IDENTIFICATION

CODE : FIMI-1-S2-EC-TH-TF
ECTS : 4

HOURS

Cours :	11h
TD :	28h
TP :	5h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	47h
Travail personnel :	37h
Total :	84h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Lesson and exercise handouts
- Moodle Internet interface (course supplements and examination papers with answer keys)

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Apply the general methods of thermodynamics in simple situations
- By using the appropriate vocabulary (system, transformation, isotherm, etc.)
- By applying the first and second principles to typical transformations of closed systems, using the concepts of reversibility, heat, work and state function (internal energy, enthalpy, entropy, free enthalpy, etc.)

Establish the properties of a pure substance using :
- the temperature and pressure of a gas, and the perfect gas model for a single gas or a mixture of gases;
- the boiling temperature of a pure substance, its saturation vapour pressure and its heat capacity according to its physical state;
- Clapeyron's relation with the quantities associated with changes of state and making the relevant simplification assumptions
- the particularities of the (P,V) and (P,T) diagrams for typical transformations.

Describe and analyse a simple thermal machine:
- By using (definitions of) motor or receiver cycles,
- By using a cycle of transformations represented on a (P,V) diagram
- By calculating the coefficient of performance in the case of ideal and real operation

Analyse a chemical reaction:
- Identify the parameters of the standard state of reaction, the product formation reactions and the heat of reaction
- Use Hess's law to calculate the standard reaction quantities (internal energy, enthalpy and entropy)
- Use the principle of adiabatic calorimetry to determine a heat of reaction, a heat capacity and a flame temperature (put in all the expected values), by applying a material balance and a heat balance.

CONTENT

The engineering student will work and will be evaluated on the following knowledge:
- Gaseous state
- System characterization and evolution
- The different forms of energy
- The first law: application to the transformations of an ideal gas and to thermo chemistry
- The second law as an evolution criterion
- Theoretical uses of the two laws to homogeneous physical systems. Thermodynamic coefficients.
- The two laws applied specifically to gases.
- Thermodynamic potentials: Gibbs free energy
- Thermodynamics applied to phase transitions: Clapeyron's law
- Application to heat engines.
- Calorimetry
- Practical work on Power, efficiency and heat capacity
- Practical work on Liquid-vapour equilibrium

BIBLIOGRAPHY

P. ARNAUD, Cours de Chimie Physique, Eds Dunod
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique PC, Eds Bréal
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique Prépas MP SI PC SI, Eds Bréal
P. GRECIAS, Exercices et problèmes de Thermodynamique Physique, 2ème édition, Collection de sciences physiques, Eds Lavoisier Tec et Doc
H Prépa, Thermodynamique 2ème année MP-MP* PT-PT*, Eds Hachette Supérieur (Chapitre 1 pour le corps pur)
P. BONNET, Cours de Thermodynamique ; Eds Ellipses
J. P. PEREZ, Thermodynamique. Fondements et Applications. Eds
M. HULIN, N. HULIN, M. VEYSSIE. Thermodynamique. Eds Dunod

PRE-REQUISITES

IDENTIFICATION

CODE : FIMI-1-S2-EC-PH-FC-SC
ECTS : 6

HOURS

Cours :	14h
TD :	35h
TP :	20h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	73h
Travail personnel :	80h
Total :	153h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Solve a dynamics problem: establish and exploit the differential equation describing motion and the equation of trajectory or the literal expression of a force or moment using a precise methodology.
AAv.2 Use a mechanical energy balance to determine either speeds at a given point, or particular positions, or the expression of forces, or the equation of motion (differential equation or trajectory).
AAv.3 Analyse the stability of an equilibrium position of a mechanical system using either mechanical actions (forces or moments) or potential energy. Study free and forced oscillations around a stable equilibrium position.
AAv.4 Produce a circuit diagram from a schematic and vice versa, and model a 1st or 2nd order transient or sinusoidal electrical circuit.
AAv.5 Determine currents, voltages and energy quantities in a 1st or 2nd order transient (including the different regimes) or sinusoidal circuit (including transfer functions and filtering).
AAv.6 Construct and use graphical representations of electrical quantities.
AAv.7 Apply the concepts seen in mechanics and electricity in an experimental context: propose and then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write up a report.

CONTENT

- AC electricity
- Dynamics (of point and solid)
- Mechanical and electrical oscillations

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors), statistics (average and standard deviation), data and functions plots.
The physics and maths curriculum of the first semester (dimensions, uncertainties and electricty + algebraic and differential equations)
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.

Company knowledge

IDENTIFICATION

CODE : FIMI-1-S2-EC-CE-FC-SH
ECTS : *

HOURS

Cours :	2h
TD :	18h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	10h
Total :	30h

ASSESMENT METHOD

- Documentary study DD-RS
Individual written assessment, report, coefficient: 0.5
Hand in the report containing the team's common elements and individual analyses by the date specified by the teacher.
- Entrepreneur" project
Group oral assessment, defense, coefficient: 0.5
Hand in oral support and project sheets before class session 9, which is dedicated to oral presentations.

TEACHING AIDS

- Course materials for theoretical contributions
- Methodological frameworks
- Case studies and examples
- Supervision of project work and research
- Additional resources for further study
Course materials are available on Moodle.

TEACHING LANGUAGE

French

CONTACT

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AIMS

OBJECTIVES (AAV / APC) :
At the end of the CE Business Knowledge module, students will be able to mobilize tools to analyze professional situations in terms of their economic, legal, managerial and ethical aspects. The learning context covers the operation of companies and other forms of organization (associations, NGOs, public bodies). Analyses are carried out according to a common theme: "VALUE CREATION".
Students will be able to :
- analyze the organization and functioning of organizations, using numerous concrete examples.
- mobilize a systemic, cross-disciplinary approach based on stakeholder analysis, drawing on theoretical foundations and strategic and operational tools from management and economics.
- gain perspective on the purposes of organizations, their role in the economic system, their capacity to act and the constraints they face.
- identify the SD-RS and socio-economic transition issues raised by the way organizations operate.
- situate the engineer in organizations and project his/her role as a future engineer in these organizations.
- carry out documentary research to deepen their knowledge independently.
- adapt tools and models to specific or novel situations.
- present their analyses in a well-argued manner, both orally and in writing.
This knowledge can be applied and developed during the company discovery internship and in the department.

KEY COMPETENCIES TARGETED (TEACHING CHARTER - Humanities Department)
2. Work, learn, develop autonomy. 2.2 2.3 2.4
3. Interact with others and work on a team. 3.1 3.2 3.4
4. Develop creativity. 4.2 4.4
5. Act responsibly in a complex world. 5.1 5.2

CONTENT

20 hours face-to-face + 10 hours personal work.
- CM: Course presentation & round-table discussions with lecturing engineers
- TD1: Corporate value creation at the heart of the economic system
- TD2: SD-RS and CSR, corporate responsibility
- TD3: Socio-ecological transition and new economic perspectives
- TD4: Markets and competition: how does it work?
- TD5: Strategic diagnostic tools for understanding the systemic environment
- TD6: Making strategic choices, building a business model
- TD7: Internal and legal organization from the company's point of view
- TD8: Work organization from the point of view of employees and engineers
- TD9: Final project presentations

BIBLIOGRAPHY

References are given during the course, in connection with the topics covered.

PRE-REQUISITES

No specific prerequisites in management or economics are required.
CE Connaissance de l'entreprise is a Humanities course. It links up with the ETRE and CSS (Culture, Sciences et Société) courses.

IDENTIFICATION

CODE : FIMI-1-S2-EC-CO-TF-SH
ECTS : undefined

HOURS

Cours :	0h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	28h
Travail personnel :	20h
Total :	48h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French
English

CONTACT

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Mme FOURMEAUX Marion :
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AIMS

AAv. 1. Analyze, explain and diagram the operation of a mechanical system based on an overall drawing, perspectives, digital model and/or real system.
AAv. 2. Using 2D and 3D tools, design a mounting or pivot connection according to the rules of the art (MIP/MAP/Jeu), taking into account environmental and mechanical constraints.
AAv. 3. modify an existing mechanical system by applying technological choices while respecting environmental constraints.

CONTENT

- being able to model a simple joint and draw the corresponding normalized symbol (ex: revolute, sliding, ball etc.)
- being able to draw a solution for simple revolute or complete joint on paper
- being able to create the virtual 3D model of a simple system using CAD software and generate 2D sketchs (definition and assambly drawings)

BIBLIOGRAPHY

PRE-REQUISITES

- sketch reading (definition and assembly drawings)
- using main functionnalities of CAD software

IDENTIFICATION

CODE : FIMI-1-S2-EC-ETRE-TF
ECTS : 2

HOURS

Cours :	0h
TD :	19h
TP :	0h
Projet :	8h
Evaluation :	1h
Face à face pédagogique :	20h
Travail personnel :	25h
Total :	53h

ASSESMENT METHOD

Continuous assessment. Three assessments are organized:
- the survey of IPCC work are assessed during the session group presentation (formative or summative, to be specified)
- the introductory project on Life Cycle Life Cycle Assessment project a graded group presentation (summative), including non-quantifiable impacts (Human Sciences)
- activities around anthropocene, living issues and and climate-energy issues give rise to an individual summative.

TEACHING AIDS

Course materials and exercises.
1st Cycle Moodle platform: all course and planning and organization, links to resources.

TEACHING LANGUAGE

French
English

CONTACT

Mme TADIER Solène :
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M. GAUTIER Mathieu :
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M. SANDEL Arnaud :
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AIMS

This teaching sequence, in S2, is the first part of a program that will continue throughout the studies, with the aim of training engineers who are aware of the challenges of the ecological transition.

In its February 26, 2020 letter of intent, INSA Lyon stated that "the courses in Sustainable Development and Social Responsibility (SDRS) courses combine the following training objectives :
* in terms of cross-disciplinary skills
* in terms of themes to be addressed: climate change, energy, raw materials resources, and damage to living organisms and human health.

Two cross-cutting themes are addressed: links between science, technology and society, and the dynamics of change.

The targeted learning outcomes are thus :
1) Use a multi-disciplinary body of knowledge to provide reasoned, qualitative and quantitative answers to simple questions on ecological transition issues relating to energy, climate and living organisms.
2) Associate the consequences of different human actions on the planet's habitability, based on planetary limits and other factors.
3) Illustrate (explain) the systemic nature of various socio-ecological issues; integrate the central role of living organisms into the reasoning.
4) Analyze and quantify the environmental and social impacts of different human activities, in particular of a product/system/service; compare different solutions.

CONTENT

The student-engineer will work on and be assessed on the following knowledge:
- Understanding of the main principles of the Anthropocene.
- Introduction to energy and living issues.
- Role of the engineer in the ecological transition.

The sequence will be structured as follows:
- 2h introduction ("Why talk about ecological transition in engineering schools?")
- 8h of lectures and transdisciplinary exercises on planetary limits and the Anthropocene
- 3h on biodiversity with the introduction to the One Health concept
- 5h on climate-energy issues related to IPCC works

The sequence ends with 9h on project on Life Cycle Assessment (LCA) and impact of the products

IMPORTANT: 8 hours of the 28-hour course will be taught by a pair of teachers (Engineering Sciences / Sciences and Humanities), in a "Sciences-Humas" format.

BIBLIOGRAPHY

Atlas of the Anthropocene. F. Gemenne, A. Rankovic, Sciences Po Cartography Workshop
IPCC reports.
IPBES reports.

PRE-REQUISITES

Associated secondary school curricula (2nde, 1ère et Terminale) on sustainable development and social responsibility.
sustainable development and social responsibility.
Climate mural created during 1st year induction week.
The various 1st semester courses (Engineering Sciences and Human Sciences are called upon more in terms of methods (e.g.: drawing up a balance sheet, analysis, restitution...) rather than knowledge.

IDENTIFICATION

CODE FIMI-1-S2-EC-PH-AM-AS-EU

ECTS : 6

HOURS

Cours :	14h
TD :	35h
TP :	20h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	73h
Travail personnel :	80h
Total :	153h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

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M. Raynaud Christophe :
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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Solve a dynamics problem: establish and exploit the differential equation describing motion and the equation of trajectory or the literal expression of a force or moment using a precise methodology.
AAv.2 Use a mechanical energy balance to determine either speeds at a given point, or particular positions, or the expression of forces, or the equation of motion (differential equation or trajectory).
AAv.3 Analyse the stability of an equilibrium position of a mechanical system using either mechanical actions (forces or moments) or potential energy. Study free and forced oscillations around a stable equilibrium position.
AAv.4 Produce a circuit diagram from a schematic and vice versa, and model a 1st or 2nd order transient or sinusoidal electrical circuit.
AAv.5 Determine currents, voltages and energy quantities in a 1st or 2nd order transient (including the different regimes) or sinusoidal circuit (including transfer functions and filtering).
AAv.6 Construct and use graphical representations of electrical quantities.
AAv.7 Apply the concepts seen in mechanics and electricity in an experimental context: propose and then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write up a report.

CONTENT

- AC electricity
- Dynamics (of point and solid)
- Mechanical and electrical oscillations

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors), statistics (average and standard deviation), data and functions plots.
The physics and maths curriculum of the first semester (dimensions, uncertainties and electricty + algebraic and differential equations)
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.

IDENTIFICATION

CODE : FIMI-1-S2-EC-CH-TF-SH
ECTS : 2

HOURS

Cours :	0h
TD :	6h
TP :	20.5h
Projet :	0h
Evaluation :	2.5h
Face à face pédagogique :	29h
Travail personnel :	20h
Total :	49h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Booklet for practical work in Chemistry 1
Summary sheet for lab reports
Moodle platform chemistry 1st year all sectors

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Determine the composition of a physico-chemical system at equilibrium as a function of its redox and acid-base properties
- by identifying possible reactions in order to predict the evolution of the system
- by using a body of knowledge and subject-specific tools

Handle appropriate measuring instruments in order to produce reliable experimental measurements
- by implementing a scientific protocol, complying with safety instructions and using appropriate equipment (qualitative vs. quantitative glassware)
- by adapting an experimental protocol to solve a simple problem
- by identifying and quantifying sources of error and uncertainties

Exploit experimental measurements in order to obtain a result with its associated uncertainty
- by establishing the analytical relationships between the quantities of interest and justifying the calculations used
- by clearly presenting the measurements or experimental data (for example: graph or table)
- by using the appropriate method for calculating uncertainties (for example: logarithmic or graphical)

Produce a scientific report of an experimental session on chemical transformations in aqueous solutions
- by justifying the experimental protocol (choice of glassware and/or dilution factor)
- by presenting the results
- by criticising the results

CONTENT

- Introduction to experimental chemistry and quantitative analysis.
The engineering student will learn to use the appropriate measuring instruments correctly in order to prepare a solution with a given concentration, to measure a physical-chemical property by colorimetry, pHmetry or spectrophotometry:
• Weigh a solid,
• Make a dilution using a volumetric glass,
• Measure the volume, pH or absorbance of a solution.

- Study oxidation-reduction and acid-base reactions and determine the composition of a physico-chemical system at equilibrium:
• Identify the possible reaction(s) in order to predict the evolution of the system
• Establish a material balance and the quantitative proportions between the different species, including but not limited to a relationship at equivalence
• Use experimental measurements to obtain a result with its associated uncertainty

BIBLIOGRAPHY

Handouts Chemistry 1 and Thermodynamics
MOODLE Chemistry 1st year platform (all sectors)
Cours de Chimie Physique - Paul Arnaud (ed. Dunod)

PRE-REQUISITES

Laboratory safety, knowledge of glasswork and its use Knowledge of major classes of materials
Redox reaction equilibrium, oxidation number (done in the 1st half)
Notions of strong / weak acid, pKa, buffer solution, colored indicators
Low energy interactions between molecules (polarity, van der Waals bonds, hydrogen bonding) (done in the 1st half)

IDENTIFICATION

CODE : FIMI-1-S2-EC-TH-TF
ECTS : 4

HOURS

Cours :	11h
TD :	28h
TP :	5h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	47h
Travail personnel :	37h
Total :	84h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Lesson and exercise handouts
- Moodle Internet interface (course supplements and examination papers with answer keys)

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Apply the general methods of thermodynamics in simple situations
- By using the appropriate vocabulary (system, transformation, isotherm, etc.)
- By applying the first and second principles to typical transformations of closed systems, using the concepts of reversibility, heat, work and state function (internal energy, enthalpy, entropy, free enthalpy, etc.)

Establish the properties of a pure substance using :
- the temperature and pressure of a gas, and the perfect gas model for a single gas or a mixture of gases;
- the boiling temperature of a pure substance, its saturation vapour pressure and its heat capacity according to its physical state;
- Clapeyron's relation with the quantities associated with changes of state and making the relevant simplification assumptions
- the particularities of the (P,V) and (P,T) diagrams for typical transformations.

Describe and analyse a simple thermal machine:
- By using (definitions of) motor or receiver cycles,
- By using a cycle of transformations represented on a (P,V) diagram
- By calculating the coefficient of performance in the case of ideal and real operation

Analyse a chemical reaction:
- Identify the parameters of the standard state of reaction, the product formation reactions and the heat of reaction
- Use Hess's law to calculate the standard reaction quantities (internal energy, enthalpy and entropy)
- Use the principle of adiabatic calorimetry to determine a heat of reaction, a heat capacity and a flame temperature (put in all the expected values), by applying a material balance and a heat balance.

CONTENT

The engineering student will work and will be evaluated on the following knowledge:
- Gaseous state
- System characterization and evolution
- The different forms of energy
- The first law: application to the transformations of an ideal gas and to thermo chemistry
- The second law as an evolution criterion
- Theoretical uses of the two laws to homogeneous physical systems. Thermodynamic coefficients.
- The two laws applied specifically to gases.
- Thermodynamic potentials: Gibbs free energy
- Thermodynamics applied to phase transitions: Clapeyron's law
- Application to heat engines.
- Calorimetry
- Practical work on Power, efficiency and heat capacity
- Practical work on Liquid-vapour equilibrium

BIBLIOGRAPHY

P. ARNAUD, Cours de Chimie Physique, Eds Dunod
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique PC, Eds Bréal
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique Prépas MP SI PC SI, Eds Bréal
P. GRECIAS, Exercices et problèmes de Thermodynamique Physique, 2ème édition, Collection de sciences physiques, Eds Lavoisier Tec et Doc
H Prépa, Thermodynamique 2ème année MP-MP* PT-PT*, Eds Hachette Supérieur (Chapitre 1 pour le corps pur)
P. BONNET, Cours de Thermodynamique ; Eds Ellipses
J. P. PEREZ, Thermodynamique. Fondements et Applications. Eds
M. HULIN, N. HULIN, M. VEYSSIE. Thermodynamique. Eds Dunod

PRE-REQUISITES

Latin-American Civilisation

IDENTIFICATION

CODE : FIMI-1-S2-EC-MOS-AM
ECTS : undefined

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	10h
Total :	30h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.
Handout distributed by the teacher.

TEACHING LANGUAGE

French

CONTACT

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AIMS

* Targeted skills
- INSA, Humanities skills reference framework
5. Acting responsibly in a complex world
7. Working in an international and intercultural context.
* Skills used
- CEFR
- Written and oral comprehension Written and oral expression (CEFR)
- INSA, Humanities skills reference framework
3. Interacting with others,teamwork.

CONTENT

This course is designed as an introduction to contemporary Latin American civilisations. To this end, there is first of all a historical approach that begins with the populating of the continent, the emergence of local cultures, through the period of European colonisation and up to the advent of independence and the establishment of the nation state.
This first part forms the basis for the second part, which looks at the construction of collective identity from the 19th century onwards in the various countries of this vast continent that emerged from a colonial process that has left its mark on present-day Latin American societies.
Finally, an analysis is made of the situation of the different populations that inhabit this region (criollas, mestizos, indigenous peoples) in order to understand the social and economic structure of today. In addition, students will be asked to take a critical look at the media and its transmission of information about Latin America, and to report, individually and collectively, on this constantly changing reality.

BIBLIOGRAPHY

- Amérique latine : introduction à l'Extrême-Occident, Alain Rouquié (1987)
- Naissance des nations, Clément Thibaud (2007)
- Race et colonialité du pouvoir, Anibal Quijano (2007)
- Histoire de l'Etat-Nation : de la politique d'intégration en Amérique Latine et en Europe, J. Gonzalez (2010)

PRE-REQUISITES

The prerequisites are the skills acquired in secondary education: the ability to appropriate information, correct use of language, logical thinking, intellectual curiosity, the ability to conceptualise a problem and grasp what is at stake, reflection,…

IDENTIFICATION

CODE :FIMI-1-S2-EC-OMNI-FI-SH

ECTS : *

HOURS

Cours :	7h
TD :	15h
TP :	6h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	25h
Total :	54.5h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Lecture notes and exercices textbook, specific content of lanes available on Moodle.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

CONTENT

Multiple integrals
Scalar and vector fields

BIBLIOGRAPHY

PRE-REQUISITES

High school and first semester of FIMI abilities.

Informatics and numerical society 2

IDENTIFICATION

CODE : FIMI-1-S2-EC-ISN-TF
ECTS : toto

HOURS

Cours :	3h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	35h
Travail personnel :	35h
Total :	70h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes :

AAv2.1 : At the end of S2, students will be able to follow a simple development method using functional decomposition, including a test plan.

AAv2.2 : At the end of S2, students are able to use iterative and recursive programming on simple cases.

AAv2.3 : At the end of S2, students will be able to develop a small team project in Python ba-sed on given specifications.

AAv2.4 : At the end of S2, students will be able to describe the general operation of a computer network, particularly in the case of loading a Web page.

AAv2.5 : At the end of S2, students are able to discuss a given list of economic, social, political and imaginary issues related to the use of a specific digital technology, in a real-life situation.

CONTENT

1- Functions and séquences
2- 2D lists
3- Mini project
4- Recursivity
5- Networks 101

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-1-S1-EC-ISN

IDENTIFICATION

CODE : FIMI-1-S2-EC-MA-AM
ECTS : 5

HOURS

Cours :	19.5h
TD :	42h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	64.5h
Travail personnel :	70h
Total :	134.5h

ASSESMENT METHOD

- IE1 : duration 1,5 h, coefficient 1.
- IE2 : duration 1,5 h, coefficient 1.
- IEF : duration 3h, coefficient 2.

Concepts from the first semestre and seen throughout the semester are necessary to all the evaluations.

TEACHING AIDS

Online documents on Moodle.

TEACHING LANGUAGE

French

CONTACT

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guy.athanaze@insa-lyon.fr

AIMS

AAv2.1 – Study the continuity or the continuous extension of a function at a point.
AAv2.2 – Use properties of continuous functions to prove the existence of certain values (Intermediate Value Theorem, extreme value theorem).
AAv2.3 – Study differentiability at a point and compute derivatives using standard formulas (product, quotient, composition, inverse).
AAv2.4 – Use differentiability to study monotonicity and convexity.
AAv2.5 – Apply the Mean Value Theorem to bound or analyze the sign of expressions.
AAv2.6 – Bound an integral using integration properties (linearity, monotonicity).
AAv2.7 – Use the Fundamental Theorem of Calculus to express and compute an integral from a primitive.
AAv2.8 – Know common Taylor expansions and use them to find the expansion of a function without applying the Taylor formula.
AAv2.9 – Use Taylor expansions for local analysis (tangent, relative position) and asymptotic behavior (limit, equivalent, asymptote).
AAv2.10 – Apply the Taylor-Lagrange formula to estimate the approximation error via bounds.
AAv2.11 – Determine whether two subspaces are supplementary, notably using dimension arguments.
AAv2.12 – Check whether a linear map is a projector and compute its characteristic elements if applicable.
AAv2.13 – Perform basic matrix operations (sum, product, transpose, inverse) when defined.
AAv2.14 – Use the link between matrices and linear maps to compose, raise to a power, or evaluate at a point.
AAv2.15 – Compute the change-of-basis matrix and its inverse.
AAv2.16 – Compute the matrices of an endomorphism in different bases, either directly or via a change of basis.

CONTENT

One-variable functions calculus and linear algebra following the first semester curriculum. Over the whole year :
- Usual functions
- Limits
- Continuity
- Differentiability
- Equivalents
- Taylor expansions
- Polynomials
- Vector spaces
- Linear Maps
- Matrices

BIBLIOGRAPHY

Azoulay-Avignant : Mathématiques (Ediscience)
Guinin-Aubonnet-Joppin : Précis de Mathématiques (Bréal)
Thuillier-Belloc : Mathématiques (Masson)
Lemberg: Bien commencer ses études en mathématiques (Vuibert)
Balac-Sturm : Algèbre et Analyse 1ère année et Exercices de 1ère année (PPUR)

PRE-REQUISITES

PC-S1-MA-**

IDENTIFICATION

CODE : FIMI-1-S2-EC-CO-TF-SH
ECTS : undefined

HOURS

Cours :	0h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	28h
Travail personnel :	20h
Total :	48h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French
English

CONTACT

M. JARRIER Laurent :
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Mme FOURMEAUX Marion :
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AIMS

AAv. 1. Analyze, explain and diagram the operation of a mechanical system based on an overall drawing, perspectives, digital model and/or real system.
AAv. 2. Using 2D and 3D tools, design a mounting or pivot connection according to the rules of the art (MIP/MAP/Jeu), taking into account environmental and mechanical constraints.
AAv. 3. modify an existing mechanical system by applying technological choices while respecting environmental constraints.

CONTENT

- being able to model a simple joint and draw the corresponding normalized symbol (ex: revolute, sliding, ball etc.)
- being able to draw a solution for simple revolute or complete joint on paper
- being able to create the virtual 3D model of a simple system using CAD software and generate 2D sketchs (definition and assambly drawings)

BIBLIOGRAPHY

PRE-REQUISITES

- sketch reading (definition and assembly drawings)
- using main functionnalities of CAD software

IDENTIFICATION

CODE : FIMI-1-S2-EC-ETRE-AS
ECTS : 2

HOURS

Cours :	0h
TD :	19h
TP :	0h
Projet :	8h
Evaluation :	1h
Face à face pédagogique :	20h
Travail personnel :	25h
Total :	53h

ASSESMENT METHOD

Continuous assessment. Three assessments are organized:
- the survey of IPCC work are assessed during the session group presentation (formative or summative, to be specified)
- the introductory project on Life Cycle Life Cycle Assessment project a graded group presentation (summative), including non-quantifiable impacts (Human Sciences)
- activities around anthropocene, living issues and and climateenergy issues give rise to an individual summative.

TEACHING AIDS

Course materials and exercises.
1st Cycle Moodle platform: all course and planning and organization, links to resources.

TEACHING LANGUAGE

French

CONTACT

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M. SANDEL Arnaud :
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AIMS

This teaching sequence, in S2, is the first part of a program that will continue throughout the studies, with the aim of training engineers who are aware of the challenges of the ecological transition.
In its February 26, 2020 letter of intent, INSA Lyon stated that "the courses in Sustainable
Development and Social Responsibility (SDRS) courses combine the following training objectives :
* in terms of cross-disciplinary skills
* in terms of themes to be addressed: climate change, energy, raw materials resources, and
damage to living organisms and human health.
Two cross-cutting themes are addressed: links between science, technology and society, and
the dynamics of change.
The teaching method is slightly adapted in Asinsa.

The targeted learning outcomes are thus :
1) Use a multi-disciplinary body of knowledge to provide reasoned, qualitative and quantitative answers to simple questions on ecological transition issues relating to energy, climate and living organisms.
2) Associate the consequences of different human actions on the planet's habitability, based on planetary limits and other factors.
3) Illustrate (explain) the systemic nature of various socio-ecological issues; integrate the central role of living organisms into the reasoning.
4) Analyze and quantify the environmental and social impacts of different human activities, in particular of a product/system/service; compare different solutions.

CONTENT

The student-engineer will work on and be assessed on the following knowledge:
- Understanding of the main principles of the Anthropocene.
- Introduction to energy and living issues.
- Role of the engineer in the ecological transition.
The sequence will be structured as follows:
- 2h introduction ("Why talk about ecological transition in engineering schools?")
- 8h of lectures and transdisciplinary exercises on planetary limits and the Anthropocene
- 3h on biodiversity with the introduction to the One Health concept
- 5h on climate-energy issues related to IPCC works
The sequence ends with 9h on project on Life Cycle Assessment (LCA) and impact of the
products
IMPORTANT: 8 hours of the 28-hour course will be taught by a pair of teachers (Engineering
Sciences / Sciences and Humanities), in a "Sciences-Humas" format.

BIBLIOGRAPHY

Atlas of the Anthropocene. F. Gemenne, A. Rankovic, Sciences Po Cartography Workshop
IPCC reports.
IPBES reports.

PRE-REQUISITES

Associated secondary school curricula (2nde, 1ère et Terminale) on sustainable development
and social responsibility.
sustainable development and social responsibility.
Climate mural created during 1st year induction week.
The various 1st semester courses (Engineering Sciences and Human Sciences are called upon
more in terms of methods (e.g.: drawing up a balance sheet, analysis, restitution...) rather than
knowledge.

IDENTIFICATION

CODE FIMI-1-S2-EC-PH-AM-AS-EU

ECTS : 6

HOURS

Cours :	14h
TD :	35h
TP :	20h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	73h
Travail personnel :	80h
Total :	153h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

Mme Nychyporuk Tetyana :
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Mme Godin Nathalie :
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M. Raynaud Christophe :
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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Solve a dynamics problem: establish and exploit the differential equation describing motion and the equation of trajectory or the literal expression of a force or moment using a precise methodology.
AAv.2 Use a mechanical energy balance to determine either speeds at a given point, or particular positions, or the expression of forces, or the equation of motion (differential equation or trajectory).
AAv.3 Analyse the stability of an equilibrium position of a mechanical system using either mechanical actions (forces or moments) or potential energy. Study free and forced oscillations around a stable equilibrium position.
AAv.4 Produce a circuit diagram from a schematic and vice versa, and model a 1st or 2nd order transient or sinusoidal electrical circuit.
AAv.5 Determine currents, voltages and energy quantities in a 1st or 2nd order transient (including the different regimes) or sinusoidal circuit (including transfer functions and filtering).
AAv.6 Construct and use graphical representations of electrical quantities.
AAv.7 Apply the concepts seen in mechanics and electricity in an experimental context: propose and then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write up a report.

CONTENT

- AC electricity
- Dynamics (of point and solid)
- Mechanical and electrical oscillations

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors), statistics (average and standard deviation), data and functions plots.
The physics and maths curriculum of the first semester (dimensions, uncertainties and electricty + algebraic and differential equations)
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.

IDENTIFICATION

CODE : FIMI-1-S2-EC-CH-TF-SH
ECTS : 2

HOURS

Cours :	0h
TD :	6h
TP :	20.5h
Projet :	0h
Evaluation :	2.5h
Face à face pédagogique :	29h
Travail personnel :	20h
Total :	49h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Booklet for practical work in Chemistry 1
Summary sheet for lab reports
Moodle platform chemistry 1st year all sectors

TEACHING LANGUAGE

French
English

CONTACT

Mme Kim Boram :
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Mme Jacolot Maïwenn :
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M. Garnier Vincent :
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AIMS

Determine the composition of a physico-chemical system at equilibrium as a function of its redox and acid-base properties
- by identifying possible reactions in order to predict the evolution of the system
- by using a body of knowledge and subject-specific tools

Handle appropriate measuring instruments in order to produce reliable experimental measurements
- by implementing a scientific protocol, complying with safety instructions and using appropriate equipment (qualitative vs. quantitative glassware)
- by adapting an experimental protocol to solve a simple problem
- by identifying and quantifying sources of error and uncertainties

Exploit experimental measurements in order to obtain a result with its associated uncertainty
- by establishing the analytical relationships between the quantities of interest and justifying the calculations used
- by clearly presenting the measurements or experimental data (for example: graph or table)
- by using the appropriate method for calculating uncertainties (for example: logarithmic or graphical)

Produce a scientific report of an experimental session on chemical transformations in aqueous solutions
- by justifying the experimental protocol (choice of glassware and/or dilution factor)
- by presenting the results
- by criticising the results

CONTENT

- Introduction to experimental chemistry and quantitative analysis.
The engineering student will learn to use the appropriate measuring instruments correctly in order to prepare a solution with a given concentration, to measure a physical-chemical property by colorimetry, pHmetry or spectrophotometry:
• Weigh a solid,
• Make a dilution using a volumetric glass,
• Measure the volume, pH or absorbance of a solution.

- Study oxidation-reduction and acid-base reactions and determine the composition of a physico-chemical system at equilibrium:
• Identify the possible reaction(s) in order to predict the evolution of the system
• Establish a material balance and the quantitative proportions between the different species, including but not limited to a relationship at equivalence
• Use experimental measurements to obtain a result with its associated uncertainty

BIBLIOGRAPHY

Handouts Chemistry 1 and Thermodynamics
MOODLE Chemistry 1st year platform (all sectors)
Cours de Chimie Physique - Paul Arnaud (ed. Dunod)

PRE-REQUISITES

Laboratory safety, knowledge of glasswork and its use Knowledge of major classes of materials
Redox reaction equilibrium, oxidation number (done in the 1st half)
Notions of strong / weak acid, pKa, buffer solution, colored indicators
Low energy interactions between molecules (polarity, van der Waals bonds, hydrogen bonding) (done in the 1st half)

IDENTIFICATION

CODE : FIMI-1-S2-EC-TH-TF
ECTS : 4

HOURS

Cours :	11h
TD :	28h
TP :	5h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	47h
Travail personnel :	37h
Total :	84h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Lesson and exercise handouts
- Moodle Internet interface (course supplements and examination papers with answer keys)

TEACHING LANGUAGE

French
English

CONTACT

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manuel.kuhni@insa-lyon.fr

M. Garnier Vincent :
vincent.garnier@insa-lyon.fr

AIMS

Apply the general methods of thermodynamics in simple situations
- By using the appropriate vocabulary (system, transformation, isotherm, etc.)
- By applying the first and second principles to typical transformations of closed systems, using the concepts of reversibility, heat, work and state function (internal energy, enthalpy, entropy, free enthalpy, etc.)

Establish the properties of a pure substance using :
- the temperature and pressure of a gas, and the perfect gas model for a single gas or a mixture of gases;
- the boiling temperature of a pure substance, its saturation vapour pressure and its heat capacity according to its physical state;
- Clapeyron's relation with the quantities associated with changes of state and making the relevant simplification assumptions
- the particularities of the (P,V) and (P,T) diagrams for typical transformations.

Describe and analyse a simple thermal machine:
- By using (definitions of) motor or receiver cycles,
- By using a cycle of transformations represented on a (P,V) diagram
- By calculating the coefficient of performance in the case of ideal and real operation

Analyse a chemical reaction:
- Identify the parameters of the standard state of reaction, the product formation reactions and the heat of reaction
- Use Hess's law to calculate the standard reaction quantities (internal energy, enthalpy and entropy)
- Use the principle of adiabatic calorimetry to determine a heat of reaction, a heat capacity and a flame temperature (put in all the expected values), by applying a material balance and a heat balance.

CONTENT

The engineering student will work and will be evaluated on the following knowledge:
- Gaseous state
- System characterization and evolution
- The different forms of energy
- The first law: application to the transformations of an ideal gas and to thermo chemistry
- The second law as an evolution criterion
- Theoretical uses of the two laws to homogeneous physical systems. Thermodynamic coefficients.
- The two laws applied specifically to gases.
- Thermodynamic potentials: Gibbs free energy
- Thermodynamics applied to phase transitions: Clapeyron's law
- Application to heat engines.
- Calorimetry
- Practical work on Power, efficiency and heat capacity
- Practical work on Liquid-vapour equilibrium

BIBLIOGRAPHY

P. ARNAUD, Cours de Chimie Physique, Eds Dunod
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique PC, Eds Bréal
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique Prépas MP SI PC SI, Eds Bréal
P. GRECIAS, Exercices et problèmes de Thermodynamique Physique, 2ème édition, Collection de sciences physiques, Eds Lavoisier Tec et Doc
H Prépa, Thermodynamique 2ème année MP-MP* PT-PT*, Eds Hachette Supérieur (Chapitre 1 pour le corps pur)
P. BONNET, Cours de Thermodynamique ; Eds Ellipses
J. P. PEREZ, Thermodynamique. Fondements et Applications. Eds
M. HULIN, N. HULIN, M. VEYSSIE. Thermodynamique. Eds Dunod

PRE-REQUISITES

Theatre - Writing and Playing

IDENTIFICATION

CODE : FIMI-1-S2-EC-MOS-AS
ECTS : undefined

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	10h
Total :	30h

ASSESMENT METHOD

Creative writing and involvement in the project: written assessment
Playlet: oral assessment of theatrical performance

TEACHING AIDS

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.
Handout distributed by the teacher.

TEACHING LANGUAGE

French

CONTACT

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AIMS

1. Knowing yourself, managing yourself physically and mentally

1.1 Situate yourself, evaluate yourself
1.2 Identify how you function (cognitive, physical, relational, affective, informational, emotional, etc.), the sources of your motivation, your sources of stress and emotions, etc.
1.3 Become aware of your biases (cognitive, socio-cultural, etc.)

2. Working, learning and developing independently

2.1 Mobilise resources (physical, motor, cognitive and emotional) by adapting to different situations
2.2 Develop, implement and regulate a relevant action strategy with a defined aim
2.3 Acquire new skills independently by seeking out the necessary resources
2.4 Exercise critical thinking and think for oneself

3. Interacting with others, working in a team

3.1 Communicate appropriately: pass on a message, listen, show empathy, assert one's point of view, argue in a reasoned manner
3.3 Communicate non-verbally: posture and body language
3.4 Integrate into a group, position yourself, build a dynamic relationship with the group, integrate new members
3.5 Managing conflict, balancing individual and collective interests
3.6 Taking part in a group project: building and running a project, developing it; becoming aware of one's role and responsibilities.

4. Demonstrate creativity, innovation and entrepreneurship

4.1 Develop a creative approach, including artistic approaches
4.2 Draw on what they have learnt in various fields to produce an original creation

7. Working in an international and intercultural context

7.1 Communicate and interact in foreign languages
7.2 Decode cultural references in speech, attitudes and behaviour
7.3 Put values, beliefs and behaviour into perspective
7.4 Integrate cultural diversity into group work

CONTENT

Learn the techniques of theatrical communication (theatre workshop)
Working from a text written by an author and imagining what happens next
Interpretation of texts, understanding and memorising them
Work on oral production: pronunciation, diction, elocution and body expression.
Working interculturally and independently in pairs.

BIBLIOGRAPHY

PRE-REQUISITES

The prerequisites are the skills acquired in secondary education: the ability to appropriate information, correct use of language, logical thinking, intellectual curiosity, the ability to conceptualise a problem and grasp what is at stake, reflexivity,...

IDENTIFICATION

CODE FIMI-1-S2-EC-MA-FC-AS-EU

ECTS : 5

HOURS

Cours :	19.5h
TD :	42h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	64.5h
Travail personnel :	70h
Total :	134.5h

ASSESMENT METHOD

- IE1 : duration 1,5 h, coefficient 1,5.
- IE2 : duration 1,5 h, coefficient 1,5.
- IEF : duration 3h, coefficient 3.

Concepts from the first semestre and seen throughout the semester are necessary to all the evaluations.

TEACHING AIDS

Online documents on Moodle.

TEACHING LANGUAGE

French

CONTACT

M. MOULIN Sylvain :
sylvain.moulin@insa-lyon.fr

AIMS

AAv2.1 – Study the continuity or the continuous extension of a function at a point.
AAv2.2 – Use properties of continuous functions to prove the existence of certain values (Intermediate Value Theorem, extreme value theorem).
AAv2.3 – Study differentiability at a point and compute derivatives using standard formulas (product, quotient, composition, inverse).
AAv2.4 – Use differentiability to study monotonicity and convexity.
AAv2.5 – Apply the Mean Value Theorem to bound or analyze the sign of expressions.
AAv2.6 – Bound an integral using integration properties (linearity, monotonicity).
AAv2.7 – Use the Fundamental Theorem of Calculus to express and compute an integral from a primitive.
AAv2.8 – Know common Taylor expansions and use them to find the expansion of a function without applying the Taylor formula.
AAv2.9 – Use Taylor expansions for local analysis (tangent, relative position) and asymptotic behavior (limit, equivalent, asymptote).
AAv2.10 – Apply the Taylor-Lagrange formula to estimate the approximation error via bounds.
AAv2.11 – Determine whether two subspaces are supplementary, notably using dimension arguments.
AAv2.12 – Check whether a linear map is a projector and compute its characteristic elements if applicable.
AAv2.13 – Perform basic matrix operations (sum, product, transpose, inverse) when defined.
AAv2.14 – Use the link between matrices and linear maps to compose, raise to a power, or evaluate at a point.
AAv2.15 – Compute the change-of-basis matrix and its inverse.
AAv2.16 – Compute the matrices of an endomorphism in different bases, either directly or via a change of basis.

CONTENT

One-variable functions calculus and linear algebra following the first semester curriculum. Over the whole year :
- Usual functions
- Limits
- Continuity
- Differentiability
- Equivalents
- Taylor expansions
- Polynomials
- Vector spaces
- Linear Maps
- Matrices

BIBLIOGRAPHY

Azoulay-Avignant : Mathématiques (Ediscience)
Guinin-Aubonnet-Joppin : Précis de Mathématiques (Bréal)
Thuillier-Belloc : Mathématiques (Masson)
Lemberg: Bien commencer ses études en mathématiques (Vuibert)
Balac-Sturm : Algèbre et Analyse 1ère année et Exercices de 1ère année (PPUR)

PRE-REQUISITES

PC-S1-MA-**

IDENTIFICATION

CODE :FIMI-1-S2-EC-OMNI-FI-SH

ECTS : *

HOURS

Cours :	7h
TD :	15h
TP :	6h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	25h
Total :	54.5h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Lecture notes and exercices textbook, specific content of lanes available on Moodle.

TEACHING LANGUAGE

French
English

CONTACT

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emmanuel.risler@insa-lyon.fr

M. Lame Olivier :
olivier.lame@insa-lyon.fr

AIMS

CONTENT

Multiple integrals
Scalar and vector fields

BIBLIOGRAPHY

PRE-REQUISITES

High school and first semester of FIMI abilities.

Informatics and numerical society 2

IDENTIFICATION

CODE : FIMI-1-S2-EC-ISN-TF
ECTS : toto

HOURS

Cours :	3h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	35h
Travail personnel :	35h
Total :	70h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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M. Rivano Hervé :
Herve.Rivano@insa-lyon.fr

AIMS

Targeted learning outcomes :

AAv2.1 : At the end of S2, students will be able to follow a simple development method using functional decomposition, including a test plan.

AAv2.2 : At the end of S2, students are able to use iterative and recursive programming on simple cases.

AAv2.3 : At the end of S2, students will be able to develop a small team project in Python ba-sed on given specifications.

AAv2.4 : At the end of S2, students will be able to describe the general operation of a computer network, particularly in the case of loading a Web page.

AAv2.5 : At the end of S2, students are able to discuss a given list of economic, social, political and imaginary issues related to the use of a specific digital technology, in a real-life situation.

CONTENT

1- Functions and séquences
2- 2D lists
3- Mini project
4- Recursivity
5- Networks 101

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-1-S1-EC-ISN

IDENTIFICATION

CODE FIMI-1-S2-EC-MA-FC-AS-EU

ECTS : 5

HOURS

Cours :	19.5h
TD :	42h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	64.5h
Travail personnel :	70h
Total :	134.5h

ASSESMENT METHOD

- IE1 : duration 1,5 h, coefficient 1,5.
- IE2 : duration 1,5 h, coefficient 1,5.
- IEF : duration 3h, coefficient 3.

Concepts from the first semestre and seen throughout the semester are necessary to all the evaluations.

TEACHING AIDS

Online documents on Moodle.

TEACHING LANGUAGE

French

CONTACT

M. MOULIN Sylvain :
sylvain.moulin@insa-lyon.fr

AIMS

AAv2.1 – Study the continuity or the continuous extension of a function at a point.
AAv2.2 – Use properties of continuous functions to prove the existence of certain values (Intermediate Value Theorem, extreme value theorem).
AAv2.3 – Study differentiability at a point and compute derivatives using standard formulas (product, quotient, composition, inverse).
AAv2.4 – Use differentiability to study monotonicity and convexity.
AAv2.5 – Apply the Mean Value Theorem to bound or analyze the sign of expressions.
AAv2.6 – Bound an integral using integration properties (linearity, monotonicity).
AAv2.7 – Use the Fundamental Theorem of Calculus to express and compute an integral from a primitive.
AAv2.8 – Know common Taylor expansions and use them to find the expansion of a function without applying the Taylor formula.
AAv2.9 – Use Taylor expansions for local analysis (tangent, relative position) and asymptotic behavior (limit, equivalent, asymptote).
AAv2.10 – Apply the Taylor-Lagrange formula to estimate the approximation error via bounds.
AAv2.11 – Determine whether two subspaces are supplementary, notably using dimension arguments.
AAv2.12 – Check whether a linear map is a projector and compute its characteristic elements if applicable.
AAv2.13 – Perform basic matrix operations (sum, product, transpose, inverse) when defined.
AAv2.14 – Use the link between matrices and linear maps to compose, raise to a power, or evaluate at a point.
AAv2.15 – Compute the change-of-basis matrix and its inverse.
AAv2.16 – Compute the matrices of an endomorphism in different bases, either directly or via a change of basis.

CONTENT

One-variable functions calculus and linear algebra following the first semester curriculum. Over the whole year :
- Usual functions
- Limits
- Continuity
- Differentiability
- Equivalents
- Taylor expansions
- Polynomials
- Vector spaces
- Linear Maps
- Matrices

BIBLIOGRAPHY

Azoulay-Avignant : Mathématiques (Ediscience)
Guinin-Aubonnet-Joppin : Précis de Mathématiques (Bréal)
Thuillier-Belloc : Mathématiques (Masson)
Lemberg: Bien commencer ses études en mathématiques (Vuibert)
Balac-Sturm : Algèbre et Analyse 1ère année et Exercices de 1ère année (PPUR)

PRE-REQUISITES

PC-S1-MA-**

IDENTIFICATION

CODE :FIMI-1-S2-EC-OMNI-FI-SH

ECTS : *

HOURS

Cours :	7h
TD :	15h
TP :	6h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	25h
Total :	54.5h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Lecture notes and exercices textbook, specific content of lanes available on Moodle.

TEACHING LANGUAGE

French
English

CONTACT

M. Risler Emmanuel :
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M. Lame Olivier :
olivier.lame@insa-lyon.fr

AIMS

CONTENT

Multiple integrals
Scalar and vector fields

BIBLIOGRAPHY

PRE-REQUISITES

High school and first semester of FIMI abilities.

Informatics and numerical society 2

IDENTIFICATION

CODE : FIMI-1-S2-EC-ISN-TF
ECTS : toto

HOURS

Cours :	3h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	35h
Travail personnel :	35h
Total :	70h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

M. Cunche Mathieu :
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M. Rivano Hervé :
Herve.Rivano@insa-lyon.fr

AIMS

Targeted learning outcomes :

AAv2.1 : At the end of S2, students will be able to follow a simple development method using functional decomposition, including a test plan.

AAv2.2 : At the end of S2, students are able to use iterative and recursive programming on simple cases.

AAv2.3 : At the end of S2, students will be able to develop a small team project in Python ba-sed on given specifications.

AAv2.4 : At the end of S2, students will be able to describe the general operation of a computer network, particularly in the case of loading a Web page.

AAv2.5 : At the end of S2, students are able to discuss a given list of economic, social, political and imaginary issues related to the use of a specific digital technology, in a real-life situation.

CONTENT

1- Functions and séquences
2- 2D lists
3- Mini project
4- Recursivity
5- Networks 101

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-1-S1-EC-ISN

IDENTIFICATION

CODE FIMI-1-S2-EC-PH-AM-AS-EU

ECTS : 6

HOURS

Cours :	14h
TD :	35h
TP :	20h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	73h
Travail personnel :	80h
Total :	153h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

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Mme Godin Nathalie :
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M. Raynaud Christophe :
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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Solve a dynamics problem: establish and exploit the differential equation describing motion and the equation of trajectory or the literal expression of a force or moment using a precise methodology.
AAv.2 Use a mechanical energy balance to determine either speeds at a given point, or particular positions, or the expression of forces, or the equation of motion (differential equation or trajectory).
AAv.3 Analyse the stability of an equilibrium position of a mechanical system using either mechanical actions (forces or moments) or potential energy. Study free and forced oscillations around a stable equilibrium position.
AAv.4 Produce a circuit diagram from a schematic and vice versa, and model a 1st or 2nd order transient or sinusoidal electrical circuit.
AAv.5 Determine currents, voltages and energy quantities in a 1st or 2nd order transient (including the different regimes) or sinusoidal circuit (including transfer functions and filtering).
AAv.6 Construct and use graphical representations of electrical quantities.
AAv.7 Apply the concepts seen in mechanics and electricity in an experimental context: propose and then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write up a report.

CONTENT

- AC electricity
- Dynamics (of point and solid)
- Mechanical and electrical oscillations

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors), statistics (average and standard deviation), data and functions plots.
The physics and maths curriculum of the first semester (dimensions, uncertainties and electricty + algebraic and differential equations)
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.

IDENTIFICATION

CODE : FIMI-1-S2-EC-CH-TF-SH
ECTS : 2

HOURS

Cours :	0h
TD :	6h
TP :	20.5h
Projet :	0h
Evaluation :	2.5h
Face à face pédagogique :	29h
Travail personnel :	20h
Total :	49h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Booklet for practical work in Chemistry 1
Summary sheet for lab reports
Moodle platform chemistry 1st year all sectors

TEACHING LANGUAGE

French
English

CONTACT

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M. Garnier Vincent :
vincent.garnier@insa-lyon.fr

AIMS

Determine the composition of a physico-chemical system at equilibrium as a function of its redox and acid-base properties
- by identifying possible reactions in order to predict the evolution of the system
- by using a body of knowledge and subject-specific tools

Handle appropriate measuring instruments in order to produce reliable experimental measurements
- by implementing a scientific protocol, complying with safety instructions and using appropriate equipment (qualitative vs. quantitative glassware)
- by adapting an experimental protocol to solve a simple problem
- by identifying and quantifying sources of error and uncertainties

Exploit experimental measurements in order to obtain a result with its associated uncertainty
- by establishing the analytical relationships between the quantities of interest and justifying the calculations used
- by clearly presenting the measurements or experimental data (for example: graph or table)
- by using the appropriate method for calculating uncertainties (for example: logarithmic or graphical)

Produce a scientific report of an experimental session on chemical transformations in aqueous solutions
- by justifying the experimental protocol (choice of glassware and/or dilution factor)
- by presenting the results
- by criticising the results

CONTENT

- Introduction to experimental chemistry and quantitative analysis.
The engineering student will learn to use the appropriate measuring instruments correctly in order to prepare a solution with a given concentration, to measure a physical-chemical property by colorimetry, pHmetry or spectrophotometry:
• Weigh a solid,
• Make a dilution using a volumetric glass,
• Measure the volume, pH or absorbance of a solution.

- Study oxidation-reduction and acid-base reactions and determine the composition of a physico-chemical system at equilibrium:
• Identify the possible reaction(s) in order to predict the evolution of the system
• Establish a material balance and the quantitative proportions between the different species, including but not limited to a relationship at equivalence
• Use experimental measurements to obtain a result with its associated uncertainty

BIBLIOGRAPHY

Handouts Chemistry 1 and Thermodynamics
MOODLE Chemistry 1st year platform (all sectors)
Cours de Chimie Physique - Paul Arnaud (ed. Dunod)

PRE-REQUISITES

Laboratory safety, knowledge of glasswork and its use Knowledge of major classes of materials
Redox reaction equilibrium, oxidation number (done in the 1st half)
Notions of strong / weak acid, pKa, buffer solution, colored indicators
Low energy interactions between molecules (polarity, van der Waals bonds, hydrogen bonding) (done in the 1st half)

IDENTIFICATION

CODE : FIMI-1-S2-EC-TH-TF
ECTS : 4

HOURS

Cours :	11h
TD :	28h
TP :	5h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	47h
Travail personnel :	37h
Total :	84h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Lesson and exercise handouts
- Moodle Internet interface (course supplements and examination papers with answer keys)

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Apply the general methods of thermodynamics in simple situations
- By using the appropriate vocabulary (system, transformation, isotherm, etc.)
- By applying the first and second principles to typical transformations of closed systems, using the concepts of reversibility, heat, work and state function (internal energy, enthalpy, entropy, free enthalpy, etc.)

Establish the properties of a pure substance using :
- the temperature and pressure of a gas, and the perfect gas model for a single gas or a mixture of gases;
- the boiling temperature of a pure substance, its saturation vapour pressure and its heat capacity according to its physical state;
- Clapeyron's relation with the quantities associated with changes of state and making the relevant simplification assumptions
- the particularities of the (P,V) and (P,T) diagrams for typical transformations.

Describe and analyse a simple thermal machine:
- By using (definitions of) motor or receiver cycles,
- By using a cycle of transformations represented on a (P,V) diagram
- By calculating the coefficient of performance in the case of ideal and real operation

Analyse a chemical reaction:
- Identify the parameters of the standard state of reaction, the product formation reactions and the heat of reaction
- Use Hess's law to calculate the standard reaction quantities (internal energy, enthalpy and entropy)
- Use the principle of adiabatic calorimetry to determine a heat of reaction, a heat capacity and a flame temperature (put in all the expected values), by applying a material balance and a heat balance.

CONTENT

The engineering student will work and will be evaluated on the following knowledge:
- Gaseous state
- System characterization and evolution
- The different forms of energy
- The first law: application to the transformations of an ideal gas and to thermo chemistry
- The second law as an evolution criterion
- Theoretical uses of the two laws to homogeneous physical systems. Thermodynamic coefficients.
- The two laws applied specifically to gases.
- Thermodynamic potentials: Gibbs free energy
- Thermodynamics applied to phase transitions: Clapeyron's law
- Application to heat engines.
- Calorimetry
- Practical work on Power, efficiency and heat capacity
- Practical work on Liquid-vapour equilibrium

BIBLIOGRAPHY

P. ARNAUD, Cours de Chimie Physique, Eds Dunod
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique PC, Eds Bréal
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique Prépas MP SI PC SI, Eds Bréal
P. GRECIAS, Exercices et problèmes de Thermodynamique Physique, 2ème édition, Collection de sciences physiques, Eds Lavoisier Tec et Doc
H Prépa, Thermodynamique 2ème année MP-MP* PT-PT*, Eds Hachette Supérieur (Chapitre 1 pour le corps pur)
P. BONNET, Cours de Thermodynamique ; Eds Ellipses
J. P. PEREZ, Thermodynamique. Fondements et Applications. Eds
M. HULIN, N. HULIN, M. VEYSSIE. Thermodynamique. Eds Dunod

PRE-REQUISITES

Initiation to European Civlisation

IDENTIFICATION

CODE : FIMI-1-S2-EC-MOS-EU
ECTS : undefined

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	10h
Total :	30h

ASSESMENT METHOD

An individual piece of writing (reflective essay)
A group project (role play, debate)

TEACHING AIDS

Handouts, methodological sheets, extracts from books, documents provided by each teacher.

TEACHING LANGUAGE

French

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M. Suarez-Lopez Gonzalo :
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AIMS

Humanities reference framework :
CT2 - WORK, LEARN AND DEVELOP INDEPENDENTLY
2.3 - Acquire new skills independently by seeking out the necessary resources
2.4 - Exercise a critical mind, think for oneself
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3.1 - Communicate appropriately: pass on a message, listen, show empathy, assert one's point of view, debate in a reasoned manner
3.2 - Situate his/her original discourse using explicit references
3.3 - Communicate non-verbally: posture and body language
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions, etc.
5.2 - Integrate a responsible dimension (deontology, ethics) into his/her actions; identify, evaluate and anticipate the consequences of his/her actions and decisions at different levels of scale.
CT7 - WORK IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.2 - Decode cultural references in discourse, attitudes and behaviour
7.3 - Put values, beliefs and behaviour into perspective
7.4 - Integrate cultural diversity into group work

CONTENT

This introductory course is organised around three themes relating to the study of Europe and its contemporary issues:
1. founding ideas and institutions
2. societies, mobility and migration, and
3. political discourse and international relations

The aim of the course is to introduce students to the contemporary challenges facing Europe, both as a continent and in terms of the various communities that make it up. It also prepares students for the Eurinsa project courses in semesters 3 and 4.

BIBLIOGRAPHY

François, Étienne et Thomas Serrier (dir.), Europa. Notre histoire, Les Arènes, 2017

Mak, Geert, Les rêves d'un Européen au XXIe siècle, Paris, Gallimard, 2022

Mak, Geert, Voyage d'un européen à travers le XXe siècle, Paris, Gallimard, 2010

Middelaar, Luuk van, Le passage à l'Europe. Histoire d'un commencement, (trad. D. Cunin et O. Vanwersch-Cot), Paris, Gallimard [coll. « Bibliothèque des idées »], 2012

Mongrenier, Jean-Sylvestre, Géopolitique de l'Europe, Paris, Presses Universitaires de France [coll. « Que sait-je »], 2020

Quatremer, Jean, Les salaud de l'Europe. Guide à l'usage des eurosceptiques, Paris, Calmann-Lévy, 2019

Information website on Europe : Toute l'Europe

PRE-REQUISITES

The prerequisites are the skills acquired in secondary education: intellectual curiosity, the ability to seek out and appropriate relevant information, general logic of thought, accuracy of written and spoken language.

IDENTIFICATION

CODE : FIMI-1-S2-EC-CO-TF-SH
ECTS : undefined

HOURS

Cours :	0h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	28h
Travail personnel :	20h
Total :	48h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French
English

CONTACT

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Mme FOURMEAUX Marion :
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AIMS

AAv. 1. Analyze, explain and diagram the operation of a mechanical system based on an overall drawing, perspectives, digital model and/or real system.
AAv. 2. Using 2D and 3D tools, design a mounting or pivot connection according to the rules of the art (MIP/MAP/Jeu), taking into account environmental and mechanical constraints.
AAv. 3. modify an existing mechanical system by applying technological choices while respecting environmental constraints.

CONTENT

- being able to model a simple joint and draw the corresponding normalized symbol (ex: revolute, sliding, ball etc.)
- being able to draw a solution for simple revolute or complete joint on paper
- being able to create the virtual 3D model of a simple system using CAD software and generate 2D sketchs (definition and assambly drawings)

BIBLIOGRAPHY

PRE-REQUISITES

- sketch reading (definition and assembly drawings)
- using main functionnalities of CAD software

IDENTIFICATION

CODE : FIMI-1-S2-EC-ETRE-TF
ECTS : 2

HOURS

Cours :	0h
TD :	19h
TP :	0h
Projet :	8h
Evaluation :	1h
Face à face pédagogique :	20h
Travail personnel :	25h
Total :	53h

ASSESMENT METHOD

Continuous assessment. Three assessments are organized:
- the survey of IPCC work are assessed during the session group presentation (formative or summative, to be specified)
- the introductory project on Life Cycle Life Cycle Assessment project a graded group presentation (summative), including non-quantifiable impacts (Human Sciences)
- activities around anthropocene, living issues and and climate-energy issues give rise to an individual summative.

TEACHING AIDS

Course materials and exercises.
1st Cycle Moodle platform: all course and planning and organization, links to resources.

TEACHING LANGUAGE

French
English

CONTACT

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M. SANDEL Arnaud :
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AIMS

This teaching sequence, in S2, is the first part of a program that will continue throughout the studies, with the aim of training engineers who are aware of the challenges of the ecological transition.

In its February 26, 2020 letter of intent, INSA Lyon stated that "the courses in Sustainable Development and Social Responsibility (SDRS) courses combine the following training objectives :
* in terms of cross-disciplinary skills
* in terms of themes to be addressed: climate change, energy, raw materials resources, and damage to living organisms and human health.

Two cross-cutting themes are addressed: links between science, technology and society, and the dynamics of change.

The targeted learning outcomes are thus :
1) Use a multi-disciplinary body of knowledge to provide reasoned, qualitative and quantitative answers to simple questions on ecological transition issues relating to energy, climate and living organisms.
2) Associate the consequences of different human actions on the planet's habitability, based on planetary limits and other factors.
3) Illustrate (explain) the systemic nature of various socio-ecological issues; integrate the central role of living organisms into the reasoning.
4) Analyze and quantify the environmental and social impacts of different human activities, in particular of a product/system/service; compare different solutions.

CONTENT

The student-engineer will work on and be assessed on the following knowledge:
- Understanding of the main principles of the Anthropocene.
- Introduction to energy and living issues.
- Role of the engineer in the ecological transition.

The sequence will be structured as follows:
- 2h introduction ("Why talk about ecological transition in engineering schools?")
- 8h of lectures and transdisciplinary exercises on planetary limits and the Anthropocene
- 3h on biodiversity with the introduction to the One Health concept
- 5h on climate-energy issues related to IPCC works

The sequence ends with 9h on project on Life Cycle Assessment (LCA) and impact of the products

IMPORTANT: 8 hours of the 28-hour course will be taught by a pair of teachers (Engineering Sciences / Sciences and Humanities), in a "Sciences-Humas" format.

BIBLIOGRAPHY

Atlas of the Anthropocene. F. Gemenne, A. Rankovic, Sciences Po Cartography Workshop
IPCC reports.
IPBES reports.

PRE-REQUISITES

Associated secondary school curricula (2nde, 1ère et Terminale) on sustainable development and social responsibility.
sustainable development and social responsibility.
Climate mural created during 1st year induction week.
The various 1st semester courses (Engineering Sciences and Human Sciences are called upon more in terms of methods (e.g.: drawing up a balance sheet, analysis, restitution...) rather than knowledge.

IDENTIFICATION

CODE : FIMI-1-S2-EC-CO-TF-SH
ECTS : undefined

HOURS

Cours :	0h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	28h
Travail personnel :	20h
Total :	48h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French
English

CONTACT

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marion.fourmeau@insa-lyon.fr

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- being able to model a simple joint and draw the corresponding normalized symbol (ex: revolute, sliding, ball etc.)
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PRE-REQUISITES

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- using main functionnalities of CAD software

IDENTIFICATION

CODE : FIMI-1-S2-EC-ETRE-TF
ECTS : 2

HOURS

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TD :	19h
TP :	0h
Projet :	8h
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Face à face pédagogique :	20h
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Total :	53h

ASSESMENT METHOD

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TEACHING AIDS

Course materials and exercises.
1st Cycle Moodle platform: all course and planning and organization, links to resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

This teaching sequence, in S2, is the first part of a program that will continue throughout the studies, with the aim of training engineers who are aware of the challenges of the ecological transition.

In its February 26, 2020 letter of intent, INSA Lyon stated that "the courses in Sustainable Development and Social Responsibility (SDRS) courses combine the following training objectives :
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- 5h on climate-energy issues related to IPCC works

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IPBES reports.

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sustainable development and social responsibility.
Climate mural created during 1st year induction week.
The various 1st semester courses (Engineering Sciences and Human Sciences are called upon more in terms of methods (e.g.: drawing up a balance sheet, analysis, restitution...) rather than knowledge.

IDENTIFICATION

CODE :FIMI-1-S2-EC-OMNI-FI-SH

ECTS : *

HOURS

Cours :	7h
TD :	15h
TP :	6h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	25h
Total :	54.5h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Lecture notes and exercices textbook, specific content of lanes available on Moodle.

TEACHING LANGUAGE

French
English

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AIMS

CONTENT

Multiple integrals
Scalar and vector fields

BIBLIOGRAPHY

PRE-REQUISITES

High school and first semester of FIMI abilities.

Informatics and numerical society 2

IDENTIFICATION

CODE : FIMI-1-S2-EC-ISN-TF
ECTS : toto

HOURS

Cours :	3h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	35h
Travail personnel :	35h
Total :	70h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

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AIMS

Targeted learning outcomes :

AAv2.1 : At the end of S2, students will be able to follow a simple development method using functional decomposition, including a test plan.

AAv2.2 : At the end of S2, students are able to use iterative and recursive programming on simple cases.

AAv2.3 : At the end of S2, students will be able to develop a small team project in Python ba-sed on given specifications.

AAv2.4 : At the end of S2, students will be able to describe the general operation of a computer network, particularly in the case of loading a Web page.

AAv2.5 : At the end of S2, students are able to discuss a given list of economic, social, political and imaginary issues related to the use of a specific digital technology, in a real-life situation.

CONTENT

1- Functions and séquences
2- 2D lists
3- Mini project
4- Recursivity
5- Networks 101

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-1-S1-EC-ISN

IDENTIFICATION

CODE : FIMI-1-S2-EC-MA-SC
ECTS : 5

HOURS

Cours :	19.5h
TD :	42h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	64.5h
Travail personnel :	70h
Total :	134.5h

ASSESMENT METHOD

- IE1 : duration 1,5 h, coefficient 1,5.
- IE2 : duration 1,5 h, coefficient 1,5.
- IEF : duration 2h, coefficient 2.

Concepts from the first semestre and seen throughout the semester are necessary to all the evaluations.

TEACHING AIDS

Online documents on Moodle.

TEACHING LANGUAGE

English

CONTACT

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AIMS

AAv2.1 – Study the continuity or the continuous extension of a function at a point.
AAv2.2 – Use properties of continuous functions to prove the existence of certain values (Intermediate Value Theorem, extreme value theorem).
AAv2.3 – Study differentiability at a point and compute derivatives using standard formulas (product, quotient, composition, inverse).
AAv2.4 – Use differentiability to study monotonicity and convexity.
AAv2.5 – Apply the Mean Value Theorem to bound or analyze the sign of expressions.
AAv2.6 – Bound an integral using integration properties (linearity, monotonicity).
AAv2.7 – Use the Fundamental Theorem of Calculus to express and compute an integral from a primitive.
AAv2.8 – Know common Taylor expansions and use them to find the expansion of a function without applying the Taylor formula.
AAv2.9 – Use Taylor expansions for local analysis (tangent, relative position) and asymptotic behavior (limit, equivalent, asymptote).
AAv2.10 – Apply the Taylor-Lagrange formula to estimate the approximation error via bounds.
AAv2.11 – Determine whether two subspaces are supplementary, notably using dimension arguments.
AAv2.12 – Check whether a linear map is a projector and compute its characteristic elements if applicable.
AAv2.13 – Perform basic matrix operations (sum, product, transpose, inverse) when defined.
AAv2.14 – Use the link between matrices and linear maps to compose, raise to a power, or evaluate at a point.
AAv2.15 – Compute the change-of-basis matrix and its inverse.
AAv2.16 – Compute the matrices of an endomorphism in different bases, either directly or via a change of basis.

CONTENT

One-variable functions calculus and linear algebra following the first semester curriculum. Over the whole year :
- Usual functions
- Limits
- Continuity
- Differentiability
- Equivalents
- Taylor expansions
- Polynomials
- Vector spaces
- Linear Maps
- Matrices

BIBLIOGRAPHY

Azoulay-Avignant : Mathématiques (Ediscience)
Guinin-Aubonnet-Joppin : Précis de Mathématiques (Bréal)
Thuillier-Belloc : Mathématiques (Masson)
Lemberg: Bien commencer ses études en mathématiques (Vuibert)
Balac-Sturm : Algèbre et Analyse 1ère année et Exercices de 1ère année (PPUR)

PRE-REQUISITES

PC-S1-MA-C

Transversal Scientific Projects

IDENTIFICATION

CODE : FIMI-1-S2-EC-MOS-SC
ECTS : undefined

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	10h
Total :	30h

ASSESMENT METHOD

Presentation to a panel - Written report

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

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AIMS

Problem-based teaching.
Implementation of cross-disciplinary connections between several scientific disciplines and humanities components, with oral and written presentations.
Project management.

CONTENT

Students are offered two-week projects with scientific content. They have to carry out documentary research and scientific analysis, and produce results in response to problem situations. These projects are presented orally to a panel of teachers and a written report is produced in English.
Doc Insa provides training in communication and documentary research.

BIBLIOGRAPHY

Doc Insa is a partner in this project and is in charge of documentary research.

PRE-REQUISITES

Fluency in English
Basic computer skills

IDENTIFICATION

CODE : FIMI-1-S2-EC-CH-TF-SH
ECTS : 2

HOURS

Cours :	0h
TD :	6h
TP :	20.5h
Projet :	0h
Evaluation :	2.5h
Face à face pédagogique :	29h
Travail personnel :	20h
Total :	49h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Booklet for practical work in Chemistry 1
Summary sheet for lab reports
Moodle platform chemistry 1st year all sectors

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Determine the composition of a physico-chemical system at equilibrium as a function of its redox and acid-base properties
- by identifying possible reactions in order to predict the evolution of the system
- by using a body of knowledge and subject-specific tools

Handle appropriate measuring instruments in order to produce reliable experimental measurements
- by implementing a scientific protocol, complying with safety instructions and using appropriate equipment (qualitative vs. quantitative glassware)
- by adapting an experimental protocol to solve a simple problem
- by identifying and quantifying sources of error and uncertainties

Exploit experimental measurements in order to obtain a result with its associated uncertainty
- by establishing the analytical relationships between the quantities of interest and justifying the calculations used
- by clearly presenting the measurements or experimental data (for example: graph or table)
- by using the appropriate method for calculating uncertainties (for example: logarithmic or graphical)

Produce a scientific report of an experimental session on chemical transformations in aqueous solutions
- by justifying the experimental protocol (choice of glassware and/or dilution factor)
- by presenting the results
- by criticising the results

CONTENT

- Introduction to experimental chemistry and quantitative analysis.
The engineering student will learn to use the appropriate measuring instruments correctly in order to prepare a solution with a given concentration, to measure a physical-chemical property by colorimetry, pHmetry or spectrophotometry:
• Weigh a solid,
• Make a dilution using a volumetric glass,
• Measure the volume, pH or absorbance of a solution.

- Study oxidation-reduction and acid-base reactions and determine the composition of a physico-chemical system at equilibrium:
• Identify the possible reaction(s) in order to predict the evolution of the system
• Establish a material balance and the quantitative proportions between the different species, including but not limited to a relationship at equivalence
• Use experimental measurements to obtain a result with its associated uncertainty

BIBLIOGRAPHY

Handouts Chemistry 1 and Thermodynamics
MOODLE Chemistry 1st year platform (all sectors)
Cours de Chimie Physique - Paul Arnaud (ed. Dunod)

PRE-REQUISITES

Laboratory safety, knowledge of glasswork and its use Knowledge of major classes of materials
Redox reaction equilibrium, oxidation number (done in the 1st half)
Notions of strong / weak acid, pKa, buffer solution, colored indicators
Low energy interactions between molecules (polarity, van der Waals bonds, hydrogen bonding) (done in the 1st half)

IDENTIFICATION

CODE : FIMI-1-S2-EC-TH-TF
ECTS : 4

HOURS

Cours :	11h
TD :	28h
TP :	5h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	47h
Travail personnel :	37h
Total :	84h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Lesson and exercise handouts
- Moodle Internet interface (course supplements and examination papers with answer keys)

TEACHING LANGUAGE

French
English

CONTACT

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M. Garnier Vincent :
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AIMS

Apply the general methods of thermodynamics in simple situations
- By using the appropriate vocabulary (system, transformation, isotherm, etc.)
- By applying the first and second principles to typical transformations of closed systems, using the concepts of reversibility, heat, work and state function (internal energy, enthalpy, entropy, free enthalpy, etc.)

Establish the properties of a pure substance using :
- the temperature and pressure of a gas, and the perfect gas model for a single gas or a mixture of gases;
- the boiling temperature of a pure substance, its saturation vapour pressure and its heat capacity according to its physical state;
- Clapeyron's relation with the quantities associated with changes of state and making the relevant simplification assumptions
- the particularities of the (P,V) and (P,T) diagrams for typical transformations.

Describe and analyse a simple thermal machine:
- By using (definitions of) motor or receiver cycles,
- By using a cycle of transformations represented on a (P,V) diagram
- By calculating the coefficient of performance in the case of ideal and real operation

Analyse a chemical reaction:
- Identify the parameters of the standard state of reaction, the product formation reactions and the heat of reaction
- Use Hess's law to calculate the standard reaction quantities (internal energy, enthalpy and entropy)
- Use the principle of adiabatic calorimetry to determine a heat of reaction, a heat capacity and a flame temperature (put in all the expected values), by applying a material balance and a heat balance.

CONTENT

The engineering student will work and will be evaluated on the following knowledge:
- Gaseous state
- System characterization and evolution
- The different forms of energy
- The first law: application to the transformations of an ideal gas and to thermo chemistry
- The second law as an evolution criterion
- Theoretical uses of the two laws to homogeneous physical systems. Thermodynamic coefficients.
- The two laws applied specifically to gases.
- Thermodynamic potentials: Gibbs free energy
- Thermodynamics applied to phase transitions: Clapeyron's law
- Application to heat engines.
- Calorimetry
- Practical work on Power, efficiency and heat capacity
- Practical work on Liquid-vapour equilibrium

BIBLIOGRAPHY

P. ARNAUD, Cours de Chimie Physique, Eds Dunod
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique PC, Eds Bréal
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique Prépas MP SI PC SI, Eds Bréal
P. GRECIAS, Exercices et problèmes de Thermodynamique Physique, 2ème édition, Collection de sciences physiques, Eds Lavoisier Tec et Doc
H Prépa, Thermodynamique 2ème année MP-MP* PT-PT*, Eds Hachette Supérieur (Chapitre 1 pour le corps pur)
P. BONNET, Cours de Thermodynamique ; Eds Ellipses
J. P. PEREZ, Thermodynamique. Fondements et Applications. Eds
M. HULIN, N. HULIN, M. VEYSSIE. Thermodynamique. Eds Dunod

PRE-REQUISITES

IDENTIFICATION

CODE : FIMI-1-S2-EC-PH-FC-SC
ECTS : 6

HOURS

Cours :	14h
TD :	35h
TP :	20h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	73h
Travail personnel :	80h
Total :	153h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Solve a dynamics problem: establish and exploit the differential equation describing motion and the equation of trajectory or the literal expression of a force or moment using a precise methodology.
AAv.2 Use a mechanical energy balance to determine either speeds at a given point, or particular positions, or the expression of forces, or the equation of motion (differential equation or trajectory).
AAv.3 Analyse the stability of an equilibrium position of a mechanical system using either mechanical actions (forces or moments) or potential energy. Study free and forced oscillations around a stable equilibrium position.
AAv.4 Produce a circuit diagram from a schematic and vice versa, and model a 1st or 2nd order transient or sinusoidal electrical circuit.
AAv.5 Determine currents, voltages and energy quantities in a 1st or 2nd order transient (including the different regimes) or sinusoidal circuit (including transfer functions and filtering).
AAv.6 Construct and use graphical representations of electrical quantities.
AAv.7 Apply the concepts seen in mechanics and electricity in an experimental context: propose and then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write up a report.

CONTENT

- AC electricity
- Dynamics (of point and solid)
- Mechanical and electrical oscillations

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors), statistics (average and standard deviation), data and functions plots.
The physics and maths curriculum of the first semester (dimensions, uncertainties and electricty + algebraic and differential equations)
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.

IDENTIFICATION

CODE : FIMI-1-S2-EC-ETRE-AV1
ECTS : 2

HOURS

Cours :	0h
TD :	19h
TP :	0h
Projet :	8h
Evaluation :	1h
Face à face pédagogique :	20h
Travail personnel :	25h
Total :	53h

ASSESMENT METHOD

Continuous assessment. Three assessments are organized:
- the survey of IPCC work are assessed during the session group presentation (formative or summative, to be specified)
- the introductory project on Life Cycle Life Cycle Assessment project a graded group presentation (summative), including non-quantifiable impacts (Human Sciences)
- activities around anthropocene, living issues and and climate-energy issues give rise to an individual summative.

TEACHING AIDS

Course materials and exercises.
1st Cycle Moodle platform: all course and planning and organization, links to resources.

TEACHING LANGUAGE

French

CONTACT

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AIMS

This teaching sequence, in S2, is the first part of a program that will continue throughout the studies, with the aim of training engineers who are aware of the challenges of the ecological transition.

In its February 26, 2020 letter of intent, INSA Lyon stated that "the courses in Sustainable Development and Social Responsibility (SDRS) courses combine the following training objectives :
* in terms of cross-disciplinary skills
* in terms of themes to be addressed: climate change, energy, raw materials resources, and damage to living organisms and human health.

Two cross-cutting themes are addressed: links between science, technology and society, and the dynamics of change.

The targeted learning outcomes are thus :
1) Use a multi-disciplinary body of knowledge to provide reasoned, qualitative and quantitative answers to simple questions on ecological transition issues relating to energy, climate and living organisms.
2) Associate the consequences of different human actions on the planet's habitability, based on planetary limits and other factors.
3) Illustrate (explain) the systemic nature of various socio-ecological issues; integrate the central role of living organisms into the reasoning.
4) Analyze and quantify the environmental and social impacts of different human activities, in particular of a product/system/service; compare different solutions.

CONTENT

The student-engineer will work on and be assessed on the following knowledge:
- Understanding of the main principles of the Anthropocene.
- Introduction to energy and living issues.
- Role of the engineer in the ecological transition.

The sequence will be structured as follows:
- 2h introduction ("Why talk about ecological transition in engineering schools?")
- 8h of lectures and transdisciplinary exercises on planetary limits and the Anthropocene
- 3h on biodiversity with the introduction to the One Health concept
- 5h on climate-energy issues related to IPCC works

The sequence ends with 9h on project on Life Cycle Assessment (LCA) and impact of the products

IMPORTANT: 8 hours of the 28-hour course will be taught by a pair of teachers (Engineering Sciences / Sciences and Humanities), in a "Sciences-Humas" format.

BIBLIOGRAPHY

Atlas of the Anthropocene. F. Gemenne, A. Rankovic, Sciences Po Cartography Workshop
IPCC reports.
IPBES reports.

PRE-REQUISITES

Associated secondary school curricula (2nde, 1ère et Terminale) on sustainable development and social responsibility.
sustainable development and social responsibility.
Climate mural created during 1st year induction week.
The various 1st semester courses (Engineering Sciences and Human Sciences are called upon more in terms of methods (e.g.: drawing up a balance sheet, analysis, restitution...) rather than knowledge.

IDENTIFICATION

CODE : FIMI-1-S2-EC-CO-AV1
ECTS : undefined

HOURS

Cours :	0h
TD :	37h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	40h
Travail personnel :	40h
Total :	80h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French

CONTACT

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AIMS

AAv. 1. Analyze, explain and diagram the operation of a mechanical system based on an overall drawing, perspectives, digital model and/or real system.
AAv. 2. Using 2D and 3D tools, design a mounting or pivot connection according to the rules of the art (MIP/MAP/Jeu), taking into account environmental and mechanical constraints.
AAv. 3. modify an existing mechanical system by applying technological choices while respecting environmental constraints.

CONTENT

- being able to model a simple joint and draw the corresponding normalized symbol (ex: revolute, sliding, ball etc.)
- being able to draw a solution for simple revolute or complete joint on paper
- being able to create the virtual 3D model of a simple system using CAD software and generate 2D sketchs (definition and assambly drawings)

BIBLIOGRAPHY

PRE-REQUISITES

- sketch reading (definition and assembly drawings)
- using main functionnalities of CAD software

IDENTIFICATION

CODE : FIMI-1-S2-EC-CH-AV1
ECTS : 1

HOURS

Cours :	0h
TD :	18h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	20h
Travail personnel :	20h
Total :	40h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Booklet for practical work in Chemistry 1
Summary sheet for lab reports
Moodle platform chemistry 1st year all sectors

TEACHING LANGUAGE

French

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AIMS

Determine the composition of a physico-chemical system at equilibrium as a function of its redox and acid-base properties
- by identifying possible reactions in order to predict the evolution of the system
- by using a body of knowledge and subject-specific tools

Handle appropriate measuring instruments in order to produce reliable experimental measurements
- by implementing a scientific protocol, complying with safety instructions and using appropriate equipment (qualitative vs. quantitative glassware)
- by adapting an experimental protocol to solve a simple problem
- by identifying and quantifying sources of error and uncertainties

Exploit experimental measurements in order to obtain a result with its associated uncertainty
- by establishing the analytical relationships between the quantities of interest and justifying the calculations used
- by clearly presenting the measurements or experimental data (for example: graph or table)
- by using the appropriate method for calculating uncertainties (for example: logarithmic or graphical)

Produce a scientific report of an experimental session on chemical transformations in aqueous solutions
- by justifying the experimental protocol (choice of glassware and/or dilution factor)
- by presenting the results
- by criticising the results

CONTENT

- Introduction to experimental chemistry and quantitative analysis.
The engineering student will learn to use the appropriate measuring instruments correctly in order to prepare a solution with a given concentration, to measure a physical-chemical property by colorimetry, pHmetry or spectrophotometry:
• Weigh a solid,
• Make a dilution using a volumetric glass,
• Measure the volume, pH or absorbance of a solution.
- Study oxidation-reduction and acid-base reactions and determine the composition of a physico-chemical system at equilibrium:
• Identify the possible reaction(s) in order to predict the evolution of the system
• Establish a material balance and the quantitative proportions between the different species, including but not limited to a relationship at equivalence
• Use experimental measurements to obtain a result with its associated uncertainty

BIBLIOGRAPHY

Handouts Chemistry 1 and Thermodynamics
MOODLE Chemistry 1st year platform (all sectors)
Cours de Chimie Physique - Paul Arnaud (ed. Dunod)

PRE-REQUISITES

Laboratory safety, knowledge of glasswork and its use Knowledge of major classes of materials
Redox reaction equilibrium, oxidation number (done in the 1st half)
Notions of strong / weak acid, pKa, buffer solution, colored indicators
Low energy interactions between molecules (polarity, van der Waals bonds, hydrogen bonding) (done in the 1st half)

IDENTIFICATION

CODE : FIMI-1-S2-EC-TH-AV1
ECTS : 5

HOURS

Cours :	13h
TD :	28h
TP :	6h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	50h
Travail personnel :	50h
Total :	100h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Lesson and exercise handouts
- Moodle Internet interface (course supplements and examination papers with answer keys)

TEACHING LANGUAGE

French

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AIMS

Apply the general methods of thermodynamics in simple situations
- By using the appropriate vocabulary (system, transformation, isotherm, etc.)
- By applying the first and second principles to typical transformations of closed systems, using the concepts of reversibility, heat, work and state function (internal energy, enthalpy, entropy, free enthalpy, etc.)

Establish the properties of a pure substance using :
- the temperature and pressure of a gas, and the perfect gas model for a single gas or a mixture of gases;
- the boiling temperature of a pure substance, its saturation vapour pressure and its heat capacity according to its physical state;
- Clapeyron's relation with the quantities associated with changes of state and making the relevant simplification assumptions
- the particularities of the (P,V) and (P,T) diagrams for typical transformations.

Describe and analyse a simple thermal machine:
- By using (definitions of) motor or receiver cycles,
- By using a cycle of transformations represented on a (P,V) diagram
- By calculating the coefficient of performance in the case of ideal and real operation

Analyse a chemical reaction:
- Identify the parameters of the standard state of reaction, the product formation reactions and the heat of reaction
- Use Hess's law to calculate the standard reaction quantities (internal energy, enthalpy and entropy)
- Use the principle of adiabatic calorimetry to determine a heat of reaction, a heat capacity and a flame temperature (put in all the expected values), by applying a material balance and a heat balance.

CONTENT

The engineering student will work and will be evaluated on the following knowledge:
- Gaseous state
- System characterization and evolution
- The different forms of energy
- The first law: application to the transformations of an ideal gas and to thermo chemistry
- The second law as an evolution criterion
- Theoretical uses of the two laws to homogeneous physical systems. Thermodynamic coefficients.
- The two laws applied specifically to gases.
- Thermodynamic potentials: Gibbs free energy
- Thermodynamics applied to phase transitions: Clapeyron's law
- Application to heat engines.
- Calorimetry
- Practical work on Power, efficiency and heat capacity
- Practical work on Liquid-vapour equilibrium

BIBLIOGRAPHY

P. ARNAUD, Cours de Chimie Physique, Eds Dunod
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique PC, Eds Bréal
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique Prépas MP SI PC SI, Eds Bréal
P. GRECIAS, Exercices et problèmes de Thermodynamique Physique, 2ème édition, Collection de sciences physiques, Eds Lavoisier Tec et Doc
H Prépa, Thermodynamique 2ème année MP-MP* PT-PT*, Eds Hachette Supérieur (Chapitre 1 pour le corps pur)
P. BONNET, Cours de Thermodynamique ; Eds Ellipses
J. P. PEREZ, Thermodynamique. Fondements et Applications. Eds
M. HULIN, N. HULIN, M. VEYSSIE. Thermodynamique. Eds Dunod

PRE-REQUISITES

Physics 2

IDENTIFICATION

CODE : FIMI-1-S2-EC-PH-AV1
ECTS : 5

HOURS

Cours :	8h
TD :	29h
TP :	12h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	50h
Travail personnel :	50h
Total :	100h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Apply the concepts seen in mechanics and electricity in an experimental context: propose and then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write up a report.
AAv.2 Determine the expression of a vector field as a function of spatial parameters and boundary conditions, from the expression of its law as a partial differential equation, exploiting the symmetries of the sources.
AAv.3 Convert laws and quantities expressed in a local (intensive) formulation into an integral (extensive) formulation and vice versa.
AAv.4 Determine the action of electromagnetic forces in an electromagnetic or electromechanical system.

CONTENT

- Electromagnetic forces (Lorentz, Laplace)
- Electricity - mechanics analogies
- Electromagnetism (field operators, sources of electric and magnetic fields, Maxwell's equations)

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors), statistics (average and standard deviation), data and functions plots.
The physics and maths curriculum of the previous semesters (AV0 S1 et S2 et AV1 S1).
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.

IDENTIFICATION

CODE : FIMI-1-S2-EC-MA-AV1
ECTS : undefined

HOURS

Cours :	16.5h
TD :	31.5h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	50h
Travail personnel :	50h
Total :	100h

ASSESMENT METHOD

Students are evaluated with written tests during the semester.

TEACHING AIDS

Lecture notes, tutorial exercises, and solutions available on Moodle

TEACHING LANGUAGE

French

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AIMS

Under construction, see the program below

CONTENT

Sequences 1: high school review, key results

Numerical series and improper integrals

Sequences 2: recursive and implicit sequences

BIBLIOGRAPHY

PRE-REQUISITES

Mathematics curriculum of AVE0: linear and asymptotic approximation, polynomials, inverse functions, equivalents, integration

Calculations curriculum of AVE0: real calculations, sums, antiderivatives

Informatics and numerical society 2

IDENTIFICATION

CODE : FIMI-1-S2-EC-ISN-AV1
ECTS : undefined

HOURS

Cours :	4h
TD :	34.5h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	40h
Travail personnel :	40h
Total :	80h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Targeted learning outcomes :

AAv2.1 : At the end of S2, students will be able to follow a simple development method using functional decomposition, including a test plan.

AAv2.2 : At the end of S2, students are able to use iterative and recursive programming on simple cases.

AAv2.3 : At the end of S2, students will be able to develop a small team project in Python ba-sed on given specifications.

AAv2.4 : At the end of S2, students will be able to describe the general operation of a computer network, particularly in the case of loading a Web page.

AAv2.5 : At the end of S2, students are able to discuss a given list of economic, social, political and imaginary issues related to the use of a specific digital technology, in a real-life situation.

CONTENT

1- Functions and sequences
2- 2-D lists and application to the game of life
3- 2D lists mini-project
4- Recursion
5- Introduction to networks
6- Analysis of a web page, the network and implications for the digital society

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-1-S1-EC-ISN-AV1

IDENTIFICATION

CODE : FIMI-1-S2-EC-CSS-AV1
ECTS : 2

HOURS

Cours : 0h
TD : 26.5h
TP : 0h
Projet : 0h
Evaluation 0.016666666666666666h
Face à face pédagogique : 26.516666666666666h
Travail personnel : 25h
Total : 51.516666666666666h

ASSESMENT METHOD

A one-hour theatrical presentation
A 2-hour study of an argumentative text

TEACHING AIDS

TEACHING LANGUAGE

French

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AIMS

Humanities framework:
CT2 - WORK, LEARN, EVOLVE IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on one's own, by seeking out the necessary resources
2.4 - Exercise one's critical faculties, think for oneself
CT3 - INTERACT WITH OTHERS, WORK IN A TEAM
3.1 - Communicate appropriately: convey a message, listen, show empathy, assert one's point of view, debate in a well-argued way

3. 2 - Situate one's original discourse with explicit references
3.3 - Communicate non-verbally: posture and gestures
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.
5.2 - Integrate a responsible dimension (deontology, ethics) into their actions; identify, evaluate and anticipate the consequences of their actions and decisions at different levels of scale.

CONTENT

- Notions of rhetoric and argumentation
- Written and oral communication exercises
- Reflections, positions, debates

BIBLIOGRAPHY

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.

PRE-REQUISITES

Learning from previous semesters

IDENTIFICATION

CODE : FIMI-1-S2-EC-CH-TF-SH
ECTS : 2

HOURS

Cours :	0h
TD :	6h
TP :	20.5h
Projet :	0h
Evaluation :	2.5h
Face à face pédagogique :	29h
Travail personnel :	20h
Total :	49h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Booklet for practical work in Chemistry 1
Summary sheet for lab reports
Moodle platform chemistry 1st year all sectors

TEACHING LANGUAGE

French
English

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AIMS

Determine the composition of a physico-chemical system at equilibrium as a function of its redox and acid-base properties
- by identifying possible reactions in order to predict the evolution of the system
- by using a body of knowledge and subject-specific tools

Handle appropriate measuring instruments in order to produce reliable experimental measurements
- by implementing a scientific protocol, complying with safety instructions and using appropriate equipment (qualitative vs. quantitative glassware)
- by adapting an experimental protocol to solve a simple problem
- by identifying and quantifying sources of error and uncertainties

Exploit experimental measurements in order to obtain a result with its associated uncertainty
- by establishing the analytical relationships between the quantities of interest and justifying the calculations used
- by clearly presenting the measurements or experimental data (for example: graph or table)
- by using the appropriate method for calculating uncertainties (for example: logarithmic or graphical)

Produce a scientific report of an experimental session on chemical transformations in aqueous solutions
- by justifying the experimental protocol (choice of glassware and/or dilution factor)
- by presenting the results
- by criticising the results

CONTENT

- Introduction to experimental chemistry and quantitative analysis.
The engineering student will learn to use the appropriate measuring instruments correctly in order to prepare a solution with a given concentration, to measure a physical-chemical property by colorimetry, pHmetry or spectrophotometry:
• Weigh a solid,
• Make a dilution using a volumetric glass,
• Measure the volume, pH or absorbance of a solution.

- Study oxidation-reduction and acid-base reactions and determine the composition of a physico-chemical system at equilibrium:
• Identify the possible reaction(s) in order to predict the evolution of the system
• Establish a material balance and the quantitative proportions between the different species, including but not limited to a relationship at equivalence
• Use experimental measurements to obtain a result with its associated uncertainty

BIBLIOGRAPHY

Handouts Chemistry 1 and Thermodynamics
MOODLE Chemistry 1st year platform (all sectors)
Cours de Chimie Physique - Paul Arnaud (ed. Dunod)

PRE-REQUISITES

Laboratory safety, knowledge of glasswork and its use Knowledge of major classes of materials
Redox reaction equilibrium, oxidation number (done in the 1st half)
Notions of strong / weak acid, pKa, buffer solution, colored indicators
Low energy interactions between molecules (polarity, van der Waals bonds, hydrogen bonding) (done in the 1st half)

IDENTIFICATION

CODE : FIMI-1-S2-EC-PH-SH
ECTS : 4

HOURS

Cours :	7h
TD :	21.5h
TP :	8h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	39.5h
Travail personnel :	40h
Total :	79.5h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Solve a dynamics problem: establish and exploit the differential equation describing motion and the equation of trajectory or the literal expression of a force or moment using a precise methodology.
AAv.2 Use a mechanical energy balance to determine either speeds at a given point, or particular positions, or the expression of forces, or the equation of motion (differential equation or trajectory).
AAv.3 Analyse the stability of an equilibrium position of a mechanical system using either mechanical actions (forces or moments) or potential energy. Study free and forced oscillations around a stable equilibrium position.
AAv. Apply the concepts seen in mechanics in an experimental context: propose and then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write up a report.

CONTENT

- Dynamics (of point and solid)
- Mechanical and electrical oscillations

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors¿), statistics (average and standard deviation), data and functions plots.
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.

Company knowledge

IDENTIFICATION

CODE : FIMI-1-S2-EC-CE-FC-SH
ECTS : *

HOURS

Cours :	2h
TD :	18h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	10h
Total :	30h

ASSESMENT METHOD

- Documentary study DD-RS
Individual written assessment, report, coefficient: 0.5
Hand in the report containing the team's common elements and individual analyses by the date specified by the teacher.
- Entrepreneur" project
Group oral assessment, defense, coefficient: 0.5
Hand in oral support and project sheets before class session 9, which is dedicated to oral presentations.

TEACHING AIDS

- Course materials for theoretical contributions
- Methodological frameworks
- Case studies and examples
- Supervision of project work and research
- Additional resources for further study
Course materials are available on Moodle.

TEACHING LANGUAGE

French

CONTACT

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AIMS

OBJECTIVES (AAV / APC) :
At the end of the CE Business Knowledge module, students will be able to mobilize tools to analyze professional situations in terms of their economic, legal, managerial and ethical aspects. The learning context covers the operation of companies and other forms of organization (associations, NGOs, public bodies). Analyses are carried out according to a common theme: "VALUE CREATION".
Students will be able to :
- analyze the organization and functioning of organizations, using numerous concrete examples.
- mobilize a systemic, cross-disciplinary approach based on stakeholder analysis, drawing on theoretical foundations and strategic and operational tools from management and economics.
- gain perspective on the purposes of organizations, their role in the economic system, their capacity to act and the constraints they face.
- identify the SD-RS and socio-economic transition issues raised by the way organizations operate.
- situate the engineer in organizations and project his/her role as a future engineer in these organizations.
- carry out documentary research to deepen their knowledge independently.
- adapt tools and models to specific or novel situations.
- present their analyses in a well-argued manner, both orally and in writing.
This knowledge can be applied and developed during the company discovery internship and in the department.

KEY COMPETENCIES TARGETED (TEACHING CHARTER - Humanities Department)
2. Work, learn, develop autonomy. 2.2 2.3 2.4
3. Interact with others and work on a team. 3.1 3.2 3.4
4. Develop creativity. 4.2 4.4
5. Act responsibly in a complex world. 5.1 5.2

CONTENT

20 hours face-to-face + 10 hours personal work.
- CM: Course presentation & round-table discussions with lecturing engineers
- TD1: Corporate value creation at the heart of the economic system
- TD2: SD-RS and CSR, corporate responsibility
- TD3: Socio-ecological transition and new economic perspectives
- TD4: Markets and competition: how does it work?
- TD5: Strategic diagnostic tools for understanding the systemic environment
- TD6: Making strategic choices, building a business model
- TD7: Internal and legal organization from the company's point of view
- TD8: Work organization from the point of view of employees and engineers
- TD9: Final project presentations

BIBLIOGRAPHY

References are given during the course, in connection with the topics covered.

PRE-REQUISITES

No specific prerequisites in management or economics are required.
CE Connaissance de l'entreprise is a Humanities course. It links up with the ETRE and CSS (Culture, Sciences et Société) courses.

IDENTIFICATION

CODE : FIMI-1-S2-EC-CSS-SH
ECTS : 2

HOURS

Cours : 0h
TD : 22h
TP : 0h
Projet : 0h
Evaluation 0.016666666666666666h
Face à face pédagogique : 22.016666666666666h
Travail personnel : 20h
Total : 42.016666666666666h

ASSESMENT METHOD

- A continuous assessment section including the following exercises: presentation of a talk in a small group ("exposé militant")
- A 3-hour exam at the end of the semester (text study followed by a reasoned discussion).

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Humanities framework:
CT2 - WORK, LEARN, EVOLVE IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on one's own, seeking out the necessary resources
2.4 - Exercise one's critical faculties, think for oneself
CT3 - INTERACT WITH OTHERS, WORK WITH TEAMS
3. 1 - Communicate appropriately: convey a message, listen, show empathy, assert one's point of view, debate

3.2 - Situate one's original discourse with explicit references
3. 3 - Communicate non-verbally: posture and gestures
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Apprehend the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions¿
5.2 - Integrate a responsible dimension (deontology, ethics) into their actions; identify, evaluate and anticipate the consequences of their actions and decisions at different levels of scale.

CONTENT

- Notions of rhetoric and argumentation
- Written and oral communication exercises
- Reflections, positions, debates

BIBLIOGRAPHY

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.

PRE-REQUISITES

These are the achievements of secondary education: the ability to appropriate information, correctness of language, logic of thought, intellectual curiosity, the ability to conceptualize a problem and grasp its implications, to reflect...

IDENTIFICATION

CODE :FIMI-1-S2-EC-OMNI-FI-SH

ECTS : *

HOURS

Cours :	7h
TD :	15h
TP :	6h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	25h
Total :	54.5h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Lecture notes and exercices textbook, specific content of lanes available on Moodle.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

CONTENT

Multiple integrals
Scalar and vector fields

BIBLIOGRAPHY

PRE-REQUISITES

High school and first semester of FIMI abilities.

Informatics and numerical society 2

IDENTIFICATION

CODE : FIMI-1-S2-EC-ISN-SH
ECTS : *

HOURS

Cours :	3h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	24h
Travail personnel :	25h
Total :	49h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French

CONTACT

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M. Rivano Hervé : Herve.Rivano@insa-lyon.fr

AIMS

Targeted learning outcomes :

AAv1.2 : At the end of semester, students will be able to write a program and simple python func-tions to solve a simple problem, while respecting good development practices.

AAv1.3 : At the end of semester, students will be able to use and adapt a number of basic algorithms to solve known simple problems.

AAv1.4 : At the end of semester, students will be able to select and use simple encodings and data structures adapted to the problem at hand (int, string, Boolean, 1D/ 2D lists, float), exploiting the concept of mutability where necessary.

CONTENT

- Nested loops
- 2D lists
- Sorting algorithms

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-1-S1-EC-ISN-SH

IDENTIFICATION

CODE : FIMI-1-S2-EC-MA-SH
ECTS : 4

HOURS

Cours :	18h
TD :	35h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	56h
Travail personnel :	60h
Total :	116h

ASSESMENT METHOD

2 tests of 1h30 (named IE1 and IE2) and a test of 3h (names DS), and 4 to 5 mini tests of 15 minutes maximum, the average of these tests is named MT.

Coefficient of the 1h30 tests : 2
Coefficient of the 3h test : 4
Coefficient of MT : 1.

Averaging with consideration of excused absences for illness, per semestre :
(2*IE1+2*IE2+4*DS+MT)/9.

The excused absences for sportive reasons will systematically lead to a substitutional test, the teacher will decide what kind.

TEACHING AIDS

Paper handout. Online documents on Moodle.

TEACHING LANGUAGE

French

CONTACT

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AIMS

The 2nd Semester is entirely dedicated to the study of functions of a real variable started in 1st Semestre.

It contributes to the following abilities in Engineer School :

C1 - analyse a system or issue
C2 - Exploit a Real or Virtual system Model
C6 - Communicate an analysis, a scientific path, in an argued and logical discussion

In this frame, the student will work and be tested on the following abilities :

C11 - Break down a problem into a set of interacting sub-parts
C15 - Identify issues or action objectives.
C16 - Build a proof.
C25 - Use algebraic and numerical computation techniques.
C54 - Results interpretation
C55 - Make a synthesis of intermediate results in response to questioning.
C62 - Make a reasoned solution respecting a balance between everyday language and symbolic language.

CONTENT

Single real variable calculus.

BIBLIOGRAPHY

(i) Azoulay-Avignant : Mathématiques (Ediscience)
(ii) Guinin-Aubonnet-Joppin : Précis de Mathématiques (Bréal)
(iii) S. Balac, F. Sturm, Algèbre et Analyse, Cours de Mathématiques de première année avec exercices corrigés, Presses Polytechniques et Universitaires Romandes (collection des Sciences Appliquées de l'INSA de Lyon).

PRE-REQUISITES

1st semester SHN0.

IDENTIFICATION

CODE : FIMI-1-S2-EC-CO-TF-SH
ECTS : undefined

HOURS

Cours :	0h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	28h
Travail personnel :	20h
Total :	48h

ASSESMENT METHOD

Regular testing

TEACHING AIDS

- Mechanical design textbook
- Drawing flipbook
- Exercices in A3 paper format
- Physical system during the class
- Virtual 3D model (CAD) of the system
- Moodle : years organisation, exercices, textbook, former exams...

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

AAv. 1. Analyze, explain and diagram the operation of a mechanical system based on an overall drawing, perspectives, digital model and/or real system.
AAv. 2. Using 2D and 3D tools, design a mounting or pivot connection according to the rules of the art (MIP/MAP/Jeu), taking into account environmental and mechanical constraints.
AAv. 3. modify an existing mechanical system by applying technological choices while respecting environmental constraints.

CONTENT

- being able to model a simple joint and draw the corresponding normalized symbol (ex: revolute, sliding, ball etc.)
- being able to draw a solution for simple revolute or complete joint on paper
- being able to create the virtual 3D model of a simple system using CAD software and generate 2D sketchs (definition and assambly drawings)

BIBLIOGRAPHY

PRE-REQUISITES

- sketch reading (definition and assembly drawings)
- using main functionnalities of CAD software

Informatics and numerical society

IDENTIFICATION

CODE : FIMI-2-S1-EC-ISN-SH2
ECTS : undefined

HOURS

Cours :	3h
TD :	23h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	29h
Travail personnel :	30h
Total :	59h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Targeted learning outcomes :

AAv3.4 : At the end of semester, students will be able to design and modify a suitable data structure (dictionary, list, graph, DB) to represent the data described in a specification.

AAv3.5 : At the end of semester, students are able to write an SQL query for a relational database.

AAv4.3 : At the end of semester, students will be able to identify the economic, social, political and imaginary issues involved in using a specific digital technology in a real-life situation.

CONTENT

- SQL database
- Matching algorithm

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-2-S2-ISN-EC-SH1

IDENTIFICATION

CODE : FIMI-2-S1-EC-MA-SH2
ECTS : 4

HOURS

Cours :	17h
TD :	31h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	51h
Travail personnel :	50h
Total :	101h

ASSESMENT METHOD

The assessment includes two written exam of 1h30 with coeff 1 and one written exam of 3h with coeff 2

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

The course offered during the fifth semester extends concepts covered in the fourth semester (generalized integrals, limits, continuity, numerical series, Sequences of functions) to new classes of mathematical objects (Normed vector spaces, Bilinear algebra, functions of several variables). The introduction of normed vector spaces will give an appropriate general framework for this study. The course also covers orthogonal projection, which can be used for instance to approximate a function by a polynomial or by a finite sum of trigonometric functions. Applications are essential in optimization theory.
We study also power series, which are a useful tool in signal processing and in probability theory.

This course will enable the student to develop the following skills :
C11 - To split up a problem or a system into its component parts in interaction
C15 - To identify problematics or objectives
C16 - To build a proof
C25 - To use algebraic and numerical computational techniques.
C54 - To interprate data in the context of a model
C55 - To synthesize intermediate results in response to questioning.
C62 - To be able to speak with a satisfying level of langage aiming at a good balance between a usual and
symbolic langage

CONTENT

Power series
Normed vector spaces
Bilinear algebra

BIBLIOGRAPHY

- F. Butin, M. Picq, J. Pousin, Mathématiques ¿ cours, exercices corrigés ¿ 2e année de classes préparatoires
itnégrées, Références sciences, Ellipses, Paris, 2013
- S. Balac, L.Chupin, Analyse et Algèbre : cours de mathématiques de deuxième année avec exercices
corrigés et illustrations Maple, PPUR presses polytechniques, 2008

PRE-REQUISITES

Mathematical course of first and second years

Applications of thermodynamics to physical and chemical systems

IDENTIFICATION

CODE : FIMI-2-S1-EC-CH-TF-SH2
ECTS : 3

HOURS

Cours :	10h
TD :	20h
TP :	15h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	47h
Travail personnel :	30h
Total :	77h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Lecture, tutorial and practical work handouts.
First Cycle Moodle interface: all lecture, tutorial and practical work documents, schedule and organization, exercise corrections, links to internet sites, exam questions and answers in French and in English.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Determine the composition at physical equilibrium liquid/liquid and liquid/vapour of an ideal or non-ideal binary mixture
- by using the law of chemical moments
- by constructing an isobaric diagram of an ideal mixture using Raoult's law
- by interpreting an isobaric diagram of an ideal or non-ideal mixture (with the three cases of total, partial or zero miscibility in the liquid state for the non-ideal mixture).

Determine the evolution towards thermodynamic equilibrium of a multiphase system characterised by one or more chemical equilibria
- by identifying the chemical reaction(s) of interest and the phases of the reactants and products
- by comparing the values obtained for the equilibrium constant K° and the quotient of the reaction Q
- - by determining the system of equations for the chemical reaction(s) of interest. by determining the system of equations which enables the equilibrium state to be defined quantitatively
- by using Le Chatelier's principle to predict the qualitative effect on equilibrium of the parameters influencing the yield of a reaction (T, P, excess reagents, etc.).

Predict the spontaneous or forced nature of an electrochemical (redox) reaction
- by determining the free enthalpy and standard free enthalpy of a redox reaction from the standard potentials of the pairs and Nernst's law
- by describing and justifying the operation of an electrochemical cell: battery and electrolyser

Adapt a simple experimental approach in order to produce reliable experimental measurements
- by drawing on knowledge acquired in the first year and on the body of knowledge in the second year
- by designing an experimental protocol to solve a complex problem
- by identifying and quantifying sources of error and uncertainties

Use experimental measurements to determine the equilibrium composition of a system
- by choosing an appropriate analytical model
- by clearly presenting the measurements or experimental data (e.g. : graph or table)
- by calculating uncertainties using a logarithmic and/or graphical method on the basis of sources of error and analytical relationships

Write a scientific report following an experimental session
- by justifying the theoretical model of the experiment
- by justifying the experimental approach chosen
- by presenting and analysing the results obtained
- by criticising the results in relation to theoretical expectations and sources of systematic error

CONTENT

Lectures, tutorial classes and practical work in CHEMISTRY 2
To apply the thermodynamic laws to physical heterogeneous systems containing several constituents, main types of binary diagrams concerning the liquid-vapor equilibriums.
To apply the thermodynamic laws to chemical systems: thermo chemistry, qualitative and quantitative laws of equilibriums, application to equilibriums in aqueous media (acid-base, redox, solubility, complexation reaction) and to electrochemical cells.

BIBLIOGRAPHY

- Cours de Chimie-Physique et Exercices résolus de Chimie-Physique : P. Arnaud (Ed. Dunod)
- Thermodynamique Chimique 2ème année PC-PC* : P. Durupthy, C. Mesnil, T. Zobiri, collection H Prépa (Ed. Hachette)
- Thermodynamique Chimique: F. Brenon, C. Busquet, C. Mesnil, Ed. Hachette Supérieur.
- Chimie : Thermodynamique et Cinétique Chimique, Equilibres chimiques en solution, J. Mesplède, Ed. Bréal
- http://chimie.net.free.fr/index2.htm

IDENTIFICATION

CODE : FIMI-2-S1-EC-PH-SH2
ECTS : 3

HOURS

Cours :	4h
TD :	13.5h
TP :	17h
Projet :	0h
Evaluation :	2.5h
Face à face pédagogique :	37h
Travail personnel :	40h
Total :	77h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Establish the propagation equations verified by the quantities characterising a wave, from which deduce the specific impedance.
AAv.2 Deduce the expression and fully characterise a wave propagating in an unlimited and limited medium with or without dissipation.
AAv.3 Express the transported power and identify the experimental conditions for its measurement.
AAv.4 Apply the concepts seen in electromagnetism in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write a report.

CONTENT

Wave propagation in unbounded media: mechanical waves on a string and electromagnetic waves (introduction, propagation equation, impedance, power transported).
Propagation in limited media with the concepts of reflection and transmission coefficients, superposition of incident and reflected waves.

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors), statistics (average and standard deviation), data and functions plots.
This teaching will also use the mathematical tools and skills that will be learnt all along the first year.

IDENTIFICATION

CODE : FIMI-2-S1-EC-ETRE-TF-SH2

ECTS : 2

HOURS

Cours :	0h
TD :	8h
TP :	2h
Projet :	14h
Evaluation :	0.016666666666666666h
Face à face pédagogique :	10.016666666666666h
Travail personnel :	25h
Total :	49.016666666666666h

ASSESMENT METHOD

Continuous assessment. Three summative assessments are organised:
- the biodiversity mission will result in a graded group presentation based on a powerpoint presentation.
- the "Et si..." project gives rise to the writing of a graded fiction (in groups), as well as a graded literary presentation. The mark may be individualised.
- An individual written test, at the End of Semester, marks the end of FIMI's ETRE sequence, by examining students on all the skills acquired during the 2 semesters S2 and S3.

TEACHING AIDS

Course materials and exercises.
1st Cycle Moodle platform: all course and planning and organization, links to resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

This teaching sequence, in S3, is the second part of a program that will continue throughout
the studies, with the aim of training engineers who are aware of the challenges of the ecological transition.
In its February 26, 2020 letter of intent, INSA Lyon stated that "the courses in Sustainable
Development and Social Responsibility (SDRS) courses combine the following training objectives :
* in terms of cross-disciplinary skills
* in terms of themes to be addressed: climate change, energy, raw materials resources, and
damage to living organisms and human health.
Two cross-cutting themes are addressed: links between science, technology and society, and
the dynamics of change.

The targeted learning outcomes are thus :
1) Use a multi-disciplinary body of knowledge to provide reasoned, qualitative and quantitative answers to advanced questions on the challenges of ecological transition in relation to resources and living organisms.
2) Associate human actions with their consequences on the planet's habitability, based on planetary limits and the finitude of resources.
3) Illustrate (explain) the systemic nature of socio-ecological issues; integrate the central role of living organisms and the human-nature relationship into the reasoning.
4) Using scientific data and a decentralized approach, imagine, design and present a forward-looking narrative on a given theme of socio-ecological transition.

CONTENT

The students will work on the following knowledge:
- Understand the issues associated with the erosion of biodiversity.
- Understand resource-related issues.
- Realise a synthesis of the 2 semesters of ETRE, through the construction of imaginary worlds and paths towards desirable futures.
The sequence will be structured as follows:
- 2h introduction: remobilisation of knowledge acquired in S2
- 8 hours of project work, involving a mission to assess the quality of the ecosystem of the campus
- 2 hours of cross-disciplinary practical work on copper resources
- and finally, 12 hours of supervised project "Et si...", the deliverables of which (in groups) are a fiction and a literary presentation.
IMPORTANT: the teachers work in pairs on each group of students: 16 hours are taught by the SPI (Sciences Pour l'Ingénieur) teacher, 4 hours by the Human Sciences teacher, and the final presentation of 2 hours is assessed by the 2 teachers.

BIBLIOGRAPHY

General Biodiversity Inventory - Doua Campus
U.S. Geological Survey, Mineral Commodity Summaries, January 2020
Ecotopia - Ernest Callenbach - Gallimard - 2021
(...)

PRE-REQUISITES

S2 curriculum for ETRE (2nd semester of 1st year).
Associated secondary school curricula (2nd, 1st and final year) on sustainable development and social responsibility.
The various 1st year INSA courses (Engineering Sciences and Human Sciences) are called upon more in terms of methods than knowledge.

IDENTIFICATION

CODE : FIMI-2-S1-EC-CP-SH2
ECTS : –

HOURS

Cours :	0h
TD :	0h
TP :	28h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	28h
Travail personnel :	8h
Total :	36h

ASSESMENT METHOD

Continuous assessment of knowledge and skills

TEACHING AIDS

1 - Design - prototyping handout
2 - Teaching resources on FIMI's Moodle workspace
3 - Design handout 1A-2A

TEACHING LANGUAGE

French

CONTACT

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AIMS

This EC is part of the Mechanical Systems, Environment and Production (ME) teaching unit.
AAv. 1. 3D modeling of assemblies: Based on specifications and an initial version of a mechanism, design and optimize the 3D modeling of a mechanical assembly, taking into account geometric, functional and assembly constraints, while integrating an eco-responsible approach.
AAv. 2. Understanding manufacturing processes: Know the capabilities, limits and tolerances of the manufacturing processes used, including turning, milling, 3D printing, multi-material laser cutting, steel laser cutting, bending and welding. Know how to adapt the geometry of the parts to be manufactured to the chosen process.
AAv. 3 Making a mechanical system: Make and assemble a mechanical system in the workshop from a 3D digital model, taking into account the constraints and limitations of the chosen processes.
AAv. 5 Workshop collaboration and safety: Work effectively in a team and independently in a prototyping workshop, applying safety rules, good manufacturing practices and rigorous organization to guarantee a safe and productive working environment.

CONTENT

By enabling the student-engineer to work on and be assessed on the following knowledge :
- safety instructions in a production workshop
- knowledge of one of the following 2 processes for producing traditional parts:
* either material-removal machining (turning, milling, drilling),
* or metal construction and deformation processes (rolling, bending, folding, laser cutting) and assembly (gluing, welding, riveting).
- knowledge of various rapid part production processes - agile prototyping:
* additive manufacturing (3D printing)
* multi-material laser cutting processes (wood, acrylic)
- be familiar with agile design concepts and their implementation
- know the characteristics of a communicating control system
- programming logic of an event-driven system
- understand the interaction between production-manufacturing and system design
- understand the possibilities offered by agile prototyping of a system

BIBLIOGRAPHY

PRE-REQUISITES

Drawing module, CAD, Technical analysis, Reading and drawing technical drawings, Dimensioning, Materials (1st year Design course).

IDENTIFICATION

CODE : FIMI-2-S1-EC-STA-SH2
ECTS : *

HOURS

Cours :	0h
TD :	1h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	1h
Travail personnel :	25h
Total :	26h

ASSESMENT METHOD

The internship report will be assessed by a lecturing engineer, in charge of monitoring a group in 1A and 2A (in 2A, 1A groups are reformed).

TEACHING AIDS

Two guides will be distributed (in pdf, available on Moodle):
- a guide to finding an internship, in November 1A
- a guide to writing an internship report, in April 1A, with a grading scale.

TEACHING LANGUAGE

French

CONTACT

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AIMS

This is the first concrete experience of working in a company for INSA Lyon students.
This internship lasts a minimum of 4 weeks and is carried out by students at the end of their 1st year.
It meets a number of key objectives:
- Experience working as part of a team (live the daily life of operators, measure the repetitive nature and arduousness of their tasks).
- Discover, observe and understand corporate life and human relations.
- Observe and study the work environment.

The skills developed revolve around the following points:
- Observe the immediate environment (workstation, team and workshop operations). workshop operations).
- Discovering mechanisms and organizations (technical, social, structural) through exchanges with those involved and by researching authorized and validated documents within the company.
- Gather different points of view, confirm or refute certain assertions.
- Know how to change initial preconceptions.
- Listen to employees to guide your thinking on management perspectives.

CONTENT

- Internship period: during the summer (from the last week of June to July 31), between 1st and 2nd year at INSA Lyon.
- Duration: minimum 4 weeks, explicitly specified in the internship agreement.
- Conditions: teamwork.
- Contractualization: this internship is the subject of an internship agreement signed by INSA Lyon, the host organization and the intern, setting out the commitments and responsibilities of INSA Lyon, the host organization and the student, and specifying the intern's activity during the internship period. Experience in the form of an employment contract (CDD) is also accepted.
- The internship is the subject of an internship report, which is graded by an INSA engineer. This engineer follows a group of students with two presentations in 1A (before the internship) and two in 2A (after the internship). The first is an account of the professions involved, with an approach to the business world, while the second focuses on the internship, respect for the environment, rules and regulations, attitudes to adopt and behavior. The 1st year groups are reformed in the 2nd year for a debriefing session in September/October, and a session to hand in the corrected and graded internship reports in February.

BIBLIOGRAPHY

PRE-REQUISITES

No particular prerequisites for this course.

IDENTIFICATION

CODE : FIMI-2-S1-EC-CSS-SH2
ECTS : 2

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- Intermediate assessment: in groups of 2 or 3 students, presentation on a social topic
- Final assessment: individual, short story-style written work of 9,000 characters on the topic chosen for the presentation.

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Humanities framework:
CT2 - WORK, LEARN, EVOLVE IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on one's own, seeking out the necessary resources
2.4 - Exercise one's critical faculties, think for oneself
CT3 - INTERACT WITH OTHERS, WORK WITH TEAMS
3. 1 - Communicate appropriately: convey a message, listen, show empathy, assert one's point of view, debate in a reasoned manner
3.2 - Situate one's original discourse with explicit references
3.3 - Communicate non-verbally: posture and gestures
CT4 - SHOW CREATIVITY, INNOVATE, ENTREPRENEURE
4. 1 - Develop a creative approach, including artistic ones
4.2 - Mobilize skills and knowledge from various fields to produce an original creation
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5. 1 - Understand the complex issues (in business and society) facing engineers: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions¿
5.2 - Integrate a responsible dimension (deontology, ethics) into their actions; identify, evaluate and anticipate the consequences of their actions and decisions at different levels of scale.

CONTENT

Around societal themes:
- Analysis of written and iconographic documents
- Methodical training in the production of organized and coherent written texts; writing workshops leading to the writing of an argumentative short story
- Use of oral and written communication.

BIBLIOGRAPHY

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.

PRE-REQUISITES

Ability to organize, synthesize and problematize in writing and orally. Methods acquired in previous semesters.

Informatics and numerical society 3

IDENTIFICATION

CODE : FIMI-2-S1-EC-ISN-TF
ECTS : toto

HOURS

Cours :	5h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	37h
Travail personnel :	35h
Total :	72h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

Mme Bennani Nadia :
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M. Rivano Hervé :
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AIMS

Targeted learning outcomes :

AAv3.1 : At the end of S3, students will be able to write a program manipulating data stored in a list, dictionary or graph, which can be retrieved from a file containing open data.

AAv3.2 : At the end of S3, students are able to design an algorithm solving a problem from data stored in a graph, using and adapting subgraph calculation algorithms.

AAv3.3 : At the end of S3, students are able to integrate the notion of algorithmic complexity into the development of efficient code.

AAv3.4 : At the end of S3, students will be able to design and modify a suitable data structure (dictionary, list, graph, DB) to represent the data described in a specification.

AAv3.5 : At the end of S3, students are able to write an SQL query for a relational database.

CONTENT

1 - Introduction to relational databases :
* Relational model
* SQL query language (selection, projection, join, grouping and calculation functions)
* Introduction to the Entity-Association model and its link with the relational model.

2 - File and dictionary manipulation:
* reading and writing a file with a standard format.
* using a dictionary: accessing, creating, updating and browsing a dictionary.
* data restructuring using dictionaries.

3 - Graphs:
* notion and concepts.
* traversal algorithms (DFS, BFS, Dijkstra) to meet an objective.
* algorithm complexity.

4-Data visualization using supplied Python libraries.

5-Matching algorithms

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-1-S2-EC-ISN-TF

IDENTIFICATION

CODE : FIMI-2-S1-EC-MA-TF
ECTS : 5

HOURS

Cours :	21h
TD :	37.5h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	61.5h
Travail personnel :	70h
Total :	131.5h

ASSESMENT METHOD

Students are evaluated with written tests three times during the semester. The coefficients of the tests are (1.5,2,2.5) and they are set according to the length of the test.

TEACHING AIDS

Moodle

TEACHING LANGUAGE

French
English

CONTACT

M. Leoni-Aubin Samuela :
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AIMS

AAv3.1 – Determine the nature of improper integrals using comparison tools, and compute their value when possible.
AAv3.2 – Determine the convergence and the limit of sequences, especially those defined by recurrence.
AAv3.3 – Apply Newton's numerical method to approximate solutions of equations, and conduct a mathematical study of the method's convergence.
AAv3.4 – Compute the determinant of a matrix of small dimension, particularly to determine whether a matrix is invertible.
AAv3.5 – Find the eigenvalues and eigenspaces of an endomorphism in order to diagonalize it when possible.
AAv3.6 – Use endomorphism reduction to study and solve linear differential systems.
AAv3.7 – Determine the convergence of a series using standard criteria (comparison, integral test, D'Alembert's ratio test, etc.).

CONTENT

Suites (study of fixed points)
Reduction of endomorphisms
Improper integrals
Numerical series
Differential calculus
Extremum of multivariate functions

BIBLIOGRAPHY

S. Balac et L. Chupin, Analyse et algèbre : cours de mathématiques de deuxième année avec exercices corrigés et illustrations avec Maple, Presses polytechniques et universitaires romandes.
F. Butin, M. Picq, J. Pousin, Mathématiques - Cours, exercices corrigés - 2e année de classes préparatoires intégrées, Collection "Références sciences", Ellipses

PRE-REQUISITES

First year math class

IDENTIFICATION

CODE : FIMI-2-S1-EC-PH-TF
ECTS : 5

HOURS

Cours :	10h
TD :	39.5h
TP :	15h
Projet :	0h
Evaluation :	4.5h
Face à face pédagogique :	69h
Travail personnel :	60h
Total :	129h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals workings.
Multiple-choice questionnaire for autonomous training and self-assessment are available.

English is used only in the SCAN groups (french in all other groups)

TEACHING LANGUAGE

French
English

CONTACT

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Mme Le Berre Martine :
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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Determine the expression of a vector field as a function of spatial parameters and boundary conditions, from the expression of its law as a partial differential equation, exploiting the symmetries of the sources.
AAv.2 Convert laws and quantities expressed in a local (intensive) formulation into an integral (extensive) formulation and vice versa.
AAv.3 Draw up an energy balance in an electromagnetic system: energy supplied, stored, dissipated.
AAv.4 Identify the different components of an electromagnetic system (resistance, capacitance, inductance) and be able to determine their value when the electric and/or magnetic field is defined in all space.
AAv.5 Determine the action of electromagnetic forces in an electromagnetic or electromechanical system.
AAv.6 Evaluate quantitatively the phenomenon of static or motional induction in a simple electromagnetic or electromechanical system.
AAv.7 Apply the concepts seen in electromagnetism in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write a report.

CONTENT

The third semester of physics is devoted to electromagnetism. A reminder of the mathematical tools necessary to approach electromagnetic field theory is first proposed. Then the following notions are presented: electrostatic field, static charges (capacitor), moving charges (resistance), magnetic field, electromagnetism at interfaces, magnetic energy (inductance), magnetic and electric moments, static and motional induction. Maxwell's equations are revealed and explained as the course progresses. Concrete examples of the application of electromagnetism will be offered, in particular through the study of induction phenomena.

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

This course will use the knowledge and know-how acquired in Mathematical and Numerical Tools for Engineers during the first year (see the corresponding sheets).
All the notions of physics covered in S1 and S2 of the first year will be considered as acquired (including: geometrical optics, dimensions, uncertainties, DC and AC electricity, mechanics, electrical and magnetic forces).

Applications of thermodynamics to physical and chemical systems

IDENTIFICATION

CODE : FIMI-2-S1-EC-CH-TF-SH2
ECTS : 3

HOURS

Cours :	10h
TD :	20h
TP :	15h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	47h
Travail personnel :	30h
Total :	77h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Lecture, tutorial and practical work handouts.
First Cycle Moodle interface: all lecture, tutorial and practical work documents, schedule and organization, exercise corrections, links to internet sites, exam questions and answers in French and in English.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Determine the composition at physical equilibrium liquid/liquid and liquid/vapour of an ideal or non-ideal binary mixture
- by using the law of chemical moments
- by constructing an isobaric diagram of an ideal mixture using Raoult's law
- by interpreting an isobaric diagram of an ideal or non-ideal mixture (with the three cases of total, partial or zero miscibility in the liquid state for the non-ideal mixture).

Determine the evolution towards thermodynamic equilibrium of a multiphase system characterised by one or more chemical equilibria
- by identifying the chemical reaction(s) of interest and the phases of the reactants and products
- by comparing the values obtained for the equilibrium constant K° and the quotient of the reaction Q
- - by determining the system of equations for the chemical reaction(s) of interest. by determining the system of equations which enables the equilibrium state to be defined quantitatively
- by using Le Chatelier's principle to predict the qualitative effect on equilibrium of the parameters influencing the yield of a reaction (T, P, excess reagents, etc.).

Predict the spontaneous or forced nature of an electrochemical (redox) reaction
- by determining the free enthalpy and standard free enthalpy of a redox reaction from the standard potentials of the pairs and Nernst's law
- by describing and justifying the operation of an electrochemical cell: battery and electrolyser

Adapt a simple experimental approach in order to produce reliable experimental measurements
- by drawing on knowledge acquired in the first year and on the body of knowledge in the second year
- by designing an experimental protocol to solve a complex problem
- by identifying and quantifying sources of error and uncertainties

Use experimental measurements to determine the equilibrium composition of a system
- by choosing an appropriate analytical model
- by clearly presenting the measurements or experimental data (e.g. : graph or table)
- by calculating uncertainties using a logarithmic and/or graphical method on the basis of sources of error and analytical relationships

Write a scientific report following an experimental session
- by justifying the theoretical model of the experiment
- by justifying the experimental approach chosen
- by presenting and analysing the results obtained
- by criticising the results in relation to theoretical expectations and sources of systematic error

CONTENT

Lectures, tutorial classes and practical work in CHEMISTRY 2
To apply the thermodynamic laws to physical heterogeneous systems containing several constituents, main types of binary diagrams concerning the liquid-vapor equilibriums.
To apply the thermodynamic laws to chemical systems: thermo chemistry, qualitative and quantitative laws of equilibriums, application to equilibriums in aqueous media (acid-base, redox, solubility, complexation reaction) and to electrochemical cells.

BIBLIOGRAPHY

- Cours de Chimie-Physique et Exercices résolus de Chimie-Physique : P. Arnaud (Ed. Dunod)
- Thermodynamique Chimique 2ème année PC-PC* : P. Durupthy, C. Mesnil, T. Zobiri, collection H Prépa (Ed. Hachette)
- Thermodynamique Chimique: F. Brenon, C. Busquet, C. Mesnil, Ed. Hachette Supérieur.
- Chimie : Thermodynamique et Cinétique Chimique, Equilibres chimiques en solution, J. Mesplède, Ed. Bréal
- http://chimie.net.free.fr/index2.htm

IDENTIFICATION

CODE : FIMI-2-S1-EC-CP-TF
ECTS : –

HOURS

Cours :	0h
TD :	12h
TP :	56h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	69h
Travail personnel :	25h
Total :	94h

ASSESMENT METHOD

Continuous assessment of knowledge and skills

TEACHING AIDS

1 - Design-prototyping handout
2 - Teaching resources on FIMI's Moodle workspace
3 - Design handout 1A-2A

TEACHING LANGUAGE

French

CONTACT

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AIMS

This EC is part of the Mechanical Systems, Environment and Production (ME) teaching unit.
AAv. 1. 3D modeling of assemblies: Based on specifications and an initial version of a mechanism, design and optimize the 3D modeling of a mechanical assembly, taking into account geometric, functional and assembly constraints, while integrating an eco-responsible approach.
AAv. 2. Understanding manufacturing processes: Know the capabilities, limits and tolerances of the manufacturing processes used, including turning, milling, 3D printing, multi-material laser cutting, steel laser cutting, bending and welding. Know how to adapt the geometry of the parts to be manufactured to the chosen process.
AAv. 3 Making a mechanical system: Make and assemble a mechanical system in the workshop from a 3D digital model, taking into account the constraints and limitations of the chosen processes.
AAv. 4 Programming and implementing a mechatronic system: Develop an Arduino program from a basic algorithm, adapting it to the requirements of the specifications and validating its correct operation on the real system studied.
AAv. 5 Workshop collaboration and safety: Work effectively in a team and independently in a prototyping workshop, applying safety rules, good manufacturing practices and rigorous organization to guarantee a safe and productive working environment.

CONTENT

By enabling the student-engineer to work on and be assessed on the following knowledge :
- safety instructions in a production workshop
- knowledge of one of the following 2 processes for producing traditional parts:
* either material-removal machining (turning, milling, drilling),
* metal construction and deformation processes (rolling, bending, folding, laser cutting) and assembly (gluing, welding, riveting).
- knowledge of various rapid part production processes - agile prototyping:
* additive manufacturing (3D printing)
* multi-material laser cutting processes (wood, acrylic)
- be familiar with agile design concepts and their implementation
- know the characteristics of a communicating control system
- programming logic of an event-driven system
- understand the interaction between production-manufacturing and system design
- the possibilities offered by agile prototyping of a system
- know the concepts of system design on CAD tools

BIBLIOGRAPHY

PRE-REQUISITES

CAD, Technical analysis, Reading and drawing technical drawings, Dimensioning, Materials (1st year Design course).

System Mechanics 1

IDENTIFICATION

CODE : FIMI-2-S1-EC-MS-TF-SH1
ECTS : 3.00

HOURS

Cours :	10h
TD :	21h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	32.5h
Travail personnel :	30h
Total :	62.5h

ASSESMENT METHOD

- 1 Written Tests (WT1 of 1.5 hours)
- 1 Final Test (FT1) of 2 hours.
Average : (WT1*1.5+FT1*2)/3.5

TEACHING AIDS

- Lecture notes and presentations
- Exercises book (the same for all the 2nd year students)
Documents available on Moodle

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Target Learning Outcomes (AvA):

AAv.1: Identify the characteristics of a mechanical system, schematize it and graphically construct the velocity fields

AAv.2: Model a real mechanical system of bounded complexity including specific static behavior laws (ex: spring, inter-solid contact, belt...)

AAv.3: Perform a complete mechanical balance, establish and solve equilibrium equations (static)

AAv.4: Establish the characteristics of a mechanical system on the basis of established equations and verify the dimensional homogeneity of the results obtained

CONTENT

WRENCH/SCREWS: Introduction and definitions: sliding vectors, system of sliding vectors, vectorial coordinates (sum, moment), scalar invariants, special wrenches/ screws, central axis, Delassus theorem on equiprojectivity.

STATICS: Fundamental principle, notion of isolated system, mechanical actions, wrench of mechanical actions associated with classic joints, analytical statics.

KINEMATICS :
- Location of a free solid, kinematics of particles, frame of reference and frame of expression, kinematics of rigid-solids, kinematic screw, time differentiation of vectors and moving basis formula, acceleration field for rigid solids, fundamental motions.
- Geometry and kinematics of joints, frame and parameter definition for mechanisms, constraint equations, mobility, combination of motions.
- Contact kinematics, sliding, rolling and pitching, kinematic constraint equations, instant motion of solids.

BIBLIOGRAPHY

AGATI Mécanique Industrielle Dunod
BEGHIN Cours de mécanique théorique Gauthier-Villar
BELLET Problème de mécanique Cepadues editions
BERKELEY Cours de Physique 1 Armand Colin
BONCOMPAIN Méca. des Syst. Indus. (T2) Dunod
BROSSARD Mécanique Générale Tech. de l'Ingénieur AF4
BROUSSE Cours de mécanique Collection U
BONE Mécanique Générale (crs et ap.) Dunod U
CAZIN Cours de mécanique générale Gauthier-Villar
ROY Mécanique du solide rigide Dunod
LASSIA Cinématique Ellipse
LASSIA-BARD Dynamique Ellipse

PRE-REQUISITES

- Vectors and Linear algebra
- Mechanical design
- Point mechanics

IDENTIFICATION

CODE : FIMI-2-S1-EC-ETRE-TF-SH2

ECTS : 2

HOURS

Cours :	0h
TD :	8h
TP :	2h
Projet :	14h
Evaluation :	0.016666666666666666h
Face à face pédagogique :	10.016666666666666h
Travail personnel :	25h
Total :	49.016666666666666h

ASSESMENT METHOD

Continuous assessment. Three summative assessments are organised:
- the biodiversity mission will result in a graded group presentation based on a powerpoint presentation.
- the "Et si..." project gives rise to the writing of a graded fiction (in groups), as well as a graded literary presentation. The mark may be individualised.
- An individual written test, at the End of Semester, marks the end of FIMI's ETRE sequence, by examining students on all the skills acquired during the 2 semesters S2 and S3.

TEACHING AIDS

Course materials and exercises.
1st Cycle Moodle platform: all course and planning and organization, links to resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

This teaching sequence, in S3, is the second part of a program that will continue throughout
the studies, with the aim of training engineers who are aware of the challenges of the ecological transition.
In its February 26, 2020 letter of intent, INSA Lyon stated that "the courses in Sustainable
Development and Social Responsibility (SDRS) courses combine the following training objectives :
* in terms of cross-disciplinary skills
* in terms of themes to be addressed: climate change, energy, raw materials resources, and
damage to living organisms and human health.
Two cross-cutting themes are addressed: links between science, technology and society, and
the dynamics of change.

The targeted learning outcomes are thus :
1) Use a multi-disciplinary body of knowledge to provide reasoned, qualitative and quantitative answers to advanced questions on the challenges of ecological transition in relation to resources and living organisms.
2) Associate human actions with their consequences on the planet's habitability, based on planetary limits and the finitude of resources.
3) Illustrate (explain) the systemic nature of socio-ecological issues; integrate the central role of living organisms and the human-nature relationship into the reasoning.
4) Using scientific data and a decentralized approach, imagine, design and present a forward-looking narrative on a given theme of socio-ecological transition.

CONTENT

The students will work on the following knowledge:
- Understand the issues associated with the erosion of biodiversity.
- Understand resource-related issues.
- Realise a synthesis of the 2 semesters of ETRE, through the construction of imaginary worlds and paths towards desirable futures.
The sequence will be structured as follows:
- 2h introduction: remobilisation of knowledge acquired in S2
- 8 hours of project work, involving a mission to assess the quality of the ecosystem of the campus
- 2 hours of cross-disciplinary practical work on copper resources
- and finally, 12 hours of supervised project "Et si...", the deliverables of which (in groups) are a fiction and a literary presentation.
IMPORTANT: the teachers work in pairs on each group of students: 16 hours are taught by the SPI (Sciences Pour l'Ingénieur) teacher, 4 hours by the Human Sciences teacher, and the final presentation of 2 hours is assessed by the 2 teachers.

BIBLIOGRAPHY

General Biodiversity Inventory - Doua Campus
U.S. Geological Survey, Mineral Commodity Summaries, January 2020
Ecotopia - Ernest Callenbach - Gallimard - 2021
(...)

PRE-REQUISITES

S2 curriculum for ETRE (2nd semester of 1st year).
Associated secondary school curricula (2nd, 1st and final year) on sustainable development and social responsibility.
The various 1st year INSA courses (Engineering Sciences and Human Sciences) are called upon more in terms of methods than knowledge.

IDENTIFICATION

CODE : FIMI-2-S1-EC-CSS-FC
ECTS : 2

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- A continuous assessment section including the following exercises: presentation of a one-hour talk in a small group
- A 2-hour exam at the end of the semester (text study leading to an argumentative essay).

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. Bousquet Philippe :
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AIMS

Humanities framework:
CT2 - WORK, LEARN, EVOLVE IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on one's own, seeking out the necessary resources
2.4 - Exercise one's critical faculties, think for oneself
CT3 - INTERACT WITH OTHERS, WORK WITH TEAMS
3. 1 - Communicate appropriately: convey a message, listen, show empathy, assert one's point of view, debate in a reasoned manner
3.2 - Situate one's original discourse using explicit references
3. 3 - Communicate non-verbally: posture and gestures
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Apprehend the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions¿
5.2 - Integrate a responsible dimension (deontology, ethics) into their actions; identify, evaluate and anticipate the consequences of their actions and decisions at different levels of scale.

CONTENT

1) Reflection on the functioning, place and role of science and technology in our societies
> This course favors a cross-disciplinary approach, at the crossroads of different disciplines in the humanities and engineering sciences:
- Theme "Man and technology" / Cross-disciplinary sessions
2) Written and oral communication exercises

BIBLIOGRAPHY

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.

PRE-REQUISITES

Methodologies acquired in semester 1 of the first year.

Informatics and numerical society 3

IDENTIFICATION

CODE : FIMI-2-S1-EC-ISN-TF
ECTS : toto

HOURS

Cours :	5h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	37h
Travail personnel :	35h
Total :	72h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

Mme Bennani Nadia :
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M. Rivano Hervé :
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AIMS

Targeted learning outcomes :

AAv3.1 : At the end of S3, students will be able to write a program manipulating data stored in a list, dictionary or graph, which can be retrieved from a file containing open data.

AAv3.2 : At the end of S3, students are able to design an algorithm solving a problem from data stored in a graph, using and adapting subgraph calculation algorithms.

AAv3.3 : At the end of S3, students are able to integrate the notion of algorithmic complexity into the development of efficient code.

AAv3.4 : At the end of S3, students will be able to design and modify a suitable data structure (dictionary, list, graph, DB) to represent the data described in a specification.

AAv3.5 : At the end of S3, students are able to write an SQL query for a relational database.

CONTENT

1 - Introduction to relational databases :
* Relational model
* SQL query language (selection, projection, join, grouping and calculation functions)
* Introduction to the Entity-Association model and its link with the relational model.

2 - File and dictionary manipulation:
* reading and writing a file with a standard format.
* using a dictionary: accessing, creating, updating and browsing a dictionary.
* data restructuring using dictionaries.

3 - Graphs:
* notion and concepts.
* traversal algorithms (DFS, BFS, Dijkstra) to meet an objective.
* algorithm complexity.

4-Data visualization using supplied Python libraries.

5-Matching algorithms

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-1-S2-EC-ISN-TF

IDENTIFICATION

CODE : FIMI-2-S1-EC-MA-TF
ECTS : 5

HOURS

Cours :	21h
TD :	37.5h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	61.5h
Travail personnel :	70h
Total :	131.5h

ASSESMENT METHOD

Students are evaluated with written tests three times during the semester. The coefficients of the tests are (1.5,2,2.5) and they are set according to the length of the test.

TEACHING AIDS

Moodle

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

AAv3.1 – Determine the nature of improper integrals using comparison tools, and compute their value when possible.
AAv3.2 – Determine the convergence and the limit of sequences, especially those defined by recurrence.
AAv3.3 – Apply Newton's numerical method to approximate solutions of equations, and conduct a mathematical study of the method's convergence.
AAv3.4 – Compute the determinant of a matrix of small dimension, particularly to determine whether a matrix is invertible.
AAv3.5 – Find the eigenvalues and eigenspaces of an endomorphism in order to diagonalize it when possible.
AAv3.6 – Use endomorphism reduction to study and solve linear differential systems.
AAv3.7 – Determine the convergence of a series using standard criteria (comparison, integral test, D'Alembert's ratio test, etc.).

CONTENT

Suites (study of fixed points)
Reduction of endomorphisms
Improper integrals
Numerical series
Differential calculus
Extremum of multivariate functions

BIBLIOGRAPHY

S. Balac et L. Chupin, Analyse et algèbre : cours de mathématiques de deuxième année avec exercices corrigés et illustrations avec Maple, Presses polytechniques et universitaires romandes.
F. Butin, M. Picq, J. Pousin, Mathématiques - Cours, exercices corrigés - 2e année de classes préparatoires intégrées, Collection "Références sciences", Ellipses

PRE-REQUISITES

First year math class

IDENTIFICATION

CODE : FIMI-2-S1-EC-PH-TF
ECTS : 5

HOURS

Cours :	10h
TD :	39.5h
TP :	15h
Projet :	0h
Evaluation :	4.5h
Face à face pédagogique :	69h
Travail personnel :	60h
Total :	129h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals workings.
Multiple-choice questionnaire for autonomous training and self-assessment are available.

English is used only in the SCAN groups (french in all other groups)

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Determine the expression of a vector field as a function of spatial parameters and boundary conditions, from the expression of its law as a partial differential equation, exploiting the symmetries of the sources.
AAv.2 Convert laws and quantities expressed in a local (intensive) formulation into an integral (extensive) formulation and vice versa.
AAv.3 Draw up an energy balance in an electromagnetic system: energy supplied, stored, dissipated.
AAv.4 Identify the different components of an electromagnetic system (resistance, capacitance, inductance) and be able to determine their value when the electric and/or magnetic field is defined in all space.
AAv.5 Determine the action of electromagnetic forces in an electromagnetic or electromechanical system.
AAv.6 Evaluate quantitatively the phenomenon of static or motional induction in a simple electromagnetic or electromechanical system.
AAv.7 Apply the concepts seen in electromagnetism in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write a report.

CONTENT

The third semester of physics is devoted to electromagnetism. A reminder of the mathematical tools necessary to approach electromagnetic field theory is first proposed. Then the following notions are presented: electrostatic field, static charges (capacitor), moving charges (resistance), magnetic field, electromagnetism at interfaces, magnetic energy (inductance), magnetic and electric moments, static and motional induction. Maxwell's equations are revealed and explained as the course progresses. Concrete examples of the application of electromagnetism will be offered, in particular through the study of induction phenomena.

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

This course will use the knowledge and know-how acquired in Mathematical and Numerical Tools for Engineers during the first year (see the corresponding sheets).
All the notions of physics covered in S1 and S2 of the first year will be considered as acquired (including: geometrical optics, dimensions, uncertainties, DC and AC electricity, mechanics, electrical and magnetic forces).

Applications of thermodynamics to physical and chemical systems

IDENTIFICATION

CODE : FIMI-2-S1-EC-CH-TF-SH2
ECTS : 3

HOURS

Cours :	10h
TD :	20h
TP :	15h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	47h
Travail personnel :	30h
Total :	77h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Lecture, tutorial and practical work handouts.
First Cycle Moodle interface: all lecture, tutorial and practical work documents, schedule and organization, exercise corrections, links to internet sites, exam questions and answers in French and in English.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Determine the composition at physical equilibrium liquid/liquid and liquid/vapour of an ideal or non-ideal binary mixture
- by using the law of chemical moments
- by constructing an isobaric diagram of an ideal mixture using Raoult's law
- by interpreting an isobaric diagram of an ideal or non-ideal mixture (with the three cases of total, partial or zero miscibility in the liquid state for the non-ideal mixture).

Determine the evolution towards thermodynamic equilibrium of a multiphase system characterised by one or more chemical equilibria
- by identifying the chemical reaction(s) of interest and the phases of the reactants and products
- by comparing the values obtained for the equilibrium constant K° and the quotient of the reaction Q
- - by determining the system of equations for the chemical reaction(s) of interest. by determining the system of equations which enables the equilibrium state to be defined quantitatively
- by using Le Chatelier's principle to predict the qualitative effect on equilibrium of the parameters influencing the yield of a reaction (T, P, excess reagents, etc.).

Predict the spontaneous or forced nature of an electrochemical (redox) reaction
- by determining the free enthalpy and standard free enthalpy of a redox reaction from the standard potentials of the pairs and Nernst's law
- by describing and justifying the operation of an electrochemical cell: battery and electrolyser

Adapt a simple experimental approach in order to produce reliable experimental measurements
- by drawing on knowledge acquired in the first year and on the body of knowledge in the second year
- by designing an experimental protocol to solve a complex problem
- by identifying and quantifying sources of error and uncertainties

Use experimental measurements to determine the equilibrium composition of a system
- by choosing an appropriate analytical model
- by clearly presenting the measurements or experimental data (e.g. : graph or table)
- by calculating uncertainties using a logarithmic and/or graphical method on the basis of sources of error and analytical relationships

Write a scientific report following an experimental session
- by justifying the theoretical model of the experiment
- by justifying the experimental approach chosen
- by presenting and analysing the results obtained
- by criticising the results in relation to theoretical expectations and sources of systematic error

CONTENT

Lectures, tutorial classes and practical work in CHEMISTRY 2
To apply the thermodynamic laws to physical heterogeneous systems containing several constituents, main types of binary diagrams concerning the liquid-vapor equilibriums.
To apply the thermodynamic laws to chemical systems: thermo chemistry, qualitative and quantitative laws of equilibriums, application to equilibriums in aqueous media (acid-base, redox, solubility, complexation reaction) and to electrochemical cells.

BIBLIOGRAPHY

- Cours de Chimie-Physique et Exercices résolus de Chimie-Physique : P. Arnaud (Ed. Dunod)
- Thermodynamique Chimique 2ème année PC-PC* : P. Durupthy, C. Mesnil, T. Zobiri, collection H Prépa (Ed. Hachette)
- Thermodynamique Chimique: F. Brenon, C. Busquet, C. Mesnil, Ed. Hachette Supérieur.
- Chimie : Thermodynamique et Cinétique Chimique, Equilibres chimiques en solution, J. Mesplède, Ed. Bréal
- http://chimie.net.free.fr/index2.htm

IDENTIFICATION

CODE : FIMI-2-S1-EC-CSS-FI
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

An individual written assignment and a group assessment.

For example, for the classic audio project, an individual written assignment involving problematisation and assessment of research, and the ability to plan a medium-term project
A group audio project, with listening to the productions, critical feedback and assessment during the final session.

TEACHING AIDS

TEACHING LANGUAGE

French

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AIMS

CT2 - WORK, LEARN, GROW IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a reasoned manner
3.2 - Situate one's original speech using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3. 5 - Manage conflicts, balance individual and collective interests
3.6 - Take part in a group project: build and run a project, develop it; be aware of your role and responsibilities
4. 1 - Develop a creative approach, including artistic
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions...
CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in speech, attitudes and behaviour
7.3 - Putting values, beliefs and behaviour into perspective
7.4 - Integrating cultural diversity into group work

CONTENT

AM/AS/EU programme:
The project consists of the design and production of an 8 minute audio document on a free subject outside the "hard and technical sciences", by an international group of 3 or 4 students.

1) Culture
- sharpen your intellectual curiosity and your openness to the world
- develop a problematic around a freely chosen subject
- know how to carry out in-depth documentary research
- know how to design and then carry out an investigation with several interviews
- learn how to question reality and link knowledge
- analyse and organise a radio discourse
- work in a team on a project lasting several weeks and listen to each other.

2) Mastering audio communication in relation to a thematic issue
- researching the subject; finding witnesses and resource people
- writing research reports, synopses, scripts
- working on sound recording, interviews
- sound processing, meaningful editing
- taking part in a group project in synergy.

Introduction to the software used: Audacity

The programme may be adapted to the specific needs of a given international section.

SCAN programme:
The group project consists of the research and development of a scripted debate around a geopolitical issue of choice tied to a theme common to the class. The group will also be required to furnish an annotated bibliography. The individual project consists of an essay synthesizing the elements from multiple sources: group research, classmate debates, multiple sources furnished by the teacher. The project means to incite intellectual curiosity and openness to the world around a freely chosen subject.

SCAN learning outcomes:
- present multiple complex points of view, cite reasoning and evidence, develop counter arguments to opposing opinions
- carry out in-depth documentary research, evaluate credibility of sources and usefulness of material

BIBLIOGRAPHY

Civilisation - pojects 1

IDENTIFICATION

CODE : FIMI-2-S1-EC-CIP
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- In S3, for the theoretical part, a group presentation on current issues in Latin America
Latin America (50%) and a presentation on the hard and soft skills learned through work with the association (50%).

TEACHING AIDS

TEACHING LANGUAGE

French

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AIMS

Skills
* Targeted
- INSA, Humanities Competency Framework
5. Acting responsibly in a complex world
7. Working in an international and intercultural context.
* Mobilised
- CEFR
- Written and oral comprehension and expression (CEFR)
- INSA, Humanities skills reference framework
3. Interacting with others, working in a team.

CONTENT

This course is designed as a continuation of the 1st year Contemporary Latin American Civilisations course, with two distinct but complementary parts: a theoretical and documentation part (history course, 1 hour per week) and a practical part (four humanitarian projects that students will take part in each year: also 1 hour per week).
The theoretical part will focus on the establishment of the nation-state in Latin America from the 19th century onwards, as an exogenous model (Western and European) imposed by a sector of the population. In S3 we will be looking in particular at the continuities of the colonial past that persist to the present day and are reflected in a socio-economic structure that still retains very strong traces of colonial racism. At the same time, we will also look at the breaks with this colonial past and how there are specific features in this region of the world, particularly with regard to certain vulnerable population groups (women, indigenous communities, LGBT groups, migrants).
In parallel, for the practical part (S3 and S4), students will be in charge of various humanitarian projects and will organise different activities to publicise these associations on campus. They will learn how to manage an association and its treasury, how to deal with other associations and institutions, how to disseminate information and work with social networks, how to create a website, etc.

BIBLIOGRAPHY

- Amérique latine : introduction à l'Extrême-Occident, Alain Rouquié (1987)
- Naissance des nations, Clément Thibaud (2007)
- Race et colonialité du pouvoir, Anibal Quijano (2007)
- Histoire de l'Etat-Nation : de la politique d'intégration en Amérique Latine et en Europe, J. Gonzalez (2010)

PRE-REQUISITES

None.

German language and culture

IDENTIFICATION

CODE : FIMI-2-S1-EC-OPAL
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- Language: continuous assessment + B1 and B2 level tests (internal or Goethe Institut).
- civilisation: continuous assessment + presentations in German on themes related to the project; progress reports on the project
- Audiovisual project: project management

TEACHING AIDS

TEACHING LANGUAGE

French

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AIMS

Humanities reference framework:
CT2 - WORK, LEARN, DEVELOP IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK WITH TEAMS
3. 1 - Communicate appropriately: pass on a message, listen, show empathy, assert one's point of view, debate in a well-argued way

3.2 - Situate one's original discourse using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3.5 - Manage conflicts, balance individual and collective interests
3. 6 - Take part in a group project: build and run a project, develop it; be aware of his/her role and responsibilities
4.1 - Develop a creative approach, including artistic ones
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5. 1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.

CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in discourse, attitudes and behaviour
7.3 - Relativising values, beliefs and behaviour
7.4 - Integrating cultural diversity into group work

CONTENT

- become familiar with the use of the German language as a means of communication
- analyse cultural, political and artistic aspects of German-speaking countries
- learn how to set up and manage a Franco-German project in the field of science and technology or in the social and cultural field
- produce audio-visual reports in German in line with the year's theme
- learn how to present the results to the public (exhibition, round table, etc.).)

Semester 3: Definition and implementation of the project:
Language course: Study of the German language with the aim of acquiring a fluent language and a minimum level of B1 (according to the European reference framework); level B2 targeted. The aim is for the students to communicate with their partners, to conduct interviews and reports in German and to present INSA in German to secondary school pupils.
Civilisation classes: classes are held in German. They focus on German civilisation + exchanges with partners in Germany but also on current political and cultural events. The course is based on cultural activities in the Lyon region (theatre, exhibitions, conferences, etc.) relating to German culture
Audiovisual project: preparation of an audiovisual report: work on audiovisual language, interview techniques, technical aspects, etc.

BIBLIOGRAPHY

- CALLA Cécile, Tour de Franz - Mein Rendezvous mit dem Deutschen, Hamburg: Ullstein 2009,
- CHAPOUTEAU Johann: Histoire de l'Allemagne (1806 à nos jours) Paris : PUF,2014, 128p
- HUGHES Pascale , Marthe et Mathilde, Hamburg :Rowohlt TB, 2010 .
- MEYER Michel , Le roman de l'Allemagne : Ou l'histoire secrète d'une renaissance...; Paris 2013, 344p
- TOURNIER Michel , Le bonheur en Allemagne ?, Paris :Folio 2004,
- de la VAISSIERE Jean-Louis: Qui sont les Allemands ? Préface de Volker Schlöndorff Paris : Max Milo, 2011 384 p.
- WICKERT Ulrich, Frankreich die wunderbare Illusion, München: Heyne, 1998,
- In addition, there is a specific bibliography based on the theme studied during the year

For more information, visit the OPAL option website:
http://leshumas.insa-lyon.fr/langues/allemand/page_allemande/engager/opal/1_opal.html

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

FORMATION INITIALE AUX METIERS D'INGENIEUR

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

European Identities and Cultures

IDENTIFICATION

CODE : FIMI-2-S1-EC-CUID
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

Presentations and reports

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Humanities reference framework:
CT2 - WORK, LEARN, DEVELOP IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK WITH TEAMS
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a reasoned way

3.2 - Situate one's original speech using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3. 5 - Manage conflicts, balance individual and collective interests
3.6 - Take part in a group project: build and run a project, develop it; be aware of your role and responsibilities
4. 1 - Develop a creative approach, including an artistic one
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.

CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in discourse, attitudes and
behaviour
7.3 - Putting values, beliefs and behaviour into perspective
7.4 - Integrating cultural diversity into group work

CONTENT

Examination of the concept of identity and, more specifically, European cultural identity.
- Raising awareness of inter-cultural issues
- Study of European current affairs and in-depth examination of a number of specific issues (immigration, minorities, sovereign debts, etc.)
- Conduct of a collective study and travel project in conjunction with partners in one of the "European cultural capitals"
- Production of video reports in one of the cultural capitals on a variety of subjects (cultural, political, social or other)

Semester 3: Definition and implementation of the project:

Initially, students will examine the very notion of culture.
This awareness-raising work on a personal and concrete scale will serve as a basis for investigating the issues highlighted by the European Capitals of Culture.

Contacts will be established with partners involved in reflection on European issues. Regular exchanges on the issue of cultural identity will be held with them. Information evenings and debates may be organised. A special website or blog will be set up on which work in progress and the results will be posted.

BIBLIOGRAPHY

CARPENTIER Jean, LEBRUN François (directions), Histoire de l'Europe, Paris, Seuil, 1990
CAUTRES Bruno : Les Européens aiment-ils (toujours) l'Europe ? Paris : La Documentation Française, 2014, 214p
ECO Umberto, La Recherche De La Langue Parfaite Dans La Culture Européenne, Paris, Seuil, 1994
KRISTEVA Julia, Europe Des Cultures Et Culture Européenne : Communauté Et Diversité, Paris, Hachette, 2008
MATTEI Jean-François, Le Regard Vide. Essai Sur L'épuisement De La Culture Européenne, Paris, Flammarion, 2007
MAK Geert : Voyage d¿un Européen à travers le XXe siècle Paris : Gallimard, 2004 (éd.frç.:2010), 944p
RODAN Martin, Notre culture européenne, cette inconnue, Bern, Peter Lang, 2009
SAPIRO Gisèle (dir.), L'espace intellectuel en Europe. De la formation des Etats-nations à la mondialisation XIXè-XXIè siècles, Paris, La Découverte, 2009
THIESSE Anne-Marie : la création des identités nationales Paris :Seuil 2001, 212 p
TODD Emmanuel, L'invention de l'Europe, Paris, Seuil, 1990

There is also a specific bibliography based on the countries studied during the year

A regularly updated bibliography can be consulted on the website: http://leshumas.insa-lyon.fr/cuid

PRE-REQUISITES

A good command of English and a knowledge of a non-native 2nd language are desirable.

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Spanish Language and Civilisation

IDENTIFICATION

CODE : FIMI-2-S1-EC-LCE
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- an oral presentation: arguing for or against a destination, highlighting possible themes, making a financial forecast (20% - individual mark)
- filming plan: themes addressed, problematisation, list of planned interviews, interview script, sources of information, report plan with technical details (voice-over, types of shots, etc.), organisation of filming. (80% - group mark)

TEACHING AIDS

TEACHING LANGUAGE

French

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AIMS

SKILLS

Targeted
CT4: SHOW CREATIVITY

Mobilised
CT2: WORK, LEARN, DEVELOP IN AN AUTONOMOUS WAY
CT3: INTERACT WITH OTHERS, WORK AS PART OF A TEAM
CT7: WORK IN AN INTERNATIONAL AND CULTURAL CONTEXT

CONTENT

Classes are taught solely in Spanish. The LCE course consists of a language course (see description in the Spanish course offer) and a Spanish Civilisation course during which a video project will be produced during the study trip (5 to 6 days) to Spain.
The audiovisual project that the students will have to produce during their stay in Spain will be done in groups of four. The students will have one year to work on a societal issue that interests them; this issue may be directly linked to the city in which we will be staying or may be broader in scope: the question of independence, gender equality, bullfighting, etc. The video production may be a short documentary or a short film. The video production could be a short documentary or a report on the chosen issue. Part of the report will consist of interviews with specialists in the field (canvassed by the students).
The first semester is devoted to choosing the destination, organising the trip, researching the subject beforehand (problematisation of a subject, researching specialists), an introduction to photography (types of shots, meanings, use of equipment) and preparing a precise shooting plan.

The stay of a few days (in February, at the very beginning of S2) will be devoted to discovering the city and its culture, and several compulsory cultural activities will take place. The students will be given complete autonomy to conduct interviews with specialists as well as strangers, to fuel discussion on the subject.
On their return, the second semester will be devoted to selecting the images, sounds and interviews that will appear in the report, editing it and producing French subtitles (particularly in language classes).

BIBLIOGRAPHY

PRE-REQUISITES

Be enrolled in Spanish in 1st year. At least A2 level, but B1/B2 is strongly recommended for interviews. Selection based on a letter of application in Spanish (from the previous May).

IDENTIFICATION

CODE : FIMI-2-S1-EC-CP-TF
ECTS : –

HOURS

Cours :	0h
TD :	12h
TP :	56h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	69h
Travail personnel :	25h
Total :	94h

ASSESMENT METHOD

Continuous assessment of knowledge and skills

TEACHING AIDS

1 - Design-prototyping handout
2 - Teaching resources on FIMI's Moodle workspace
3 - Design handout 1A-2A

TEACHING LANGUAGE

French

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AIMS

This EC is part of the Mechanical Systems, Environment and Production (ME) teaching unit.
AAv. 1. 3D modeling of assemblies: Based on specifications and an initial version of a mechanism, design and optimize the 3D modeling of a mechanical assembly, taking into account geometric, functional and assembly constraints, while integrating an eco-responsible approach.
AAv. 2. Understanding manufacturing processes: Know the capabilities, limits and tolerances of the manufacturing processes used, including turning, milling, 3D printing, multi-material laser cutting, steel laser cutting, bending and welding. Know how to adapt the geometry of the parts to be manufactured to the chosen process.
AAv. 3 Making a mechanical system: Make and assemble a mechanical system in the workshop from a 3D digital model, taking into account the constraints and limitations of the chosen processes.
AAv. 4 Programming and implementing a mechatronic system: Develop an Arduino program from a basic algorithm, adapting it to the requirements of the specifications and validating its correct operation on the real system studied.
AAv. 5 Workshop collaboration and safety: Work effectively in a team and independently in a prototyping workshop, applying safety rules, good manufacturing practices and rigorous organization to guarantee a safe and productive working environment.

CONTENT

By enabling the student-engineer to work on and be assessed on the following knowledge :
- safety instructions in a production workshop
- knowledge of one of the following 2 processes for producing traditional parts:
* either material-removal machining (turning, milling, drilling),
* metal construction and deformation processes (rolling, bending, folding, laser cutting) and assembly (gluing, welding, riveting).
- knowledge of various rapid part production processes - agile prototyping:
* additive manufacturing (3D printing)
* multi-material laser cutting processes (wood, acrylic)
- be familiar with agile design concepts and their implementation
- know the characteristics of a communicating control system
- programming logic of an event-driven system
- understand the interaction between production-manufacturing and system design
- the possibilities offered by agile prototyping of a system
- know the concepts of system design on CAD tools

BIBLIOGRAPHY

PRE-REQUISITES

CAD, Technical analysis, Reading and drawing technical drawings, Dimensioning, Materials (1st year Design course).

System Mechanics 1

IDENTIFICATION

CODE : FIMI-2-S1-EC-MS-TF-SH1
ECTS : 3.00

HOURS

Cours :	10h
TD :	21h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	32.5h
Travail personnel :	30h
Total :	62.5h

ASSESMENT METHOD

- 1 Written Tests (WT1 of 1.5 hours)
- 1 Final Test (FT1) of 2 hours.
Average : (WT1*1.5+FT1*2)/3.5

TEACHING AIDS

- Lecture notes and presentations
- Exercises book (the same for all the 2nd year students)
Documents available on Moodle

TEACHING LANGUAGE

French
English

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AIMS

Target Learning Outcomes (AvA):

AAv.1: Identify the characteristics of a mechanical system, schematize it and graphically construct the velocity fields

AAv.2: Model a real mechanical system of bounded complexity including specific static behavior laws (ex: spring, inter-solid contact, belt...)

AAv.3: Perform a complete mechanical balance, establish and solve equilibrium equations (static)

AAv.4: Establish the characteristics of a mechanical system on the basis of established equations and verify the dimensional homogeneity of the results obtained

CONTENT

WRENCH/SCREWS: Introduction and definitions: sliding vectors, system of sliding vectors, vectorial coordinates (sum, moment), scalar invariants, special wrenches/ screws, central axis, Delassus theorem on equiprojectivity.

STATICS: Fundamental principle, notion of isolated system, mechanical actions, wrench of mechanical actions associated with classic joints, analytical statics.

KINEMATICS :
- Location of a free solid, kinematics of particles, frame of reference and frame of expression, kinematics of rigid-solids, kinematic screw, time differentiation of vectors and moving basis formula, acceleration field for rigid solids, fundamental motions.
- Geometry and kinematics of joints, frame and parameter definition for mechanisms, constraint equations, mobility, combination of motions.
- Contact kinematics, sliding, rolling and pitching, kinematic constraint equations, instant motion of solids.

BIBLIOGRAPHY

AGATI Mécanique Industrielle Dunod
BEGHIN Cours de mécanique théorique Gauthier-Villar
BELLET Problème de mécanique Cepadues editions
BERKELEY Cours de Physique 1 Armand Colin
BONCOMPAIN Méca. des Syst. Indus. (T2) Dunod
BROSSARD Mécanique Générale Tech. de l'Ingénieur AF4
BROUSSE Cours de mécanique Collection U
BONE Mécanique Générale (crs et ap.) Dunod U
CAZIN Cours de mécanique générale Gauthier-Villar
ROY Mécanique du solide rigide Dunod
LASSIA Cinématique Ellipse
LASSIA-BARD Dynamique Ellipse

PRE-REQUISITES

- Vectors and Linear algebra
- Mechanical design
- Point mechanics

IDENTIFICATION

CODE : FIMI-2-S1-EC-ETRE-TF-SH2

ECTS : 2

HOURS

Cours :	0h
TD :	8h
TP :	2h
Projet :	14h
Evaluation :	0.016666666666666666h
Face à face pédagogique :	10.016666666666666h
Travail personnel :	25h
Total :	49.016666666666666h

ASSESMENT METHOD

Continuous assessment. Three summative assessments are organised:
- the biodiversity mission will result in a graded group presentation based on a powerpoint presentation.
- the "Et si..." project gives rise to the writing of a graded fiction (in groups), as well as a graded literary presentation. The mark may be individualised.
- An individual written test, at the End of Semester, marks the end of FIMI's ETRE sequence, by examining students on all the skills acquired during the 2 semesters S2 and S3.

TEACHING AIDS

Course materials and exercises.
1st Cycle Moodle platform: all course and planning and organization, links to resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

This teaching sequence, in S3, is the second part of a program that will continue throughout
the studies, with the aim of training engineers who are aware of the challenges of the ecological transition.
In its February 26, 2020 letter of intent, INSA Lyon stated that "the courses in Sustainable
Development and Social Responsibility (SDRS) courses combine the following training objectives :
* in terms of cross-disciplinary skills
* in terms of themes to be addressed: climate change, energy, raw materials resources, and
damage to living organisms and human health.
Two cross-cutting themes are addressed: links between science, technology and society, and
the dynamics of change.

The targeted learning outcomes are thus :
1) Use a multi-disciplinary body of knowledge to provide reasoned, qualitative and quantitative answers to advanced questions on the challenges of ecological transition in relation to resources and living organisms.
2) Associate human actions with their consequences on the planet's habitability, based on planetary limits and the finitude of resources.
3) Illustrate (explain) the systemic nature of socio-ecological issues; integrate the central role of living organisms and the human-nature relationship into the reasoning.
4) Using scientific data and a decentralized approach, imagine, design and present a forward-looking narrative on a given theme of socio-ecological transition.

CONTENT

The students will work on the following knowledge:
- Understand the issues associated with the erosion of biodiversity.
- Understand resource-related issues.
- Realise a synthesis of the 2 semesters of ETRE, through the construction of imaginary worlds and paths towards desirable futures.
The sequence will be structured as follows:
- 2h introduction: remobilisation of knowledge acquired in S2
- 8 hours of project work, involving a mission to assess the quality of the ecosystem of the campus
- 2 hours of cross-disciplinary practical work on copper resources
- and finally, 12 hours of supervised project "Et si...", the deliverables of which (in groups) are a fiction and a literary presentation.
IMPORTANT: the teachers work in pairs on each group of students: 16 hours are taught by the SPI (Sciences Pour l'Ingénieur) teacher, 4 hours by the Human Sciences teacher, and the final presentation of 2 hours is assessed by the 2 teachers.

BIBLIOGRAPHY

General Biodiversity Inventory - Doua Campus
U.S. Geological Survey, Mineral Commodity Summaries, January 2020
Ecotopia - Ernest Callenbach - Gallimard - 2021
(...)

PRE-REQUISITES

S2 curriculum for ETRE (2nd semester of 1st year).
Associated secondary school curricula (2nd, 1st and final year) on sustainable development and social responsibility.
The various 1st year INSA courses (Engineering Sciences and Human Sciences) are called upon more in terms of methods than knowledge.

Informatics and numerical society 3

IDENTIFICATION

CODE : FIMI-2-S1-EC-ISN-TF
ECTS : toto

HOURS

Cours :	5h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	37h
Travail personnel :	35h
Total :	72h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

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AIMS

Targeted learning outcomes :

AAv3.1 : At the end of S3, students will be able to write a program manipulating data stored in a list, dictionary or graph, which can be retrieved from a file containing open data.

AAv3.2 : At the end of S3, students are able to design an algorithm solving a problem from data stored in a graph, using and adapting subgraph calculation algorithms.

AAv3.3 : At the end of S3, students are able to integrate the notion of algorithmic complexity into the development of efficient code.

AAv3.4 : At the end of S3, students will be able to design and modify a suitable data structure (dictionary, list, graph, DB) to represent the data described in a specification.

AAv3.5 : At the end of S3, students are able to write an SQL query for a relational database.

CONTENT

1 - Introduction to relational databases :
* Relational model
* SQL query language (selection, projection, join, grouping and calculation functions)
* Introduction to the Entity-Association model and its link with the relational model.

2 - File and dictionary manipulation:
* reading and writing a file with a standard format.
* using a dictionary: accessing, creating, updating and browsing a dictionary.
* data restructuring using dictionaries.

3 - Graphs:
* notion and concepts.
* traversal algorithms (DFS, BFS, Dijkstra) to meet an objective.
* algorithm complexity.

4-Data visualization using supplied Python libraries.

5-Matching algorithms

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-1-S2-EC-ISN-TF

IDENTIFICATION

CODE : FIMI-2-S1-EC-MA-TF
ECTS : 5

HOURS

Cours :	21h
TD :	37.5h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	61.5h
Travail personnel :	70h
Total :	131.5h

ASSESMENT METHOD

Students are evaluated with written tests three times during the semester. The coefficients of the tests are (1.5,2,2.5) and they are set according to the length of the test.

TEACHING AIDS

Moodle

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

AAv3.1 – Determine the nature of improper integrals using comparison tools, and compute their value when possible.
AAv3.2 – Determine the convergence and the limit of sequences, especially those defined by recurrence.
AAv3.3 – Apply Newton's numerical method to approximate solutions of equations, and conduct a mathematical study of the method's convergence.
AAv3.4 – Compute the determinant of a matrix of small dimension, particularly to determine whether a matrix is invertible.
AAv3.5 – Find the eigenvalues and eigenspaces of an endomorphism in order to diagonalize it when possible.
AAv3.6 – Use endomorphism reduction to study and solve linear differential systems.
AAv3.7 – Determine the convergence of a series using standard criteria (comparison, integral test, D'Alembert's ratio test, etc.).

CONTENT

Suites (study of fixed points)
Reduction of endomorphisms
Improper integrals
Numerical series
Differential calculus
Extremum of multivariate functions

BIBLIOGRAPHY

S. Balac et L. Chupin, Analyse et algèbre : cours de mathématiques de deuxième année avec exercices corrigés et illustrations avec Maple, Presses polytechniques et universitaires romandes.
F. Butin, M. Picq, J. Pousin, Mathématiques - Cours, exercices corrigés - 2e année de classes préparatoires intégrées, Collection "Références sciences", Ellipses

PRE-REQUISITES

First year math class

IDENTIFICATION

CODE : FIMI-2-S1-EC-PH-TF
ECTS : 5

HOURS

Cours :	10h
TD :	39.5h
TP :	15h
Projet :	0h
Evaluation :	4.5h
Face à face pédagogique :	69h
Travail personnel :	60h
Total :	129h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals workings.
Multiple-choice questionnaire for autonomous training and self-assessment are available.

English is used only in the SCAN groups (french in all other groups)

TEACHING LANGUAGE

French
English

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Determine the expression of a vector field as a function of spatial parameters and boundary conditions, from the expression of its law as a partial differential equation, exploiting the symmetries of the sources.
AAv.2 Convert laws and quantities expressed in a local (intensive) formulation into an integral (extensive) formulation and vice versa.
AAv.3 Draw up an energy balance in an electromagnetic system: energy supplied, stored, dissipated.
AAv.4 Identify the different components of an electromagnetic system (resistance, capacitance, inductance) and be able to determine their value when the electric and/or magnetic field is defined in all space.
AAv.5 Determine the action of electromagnetic forces in an electromagnetic or electromechanical system.
AAv.6 Evaluate quantitatively the phenomenon of static or motional induction in a simple electromagnetic or electromechanical system.
AAv.7 Apply the concepts seen in electromagnetism in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write a report.

CONTENT

The third semester of physics is devoted to electromagnetism. A reminder of the mathematical tools necessary to approach electromagnetic field theory is first proposed. Then the following notions are presented: electrostatic field, static charges (capacitor), moving charges (resistance), magnetic field, electromagnetism at interfaces, magnetic energy (inductance), magnetic and electric moments, static and motional induction. Maxwell's equations are revealed and explained as the course progresses. Concrete examples of the application of electromagnetism will be offered, in particular through the study of induction phenomena.

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

This course will use the knowledge and know-how acquired in Mathematical and Numerical Tools for Engineers during the first year (see the corresponding sheets).
All the notions of physics covered in S1 and S2 of the first year will be considered as acquired (including: geometrical optics, dimensions, uncertainties, DC and AC electricity, mechanics, electrical and magnetic forces).

Applications of thermodynamics to physical and chemical systems

IDENTIFICATION

CODE : FIMI-2-S1-EC-CH-TF-SH2
ECTS : 3

HOURS

Cours :	10h
TD :	20h
TP :	15h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	47h
Travail personnel :	30h
Total :	77h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Lecture, tutorial and practical work handouts.
First Cycle Moodle interface: all lecture, tutorial and practical work documents, schedule and organization, exercise corrections, links to internet sites, exam questions and answers in French and in English.

TEACHING LANGUAGE

French
English

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AIMS

Determine the composition at physical equilibrium liquid/liquid and liquid/vapour of an ideal or non-ideal binary mixture
- by using the law of chemical moments
- by constructing an isobaric diagram of an ideal mixture using Raoult's law
- by interpreting an isobaric diagram of an ideal or non-ideal mixture (with the three cases of total, partial or zero miscibility in the liquid state for the non-ideal mixture).

Determine the evolution towards thermodynamic equilibrium of a multiphase system characterised by one or more chemical equilibria
- by identifying the chemical reaction(s) of interest and the phases of the reactants and products
- by comparing the values obtained for the equilibrium constant K° and the quotient of the reaction Q
- - by determining the system of equations for the chemical reaction(s) of interest. by determining the system of equations which enables the equilibrium state to be defined quantitatively
- by using Le Chatelier's principle to predict the qualitative effect on equilibrium of the parameters influencing the yield of a reaction (T, P, excess reagents, etc.).

Predict the spontaneous or forced nature of an electrochemical (redox) reaction
- by determining the free enthalpy and standard free enthalpy of a redox reaction from the standard potentials of the pairs and Nernst's law
- by describing and justifying the operation of an electrochemical cell: battery and electrolyser

Adapt a simple experimental approach in order to produce reliable experimental measurements
- by drawing on knowledge acquired in the first year and on the body of knowledge in the second year
- by designing an experimental protocol to solve a complex problem
- by identifying and quantifying sources of error and uncertainties

Use experimental measurements to determine the equilibrium composition of a system
- by choosing an appropriate analytical model
- by clearly presenting the measurements or experimental data (e.g. : graph or table)
- by calculating uncertainties using a logarithmic and/or graphical method on the basis of sources of error and analytical relationships

Write a scientific report following an experimental session
- by justifying the theoretical model of the experiment
- by justifying the experimental approach chosen
- by presenting and analysing the results obtained
- by criticising the results in relation to theoretical expectations and sources of systematic error

CONTENT

Lectures, tutorial classes and practical work in CHEMISTRY 2
To apply the thermodynamic laws to physical heterogeneous systems containing several constituents, main types of binary diagrams concerning the liquid-vapor equilibriums.
To apply the thermodynamic laws to chemical systems: thermo chemistry, qualitative and quantitative laws of equilibriums, application to equilibriums in aqueous media (acid-base, redox, solubility, complexation reaction) and to electrochemical cells.

BIBLIOGRAPHY

- Cours de Chimie-Physique et Exercices résolus de Chimie-Physique : P. Arnaud (Ed. Dunod)
- Thermodynamique Chimique 2ème année PC-PC* : P. Durupthy, C. Mesnil, T. Zobiri, collection H Prépa (Ed. Hachette)
- Thermodynamique Chimique: F. Brenon, C. Busquet, C. Mesnil, Ed. Hachette Supérieur.
- Chimie : Thermodynamique et Cinétique Chimique, Equilibres chimiques en solution, J. Mesplède, Ed. Bréal
- http://chimie.net.free.fr/index2.htm

IDENTIFICATION

CODE : FIMI-2-S1-EC-ETRE-AS
ECTS : 2

HOURS

Cours : 0h
TD : 8h
TP : 2h
Projet : 14h
Evaluation : 0.016666666666666666h
Face à face pédagogique : 10.016666666666667h
Travail personnel : 25h
Total : 49.016666666666666h

ASSESMENT METHOD

Continuous assessment. Three summative assessments are organised:
- the biodiversity mission will result in a graded group presentation based on a powerpoint presentation.
- the "Et si..." project gives rise to the writing of a graded fiction (in groups), as well as a graded literary presentation. The mark may be individualised.
- An individual written test, at the End of Semester, marks the end of FIMI's ETRE sequence, by examining students on all the skills acquired during the 2 semesters S2 and S3.

TEACHING AIDS

Course materials and exercises.
1st Cycle Moodle platform: all course and planning and organization, links to resources.

TEACHING LANGUAGE

French

CONTACT

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AIMS

This teaching sequence, in S3, is the second part of a program that will continue throughout
the studies, with the aim of training engineers who are aware of the challenges of the ecological transition.
In its February 26, 2020 letter of intent, INSA Lyon stated that "the courses in Sustainable
Development and Social Responsibility (SDRS) courses combine the following training objectives :
* in terms of cross-disciplinary skills
* in terms of themes to be addressed: climate change, energy, raw materials resources, and
damage to living organisms and human health.
Two cross-cutting themes are addressed: links between science, technology and society, and
the dynamics of change.
The teaching method is slightly adapted in Asinsa.

The targeted learning outcomes are thus :
1) Use a multi-disciplinary body of knowledge to provide reasoned, qualitative and quantitative answers to advanced questions on the challenges of ecological transition in relation to resources and living organisms.
2) Associate human actions with their consequences on the planet's habitability, based on planetary limits and the finitude of resources.
3) Illustrate (explain) the systemic nature of socio-ecological issues; integrate the central role of living organisms and the human-nature relationship into the reasoning.
4) Using scientific data and a decentralized approach, imagine, design and present a forward-looking narrative on a given theme of socio-ecological transition.

CONTENT

The students will work on the following knowledge:
- Understand the issues associated with the erosion of biodiversity.
- Understand resource-related issues.
- Realise a synthesis of the 2 semesters of ETRE, through the construction of imaginary worlds and paths towards desirable futures.
The sequence will be structured as follows:
- 2h introduction: remobilisation of knowledge acquired in S2
- 8 hours of project work, involving a mission to assess the quality of the ecosystem of the
campus
- 2 hours of cross-disciplinary practical work on copper resources
- and finally, 12 hours of supervised project "Et si...", the deliverables of which (in groups) are a fiction and a literary presentation.
IMPORTANT: the teachers work in pairs on each group of students: 16 hours are taught by the
SPI (Sciences Pour l'Ingénieur) teacher, 4 hours by the Human Sciences teacher, and the final presentation of 2 hours is assessed by the 2 teachers.

BIBLIOGRAPHY

General Biodiversity Inventory - Doua Campus
U.S. Geological Survey, Mineral Commodity Summaries, January 2020
Ecotopia - Ernest Callenbach - Gallimard - 2021
(...)

PRE-REQUISITES

S2 curriculum for ETRE (2nd semester of 1st year).
Associated secondary school curricula (2nd, 1st and final year) on sustainable development
and social responsibility.
The various 1st year INSA courses (Engineering Sciences and Human Sciences) are called upon more in terms of methods than knowledge

IDENTIFICATION

CODE : FIMI-2-S1-EC-CP-TF
ECTS : –

HOURS

Cours :	0h
TD :	12h
TP :	56h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	69h
Travail personnel :	25h
Total :	94h

ASSESMENT METHOD

Continuous assessment of knowledge and skills

TEACHING AIDS

1 - Design-prototyping handout
2 - Teaching resources on FIMI's Moodle workspace
3 - Design handout 1A-2A

TEACHING LANGUAGE

French

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AIMS

This EC is part of the Mechanical Systems, Environment and Production (ME) teaching unit.
AAv. 1. 3D modeling of assemblies: Based on specifications and an initial version of a mechanism, design and optimize the 3D modeling of a mechanical assembly, taking into account geometric, functional and assembly constraints, while integrating an eco-responsible approach.
AAv. 2. Understanding manufacturing processes: Know the capabilities, limits and tolerances of the manufacturing processes used, including turning, milling, 3D printing, multi-material laser cutting, steel laser cutting, bending and welding. Know how to adapt the geometry of the parts to be manufactured to the chosen process.
AAv. 3 Making a mechanical system: Make and assemble a mechanical system in the workshop from a 3D digital model, taking into account the constraints and limitations of the chosen processes.
AAv. 4 Programming and implementing a mechatronic system: Develop an Arduino program from a basic algorithm, adapting it to the requirements of the specifications and validating its correct operation on the real system studied.
AAv. 5 Workshop collaboration and safety: Work effectively in a team and independently in a prototyping workshop, applying safety rules, good manufacturing practices and rigorous organization to guarantee a safe and productive working environment.

CONTENT

By enabling the student-engineer to work on and be assessed on the following knowledge :
- safety instructions in a production workshop
- knowledge of one of the following 2 processes for producing traditional parts:
* either material-removal machining (turning, milling, drilling),
* metal construction and deformation processes (rolling, bending, folding, laser cutting) and assembly (gluing, welding, riveting).
- knowledge of various rapid part production processes - agile prototyping:
* additive manufacturing (3D printing)
* multi-material laser cutting processes (wood, acrylic)
- be familiar with agile design concepts and their implementation
- know the characteristics of a communicating control system
- programming logic of an event-driven system
- understand the interaction between production-manufacturing and system design
- the possibilities offered by agile prototyping of a system
- know the concepts of system design on CAD tools

BIBLIOGRAPHY

PRE-REQUISITES

CAD, Technical analysis, Reading and drawing technical drawings, Dimensioning, Materials (1st year Design course).

System Mechanics 1

IDENTIFICATION

CODE : FIMI-2-S1-EC-MS-TF-SH1
ECTS : 3.00

HOURS

Cours :	10h
TD :	21h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	32.5h
Travail personnel :	30h
Total :	62.5h

ASSESMENT METHOD

- 1 Written Tests (WT1 of 1.5 hours)
- 1 Final Test (FT1) of 2 hours.
Average : (WT1*1.5+FT1*2)/3.5

TEACHING AIDS

- Lecture notes and presentations
- Exercises book (the same for all the 2nd year students)
Documents available on Moodle

TEACHING LANGUAGE

French
English

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AIMS

Target Learning Outcomes (AvA):

AAv.1: Identify the characteristics of a mechanical system, schematize it and graphically construct the velocity fields

AAv.2: Model a real mechanical system of bounded complexity including specific static behavior laws (ex: spring, inter-solid contact, belt...)

AAv.3: Perform a complete mechanical balance, establish and solve equilibrium equations (static)

AAv.4: Establish the characteristics of a mechanical system on the basis of established equations and verify the dimensional homogeneity of the results obtained

CONTENT

WRENCH/SCREWS: Introduction and definitions: sliding vectors, system of sliding vectors, vectorial coordinates (sum, moment), scalar invariants, special wrenches/ screws, central axis, Delassus theorem on equiprojectivity.

STATICS: Fundamental principle, notion of isolated system, mechanical actions, wrench of mechanical actions associated with classic joints, analytical statics.

KINEMATICS :
- Location of a free solid, kinematics of particles, frame of reference and frame of expression, kinematics of rigid-solids, kinematic screw, time differentiation of vectors and moving basis formula, acceleration field for rigid solids, fundamental motions.
- Geometry and kinematics of joints, frame and parameter definition for mechanisms, constraint equations, mobility, combination of motions.
- Contact kinematics, sliding, rolling and pitching, kinematic constraint equations, instant motion of solids.

BIBLIOGRAPHY

AGATI Mécanique Industrielle Dunod
BEGHIN Cours de mécanique théorique Gauthier-Villar
BELLET Problème de mécanique Cepadues editions
BERKELEY Cours de Physique 1 Armand Colin
BONCOMPAIN Méca. des Syst. Indus. (T2) Dunod
BROSSARD Mécanique Générale Tech. de l'Ingénieur AF4
BROUSSE Cours de mécanique Collection U
BONE Mécanique Générale (crs et ap.) Dunod U
CAZIN Cours de mécanique générale Gauthier-Villar
ROY Mécanique du solide rigide Dunod
LASSIA Cinématique Ellipse
LASSIA-BARD Dynamique Ellipse

PRE-REQUISITES

- Vectors and Linear algebra
- Mechanical design
- Point mechanics

IDENTIFICATION

CODE : FIMI-2-S1-EC-CSS-FI
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

An individual written assignment and a group assessment.

For example, for the classic audio project, an individual written assignment involving problematisation and assessment of research, and the ability to plan a medium-term project
A group audio project, with listening to the productions, critical feedback and assessment during the final session.

TEACHING AIDS

TEACHING LANGUAGE

French

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AIMS

CT2 - WORK, LEARN, GROW IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a reasoned manner
3.2 - Situate one's original speech using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3. 5 - Manage conflicts, balance individual and collective interests
3.6 - Take part in a group project: build and run a project, develop it; be aware of your role and responsibilities
4. 1 - Develop a creative approach, including artistic
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions...
CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in speech, attitudes and behaviour
7.3 - Putting values, beliefs and behaviour into perspective
7.4 - Integrating cultural diversity into group work

CONTENT

AM/AS/EU programme:
The project consists of the design and production of an 8 minute audio document on a free subject outside the "hard and technical sciences", by an international group of 3 or 4 students.

1) Culture
- sharpen your intellectual curiosity and your openness to the world
- develop a problematic around a freely chosen subject
- know how to carry out in-depth documentary research
- know how to design and then carry out an investigation with several interviews
- learn how to question reality and link knowledge
- analyse and organise a radio discourse
- work in a team on a project lasting several weeks and listen to each other.

2) Mastering audio communication in relation to a thematic issue
- researching the subject; finding witnesses and resource people
- writing research reports, synopses, scripts
- working on sound recording, interviews
- sound processing, meaningful editing
- taking part in a group project in synergy.

Introduction to the software used: Audacity

The programme may be adapted to the specific needs of a given international section.

SCAN programme:
The group project consists of the research and development of a scripted debate around a geopolitical issue of choice tied to a theme common to the class. The group will also be required to furnish an annotated bibliography. The individual project consists of an essay synthesizing the elements from multiple sources: group research, classmate debates, multiple sources furnished by the teacher. The project means to incite intellectual curiosity and openness to the world around a freely chosen subject.

SCAN learning outcomes:
- present multiple complex points of view, cite reasoning and evidence, develop counter arguments to opposing opinions
- carry out in-depth documentary research, evaluate credibility of sources and usefulness of material

BIBLIOGRAPHY

Informatics and numerical society 3

IDENTIFICATION

CODE : FIMI-2-S1-EC-ISN-TF
ECTS : toto

HOURS

Cours :	5h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	37h
Travail personnel :	35h
Total :	72h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes :

AAv3.1 : At the end of S3, students will be able to write a program manipulating data stored in a list, dictionary or graph, which can be retrieved from a file containing open data.

AAv3.2 : At the end of S3, students are able to design an algorithm solving a problem from data stored in a graph, using and adapting subgraph calculation algorithms.

AAv3.3 : At the end of S3, students are able to integrate the notion of algorithmic complexity into the development of efficient code.

AAv3.4 : At the end of S3, students will be able to design and modify a suitable data structure (dictionary, list, graph, DB) to represent the data described in a specification.

AAv3.5 : At the end of S3, students are able to write an SQL query for a relational database.

CONTENT

1 - Introduction to relational databases :
* Relational model
* SQL query language (selection, projection, join, grouping and calculation functions)
* Introduction to the Entity-Association model and its link with the relational model.

2 - File and dictionary manipulation:
* reading and writing a file with a standard format.
* using a dictionary: accessing, creating, updating and browsing a dictionary.
* data restructuring using dictionaries.

3 - Graphs:
* notion and concepts.
* traversal algorithms (DFS, BFS, Dijkstra) to meet an objective.
* algorithm complexity.

4-Data visualization using supplied Python libraries.

5-Matching algorithms

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-1-S2-EC-ISN-TF

IDENTIFICATION

CODE : FIMI-2-S1-EC-MA-TF
ECTS : 5

HOURS

Cours :	21h
TD :	37.5h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	61.5h
Travail personnel :	70h
Total :	131.5h

ASSESMENT METHOD

Students are evaluated with written tests three times during the semester. The coefficients of the tests are (1.5,2,2.5) and they are set according to the length of the test.

TEACHING AIDS

Moodle

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

AAv3.1 – Determine the nature of improper integrals using comparison tools, and compute their value when possible.
AAv3.2 – Determine the convergence and the limit of sequences, especially those defined by recurrence.
AAv3.3 – Apply Newton's numerical method to approximate solutions of equations, and conduct a mathematical study of the method's convergence.
AAv3.4 – Compute the determinant of a matrix of small dimension, particularly to determine whether a matrix is invertible.
AAv3.5 – Find the eigenvalues and eigenspaces of an endomorphism in order to diagonalize it when possible.
AAv3.6 – Use endomorphism reduction to study and solve linear differential systems.
AAv3.7 – Determine the convergence of a series using standard criteria (comparison, integral test, D'Alembert's ratio test, etc.).

CONTENT

Suites (study of fixed points)
Reduction of endomorphisms
Improper integrals
Numerical series
Differential calculus
Extremum of multivariate functions

BIBLIOGRAPHY

S. Balac et L. Chupin, Analyse et algèbre : cours de mathématiques de deuxième année avec exercices corrigés et illustrations avec Maple, Presses polytechniques et universitaires romandes.
F. Butin, M. Picq, J. Pousin, Mathématiques - Cours, exercices corrigés - 2e année de classes préparatoires intégrées, Collection "Références sciences", Ellipses

PRE-REQUISITES

First year math class

IDENTIFICATION

CODE : FIMI-2-S1-EC-PH-TF
ECTS : 5

HOURS

Cours :	10h
TD :	39.5h
TP :	15h
Projet :	0h
Evaluation :	4.5h
Face à face pédagogique :	69h
Travail personnel :	60h
Total :	129h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals workings.
Multiple-choice questionnaire for autonomous training and self-assessment are available.

English is used only in the SCAN groups (french in all other groups)

TEACHING LANGUAGE

French
English

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Determine the expression of a vector field as a function of spatial parameters and boundary conditions, from the expression of its law as a partial differential equation, exploiting the symmetries of the sources.
AAv.2 Convert laws and quantities expressed in a local (intensive) formulation into an integral (extensive) formulation and vice versa.
AAv.3 Draw up an energy balance in an electromagnetic system: energy supplied, stored, dissipated.
AAv.4 Identify the different components of an electromagnetic system (resistance, capacitance, inductance) and be able to determine their value when the electric and/or magnetic field is defined in all space.
AAv.5 Determine the action of electromagnetic forces in an electromagnetic or electromechanical system.
AAv.6 Evaluate quantitatively the phenomenon of static or motional induction in a simple electromagnetic or electromechanical system.
AAv.7 Apply the concepts seen in electromagnetism in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write a report.

CONTENT

The third semester of physics is devoted to electromagnetism. A reminder of the mathematical tools necessary to approach electromagnetic field theory is first proposed. Then the following notions are presented: electrostatic field, static charges (capacitor), moving charges (resistance), magnetic field, electromagnetism at interfaces, magnetic energy (inductance), magnetic and electric moments, static and motional induction. Maxwell's equations are revealed and explained as the course progresses. Concrete examples of the application of electromagnetism will be offered, in particular through the study of induction phenomena.

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

This course will use the knowledge and know-how acquired in Mathematical and Numerical Tools for Engineers during the first year (see the corresponding sheets).
All the notions of physics covered in S1 and S2 of the first year will be considered as acquired (including: geometrical optics, dimensions, uncertainties, DC and AC electricity, mechanics, electrical and magnetic forces).

Applications of thermodynamics to physical and chemical systems

IDENTIFICATION

CODE : FIMI-2-S1-EC-CH-TF-SH2
ECTS : 3

HOURS

Cours :	10h
TD :	20h
TP :	15h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	47h
Travail personnel :	30h
Total :	77h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Lecture, tutorial and practical work handouts.
First Cycle Moodle interface: all lecture, tutorial and practical work documents, schedule and organization, exercise corrections, links to internet sites, exam questions and answers in French and in English.

TEACHING LANGUAGE

French
English

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AIMS

Determine the composition at physical equilibrium liquid/liquid and liquid/vapour of an ideal or non-ideal binary mixture
- by using the law of chemical moments
- by constructing an isobaric diagram of an ideal mixture using Raoult's law
- by interpreting an isobaric diagram of an ideal or non-ideal mixture (with the three cases of total, partial or zero miscibility in the liquid state for the non-ideal mixture).

Determine the evolution towards thermodynamic equilibrium of a multiphase system characterised by one or more chemical equilibria
- by identifying the chemical reaction(s) of interest and the phases of the reactants and products
- by comparing the values obtained for the equilibrium constant K° and the quotient of the reaction Q
- - by determining the system of equations for the chemical reaction(s) of interest. by determining the system of equations which enables the equilibrium state to be defined quantitatively
- by using Le Chatelier's principle to predict the qualitative effect on equilibrium of the parameters influencing the yield of a reaction (T, P, excess reagents, etc.).

Predict the spontaneous or forced nature of an electrochemical (redox) reaction
- by determining the free enthalpy and standard free enthalpy of a redox reaction from the standard potentials of the pairs and Nernst's law
- by describing and justifying the operation of an electrochemical cell: battery and electrolyser

Adapt a simple experimental approach in order to produce reliable experimental measurements
- by drawing on knowledge acquired in the first year and on the body of knowledge in the second year
- by designing an experimental protocol to solve a complex problem
- by identifying and quantifying sources of error and uncertainties

Use experimental measurements to determine the equilibrium composition of a system
- by choosing an appropriate analytical model
- by clearly presenting the measurements or experimental data (e.g. : graph or table)
- by calculating uncertainties using a logarithmic and/or graphical method on the basis of sources of error and analytical relationships

Write a scientific report following an experimental session
- by justifying the theoretical model of the experiment
- by justifying the experimental approach chosen
- by presenting and analysing the results obtained
- by criticising the results in relation to theoretical expectations and sources of systematic error

CONTENT

Lectures, tutorial classes and practical work in CHEMISTRY 2
To apply the thermodynamic laws to physical heterogeneous systems containing several constituents, main types of binary diagrams concerning the liquid-vapor equilibriums.
To apply the thermodynamic laws to chemical systems: thermo chemistry, qualitative and quantitative laws of equilibriums, application to equilibriums in aqueous media (acid-base, redox, solubility, complexation reaction) and to electrochemical cells.

BIBLIOGRAPHY

- Cours de Chimie-Physique et Exercices résolus de Chimie-Physique : P. Arnaud (Ed. Dunod)
- Thermodynamique Chimique 2ème année PC-PC* : P. Durupthy, C. Mesnil, T. Zobiri, collection H Prépa (Ed. Hachette)
- Thermodynamique Chimique: F. Brenon, C. Busquet, C. Mesnil, Ed. Hachette Supérieur.
- Chimie : Thermodynamique et Cinétique Chimique, Equilibres chimiques en solution, J. Mesplède, Ed. Bréal
- http://chimie.net.free.fr/index2.htm

IDENTIFICATION

CODE : FIMI-2-S1-EC-CP-TF
ECTS : –

HOURS

Cours :	0h
TD :	12h
TP :	56h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	69h
Travail personnel :	25h
Total :	94h

ASSESMENT METHOD

Continuous assessment of knowledge and skills

TEACHING AIDS

1 - Design-prototyping handout
2 - Teaching resources on FIMI's Moodle workspace
3 - Design handout 1A-2A

TEACHING LANGUAGE

French

CONTACT

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AIMS

This EC is part of the Mechanical Systems, Environment and Production (ME) teaching unit.
AAv. 1. 3D modeling of assemblies: Based on specifications and an initial version of a mechanism, design and optimize the 3D modeling of a mechanical assembly, taking into account geometric, functional and assembly constraints, while integrating an eco-responsible approach.
AAv. 2. Understanding manufacturing processes: Know the capabilities, limits and tolerances of the manufacturing processes used, including turning, milling, 3D printing, multi-material laser cutting, steel laser cutting, bending and welding. Know how to adapt the geometry of the parts to be manufactured to the chosen process.
AAv. 3 Making a mechanical system: Make and assemble a mechanical system in the workshop from a 3D digital model, taking into account the constraints and limitations of the chosen processes.
AAv. 4 Programming and implementing a mechatronic system: Develop an Arduino program from a basic algorithm, adapting it to the requirements of the specifications and validating its correct operation on the real system studied.
AAv. 5 Workshop collaboration and safety: Work effectively in a team and independently in a prototyping workshop, applying safety rules, good manufacturing practices and rigorous organization to guarantee a safe and productive working environment.

CONTENT

By enabling the student-engineer to work on and be assessed on the following knowledge :
- safety instructions in a production workshop
- knowledge of one of the following 2 processes for producing traditional parts:
* either material-removal machining (turning, milling, drilling),
* metal construction and deformation processes (rolling, bending, folding, laser cutting) and assembly (gluing, welding, riveting).
- knowledge of various rapid part production processes - agile prototyping:
* additive manufacturing (3D printing)
* multi-material laser cutting processes (wood, acrylic)
- be familiar with agile design concepts and their implementation
- know the characteristics of a communicating control system
- programming logic of an event-driven system
- understand the interaction between production-manufacturing and system design
- the possibilities offered by agile prototyping of a system
- know the concepts of system design on CAD tools

BIBLIOGRAPHY

PRE-REQUISITES

CAD, Technical analysis, Reading and drawing technical drawings, Dimensioning, Materials (1st year Design course).

System Mechanics 1

IDENTIFICATION

CODE : FIMI-2-S1-EC-MS-TF-SH1
ECTS : 3.00

HOURS

Cours :	10h
TD :	21h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	32.5h
Travail personnel :	30h
Total :	62.5h

ASSESMENT METHOD

- 1 Written Tests (WT1 of 1.5 hours)
- 1 Final Test (FT1) of 2 hours.
Average : (WT1*1.5+FT1*2)/3.5

TEACHING AIDS

- Lecture notes and presentations
- Exercises book (the same for all the 2nd year students)
Documents available on Moodle

TEACHING LANGUAGE

French
English

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AIMS

Target Learning Outcomes (AvA):

AAv.1: Identify the characteristics of a mechanical system, schematize it and graphically construct the velocity fields

AAv.2: Model a real mechanical system of bounded complexity including specific static behavior laws (ex: spring, inter-solid contact, belt...)

AAv.3: Perform a complete mechanical balance, establish and solve equilibrium equations (static)

AAv.4: Establish the characteristics of a mechanical system on the basis of established equations and verify the dimensional homogeneity of the results obtained

CONTENT

WRENCH/SCREWS: Introduction and definitions: sliding vectors, system of sliding vectors, vectorial coordinates (sum, moment), scalar invariants, special wrenches/ screws, central axis, Delassus theorem on equiprojectivity.

STATICS: Fundamental principle, notion of isolated system, mechanical actions, wrench of mechanical actions associated with classic joints, analytical statics.

KINEMATICS :
- Location of a free solid, kinematics of particles, frame of reference and frame of expression, kinematics of rigid-solids, kinematic screw, time differentiation of vectors and moving basis formula, acceleration field for rigid solids, fundamental motions.
- Geometry and kinematics of joints, frame and parameter definition for mechanisms, constraint equations, mobility, combination of motions.
- Contact kinematics, sliding, rolling and pitching, kinematic constraint equations, instant motion of solids.

BIBLIOGRAPHY

AGATI Mécanique Industrielle Dunod
BEGHIN Cours de mécanique théorique Gauthier-Villar
BELLET Problème de mécanique Cepadues editions
BERKELEY Cours de Physique 1 Armand Colin
BONCOMPAIN Méca. des Syst. Indus. (T2) Dunod
BROSSARD Mécanique Générale Tech. de l'Ingénieur AF4
BROUSSE Cours de mécanique Collection U
BONE Mécanique Générale (crs et ap.) Dunod U
CAZIN Cours de mécanique générale Gauthier-Villar
ROY Mécanique du solide rigide Dunod
LASSIA Cinématique Ellipse
LASSIA-BARD Dynamique Ellipse

PRE-REQUISITES

- Vectors and Linear algebra
- Mechanical design
- Point mechanics

IDENTIFICATION

CODE : FIMI-2-S1-EC-ETRE-TF-SH2

ECTS : 2

HOURS

Cours :	0h
TD :	8h
TP :	2h
Projet :	14h
Evaluation :	0.016666666666666666h
Face à face pédagogique :	10.016666666666666h
Travail personnel :	25h
Total :	49.016666666666666h

ASSESMENT METHOD

Continuous assessment. Three summative assessments are organised:
- the biodiversity mission will result in a graded group presentation based on a powerpoint presentation.
- the "Et si..." project gives rise to the writing of a graded fiction (in groups), as well as a graded literary presentation. The mark may be individualised.
- An individual written test, at the End of Semester, marks the end of FIMI's ETRE sequence, by examining students on all the skills acquired during the 2 semesters S2 and S3.

TEACHING AIDS

Course materials and exercises.
1st Cycle Moodle platform: all course and planning and organization, links to resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

This teaching sequence, in S3, is the second part of a program that will continue throughout
the studies, with the aim of training engineers who are aware of the challenges of the ecological transition.
In its February 26, 2020 letter of intent, INSA Lyon stated that "the courses in Sustainable
Development and Social Responsibility (SDRS) courses combine the following training objectives :
* in terms of cross-disciplinary skills
* in terms of themes to be addressed: climate change, energy, raw materials resources, and
damage to living organisms and human health.
Two cross-cutting themes are addressed: links between science, technology and society, and
the dynamics of change.

The targeted learning outcomes are thus :
1) Use a multi-disciplinary body of knowledge to provide reasoned, qualitative and quantitative answers to advanced questions on the challenges of ecological transition in relation to resources and living organisms.
2) Associate human actions with their consequences on the planet's habitability, based on planetary limits and the finitude of resources.
3) Illustrate (explain) the systemic nature of socio-ecological issues; integrate the central role of living organisms and the human-nature relationship into the reasoning.
4) Using scientific data and a decentralized approach, imagine, design and present a forward-looking narrative on a given theme of socio-ecological transition.

CONTENT

The students will work on the following knowledge:
- Understand the issues associated with the erosion of biodiversity.
- Understand resource-related issues.
- Realise a synthesis of the 2 semesters of ETRE, through the construction of imaginary worlds and paths towards desirable futures.
The sequence will be structured as follows:
- 2h introduction: remobilisation of knowledge acquired in S2
- 8 hours of project work, involving a mission to assess the quality of the ecosystem of the campus
- 2 hours of cross-disciplinary practical work on copper resources
- and finally, 12 hours of supervised project "Et si...", the deliverables of which (in groups) are a fiction and a literary presentation.
IMPORTANT: the teachers work in pairs on each group of students: 16 hours are taught by the SPI (Sciences Pour l'Ingénieur) teacher, 4 hours by the Human Sciences teacher, and the final presentation of 2 hours is assessed by the 2 teachers.

BIBLIOGRAPHY

General Biodiversity Inventory - Doua Campus
U.S. Geological Survey, Mineral Commodity Summaries, January 2020
Ecotopia - Ernest Callenbach - Gallimard - 2021
(...)

PRE-REQUISITES

S2 curriculum for ETRE (2nd semester of 1st year).
Associated secondary school curricula (2nd, 1st and final year) on sustainable development and social responsibility.
The various 1st year INSA courses (Engineering Sciences and Human Sciences) are called upon more in terms of methods than knowledge.

IDENTIFICATION

CODE : FIMI-2-S1-EC-CSS-FI
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

An individual written assignment and a group assessment.

For example, for the classic audio project, an individual written assignment involving problematisation and assessment of research, and the ability to plan a medium-term project
A group audio project, with listening to the productions, critical feedback and assessment during the final session.

TEACHING AIDS

TEACHING LANGUAGE

French

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AIMS

CT2 - WORK, LEARN, GROW IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a reasoned manner
3.2 - Situate one's original speech using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3. 5 - Manage conflicts, balance individual and collective interests
3.6 - Take part in a group project: build and run a project, develop it; be aware of your role and responsibilities
4. 1 - Develop a creative approach, including artistic
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions...
CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in speech, attitudes and behaviour
7.3 - Putting values, beliefs and behaviour into perspective
7.4 - Integrating cultural diversity into group work

CONTENT

AM/AS/EU programme:
The project consists of the design and production of an 8 minute audio document on a free subject outside the "hard and technical sciences", by an international group of 3 or 4 students.

1) Culture
- sharpen your intellectual curiosity and your openness to the world
- develop a problematic around a freely chosen subject
- know how to carry out in-depth documentary research
- know how to design and then carry out an investigation with several interviews
- learn how to question reality and link knowledge
- analyse and organise a radio discourse
- work in a team on a project lasting several weeks and listen to each other.

2) Mastering audio communication in relation to a thematic issue
- researching the subject; finding witnesses and resource people
- writing research reports, synopses, scripts
- working on sound recording, interviews
- sound processing, meaningful editing
- taking part in a group project in synergy.

Introduction to the software used: Audacity

The programme may be adapted to the specific needs of a given international section.

SCAN programme:
The group project consists of the research and development of a scripted debate around a geopolitical issue of choice tied to a theme common to the class. The group will also be required to furnish an annotated bibliography. The individual project consists of an essay synthesizing the elements from multiple sources: group research, classmate debates, multiple sources furnished by the teacher. The project means to incite intellectual curiosity and openness to the world around a freely chosen subject.

SCAN learning outcomes:
- present multiple complex points of view, cite reasoning and evidence, develop counter arguments to opposing opinions
- carry out in-depth documentary research, evaluate credibility of sources and usefulness of material

BIBLIOGRAPHY

Civilisation - pojects 1

IDENTIFICATION

CODE : FIMI-2-S1-EC-CIP
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- In S3, for the theoretical part, a group presentation on current issues in Latin America
Latin America (50%) and a presentation on the hard and soft skills learned through work with the association (50%).

TEACHING AIDS

TEACHING LANGUAGE

French

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AIMS

Skills
* Targeted
- INSA, Humanities Competency Framework
5. Acting responsibly in a complex world
7. Working in an international and intercultural context.
* Mobilised
- CEFR
- Written and oral comprehension and expression (CEFR)
- INSA, Humanities skills reference framework
3. Interacting with others, working in a team.

CONTENT

This course is designed as a continuation of the 1st year Contemporary Latin American Civilisations course, with two distinct but complementary parts: a theoretical and documentation part (history course, 1 hour per week) and a practical part (four humanitarian projects that students will take part in each year: also 1 hour per week).
The theoretical part will focus on the establishment of the nation-state in Latin America from the 19th century onwards, as an exogenous model (Western and European) imposed by a sector of the population. In S3 we will be looking in particular at the continuities of the colonial past that persist to the present day and are reflected in a socio-economic structure that still retains very strong traces of colonial racism. At the same time, we will also look at the breaks with this colonial past and how there are specific features in this region of the world, particularly with regard to certain vulnerable population groups (women, indigenous communities, LGBT groups, migrants).
In parallel, for the practical part (S3 and S4), students will be in charge of various humanitarian projects and will organise different activities to publicise these associations on campus. They will learn how to manage an association and its treasury, how to deal with other associations and institutions, how to disseminate information and work with social networks, how to create a website, etc.

BIBLIOGRAPHY

- Amérique latine : introduction à l'Extrême-Occident, Alain Rouquié (1987)
- Naissance des nations, Clément Thibaud (2007)
- Race et colonialité du pouvoir, Anibal Quijano (2007)
- Histoire de l'Etat-Nation : de la politique d'intégration en Amérique Latine et en Europe, J. Gonzalez (2010)

PRE-REQUISITES

None.

German language and culture

IDENTIFICATION

CODE : FIMI-2-S1-EC-OPAL
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- Language: continuous assessment + B1 and B2 level tests (internal or Goethe Institut).
- civilisation: continuous assessment + presentations in German on themes related to the project; progress reports on the project
- Audiovisual project: project management

TEACHING AIDS

TEACHING LANGUAGE

French

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AIMS

Humanities reference framework:
CT2 - WORK, LEARN, DEVELOP IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK WITH TEAMS
3. 1 - Communicate appropriately: pass on a message, listen, show empathy, assert one's point of view, debate in a well-argued way

3.2 - Situate one's original discourse using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3.5 - Manage conflicts, balance individual and collective interests
3. 6 - Take part in a group project: build and run a project, develop it; be aware of his/her role and responsibilities
4.1 - Develop a creative approach, including artistic ones
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5. 1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.

CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in discourse, attitudes and behaviour
7.3 - Relativising values, beliefs and behaviour
7.4 - Integrating cultural diversity into group work

CONTENT

- become familiar with the use of the German language as a means of communication
- analyse cultural, political and artistic aspects of German-speaking countries
- learn how to set up and manage a Franco-German project in the field of science and technology or in the social and cultural field
- produce audio-visual reports in German in line with the year's theme
- learn how to present the results to the public (exhibition, round table, etc.).)

Semester 3: Definition and implementation of the project:
Language course: Study of the German language with the aim of acquiring a fluent language and a minimum level of B1 (according to the European reference framework); level B2 targeted. The aim is for the students to communicate with their partners, to conduct interviews and reports in German and to present INSA in German to secondary school pupils.
Civilisation classes: classes are held in German. They focus on German civilisation + exchanges with partners in Germany but also on current political and cultural events. The course is based on cultural activities in the Lyon region (theatre, exhibitions, conferences, etc.) relating to German culture
Audiovisual project: preparation of an audiovisual report: work on audiovisual language, interview techniques, technical aspects, etc.

BIBLIOGRAPHY

- CALLA Cécile, Tour de Franz - Mein Rendezvous mit dem Deutschen, Hamburg: Ullstein 2009,
- CHAPOUTEAU Johann: Histoire de l'Allemagne (1806 à nos jours) Paris : PUF,2014, 128p
- HUGHES Pascale , Marthe et Mathilde, Hamburg :Rowohlt TB, 2010 .
- MEYER Michel , Le roman de l'Allemagne : Ou l'histoire secrète d'une renaissance...; Paris 2013, 344p
- TOURNIER Michel , Le bonheur en Allemagne ?, Paris :Folio 2004,
- de la VAISSIERE Jean-Louis: Qui sont les Allemands ? Préface de Volker Schlöndorff Paris : Max Milo, 2011 384 p.
- WICKERT Ulrich, Frankreich die wunderbare Illusion, München: Heyne, 1998,
- In addition, there is a specific bibliography based on the theme studied during the year

For more information, visit the OPAL option website:
http://leshumas.insa-lyon.fr/langues/allemand/page_allemande/engager/opal/1_opal.html

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

FORMATION INITIALE AUX METIERS D'INGENIEUR

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

European Identities and Cultures

IDENTIFICATION

CODE : FIMI-2-S1-EC-CUID
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

Presentations and reports

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Humanities reference framework:
CT2 - WORK, LEARN, DEVELOP IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK WITH TEAMS
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a reasoned way

3.2 - Situate one's original speech using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3. 5 - Manage conflicts, balance individual and collective interests
3.6 - Take part in a group project: build and run a project, develop it; be aware of your role and responsibilities
4. 1 - Develop a creative approach, including an artistic one
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.

CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in discourse, attitudes and
behaviour
7.3 - Putting values, beliefs and behaviour into perspective
7.4 - Integrating cultural diversity into group work

CONTENT

Examination of the concept of identity and, more specifically, European cultural identity.
- Raising awareness of inter-cultural issues
- Study of European current affairs and in-depth examination of a number of specific issues (immigration, minorities, sovereign debts, etc.)
- Conduct of a collective study and travel project in conjunction with partners in one of the "European cultural capitals"
- Production of video reports in one of the cultural capitals on a variety of subjects (cultural, political, social or other)

Semester 3: Definition and implementation of the project:

Initially, students will examine the very notion of culture.
This awareness-raising work on a personal and concrete scale will serve as a basis for investigating the issues highlighted by the European Capitals of Culture.

Contacts will be established with partners involved in reflection on European issues. Regular exchanges on the issue of cultural identity will be held with them. Information evenings and debates may be organised. A special website or blog will be set up on which work in progress and the results will be posted.

BIBLIOGRAPHY

CARPENTIER Jean, LEBRUN François (directions), Histoire de l'Europe, Paris, Seuil, 1990
CAUTRES Bruno : Les Européens aiment-ils (toujours) l'Europe ? Paris : La Documentation Française, 2014, 214p
ECO Umberto, La Recherche De La Langue Parfaite Dans La Culture Européenne, Paris, Seuil, 1994
KRISTEVA Julia, Europe Des Cultures Et Culture Européenne : Communauté Et Diversité, Paris, Hachette, 2008
MATTEI Jean-François, Le Regard Vide. Essai Sur L'épuisement De La Culture Européenne, Paris, Flammarion, 2007
MAK Geert : Voyage d¿un Européen à travers le XXe siècle Paris : Gallimard, 2004 (éd.frç.:2010), 944p
RODAN Martin, Notre culture européenne, cette inconnue, Bern, Peter Lang, 2009
SAPIRO Gisèle (dir.), L'espace intellectuel en Europe. De la formation des Etats-nations à la mondialisation XIXè-XXIè siècles, Paris, La Découverte, 2009
THIESSE Anne-Marie : la création des identités nationales Paris :Seuil 2001, 212 p
TODD Emmanuel, L'invention de l'Europe, Paris, Seuil, 1990

There is also a specific bibliography based on the countries studied during the year

A regularly updated bibliography can be consulted on the website: http://leshumas.insa-lyon.fr/cuid

PRE-REQUISITES

A good command of English and a knowledge of a non-native 2nd language are desirable.

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20, avenue Albert Einstein - 69621 Villeurbanne cedex - France
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Spanish Language and Civilisation

IDENTIFICATION

CODE : FIMI-2-S1-EC-LCE
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- an oral presentation: arguing for or against a destination, highlighting possible themes, making a financial forecast (20% - individual mark)
- filming plan: themes addressed, problematisation, list of planned interviews, interview script, sources of information, report plan with technical details (voice-over, types of shots, etc.), organisation of filming. (80% - group mark)

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

SKILLS

Targeted
CT4: SHOW CREATIVITY

Mobilised
CT2: WORK, LEARN, DEVELOP IN AN AUTONOMOUS WAY
CT3: INTERACT WITH OTHERS, WORK AS PART OF A TEAM
CT7: WORK IN AN INTERNATIONAL AND CULTURAL CONTEXT

CONTENT

Classes are taught solely in Spanish. The LCE course consists of a language course (see description in the Spanish course offer) and a Spanish Civilisation course during which a video project will be produced during the study trip (5 to 6 days) to Spain.
The audiovisual project that the students will have to produce during their stay in Spain will be done in groups of four. The students will have one year to work on a societal issue that interests them; this issue may be directly linked to the city in which we will be staying or may be broader in scope: the question of independence, gender equality, bullfighting, etc. The video production may be a short documentary or a short film. The video production could be a short documentary or a report on the chosen issue. Part of the report will consist of interviews with specialists in the field (canvassed by the students).
The first semester is devoted to choosing the destination, organising the trip, researching the subject beforehand (problematisation of a subject, researching specialists), an introduction to photography (types of shots, meanings, use of equipment) and preparing a precise shooting plan.

The stay of a few days (in February, at the very beginning of S2) will be devoted to discovering the city and its culture, and several compulsory cultural activities will take place. The students will be given complete autonomy to conduct interviews with specialists as well as strangers, to fuel discussion on the subject.
On their return, the second semester will be devoted to selecting the images, sounds and interviews that will appear in the report, editing it and producing French subtitles (particularly in language classes).

BIBLIOGRAPHY

PRE-REQUISITES

Be enrolled in Spanish in 1st year. At least A2 level, but B1/B2 is strongly recommended for interviews. Selection based on a letter of application in Spanish (from the previous May).

Informatics and numerical society 3

IDENTIFICATION

CODE : FIMI-2-S1-EC-ISN-TF
ECTS : toto

HOURS

Cours :	5h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	37h
Travail personnel :	35h
Total :	72h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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M. Rivano Hervé :
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AIMS

Targeted learning outcomes :

AAv3.1 : At the end of S3, students will be able to write a program manipulating data stored in a list, dictionary or graph, which can be retrieved from a file containing open data.

AAv3.2 : At the end of S3, students are able to design an algorithm solving a problem from data stored in a graph, using and adapting subgraph calculation algorithms.

AAv3.3 : At the end of S3, students are able to integrate the notion of algorithmic complexity into the development of efficient code.

AAv3.4 : At the end of S3, students will be able to design and modify a suitable data structure (dictionary, list, graph, DB) to represent the data described in a specification.

AAv3.5 : At the end of S3, students are able to write an SQL query for a relational database.

CONTENT

1 - Introduction to relational databases :
* Relational model
* SQL query language (selection, projection, join, grouping and calculation functions)
* Introduction to the Entity-Association model and its link with the relational model.

2 - File and dictionary manipulation:
* reading and writing a file with a standard format.
* using a dictionary: accessing, creating, updating and browsing a dictionary.
* data restructuring using dictionaries.

3 - Graphs:
* notion and concepts.
* traversal algorithms (DFS, BFS, Dijkstra) to meet an objective.
* algorithm complexity.

4-Data visualization using supplied Python libraries.

5-Matching algorithms

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-1-S2-EC-ISN-TF

IDENTIFICATION

CODE : FIMI-2-S1-EC-MA-TF
ECTS : 5

HOURS

Cours :	21h
TD :	37.5h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	61.5h
Travail personnel :	70h
Total :	131.5h

ASSESMENT METHOD

Students are evaluated with written tests three times during the semester. The coefficients of the tests are (1.5,2,2.5) and they are set according to the length of the test.

TEACHING AIDS

Moodle

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

AAv3.1 – Determine the nature of improper integrals using comparison tools, and compute their value when possible.
AAv3.2 – Determine the convergence and the limit of sequences, especially those defined by recurrence.
AAv3.3 – Apply Newton's numerical method to approximate solutions of equations, and conduct a mathematical study of the method's convergence.
AAv3.4 – Compute the determinant of a matrix of small dimension, particularly to determine whether a matrix is invertible.
AAv3.5 – Find the eigenvalues and eigenspaces of an endomorphism in order to diagonalize it when possible.
AAv3.6 – Use endomorphism reduction to study and solve linear differential systems.
AAv3.7 – Determine the convergence of a series using standard criteria (comparison, integral test, D'Alembert's ratio test, etc.).

CONTENT

Suites (study of fixed points)
Reduction of endomorphisms
Improper integrals
Numerical series
Differential calculus
Extremum of multivariate functions

BIBLIOGRAPHY

S. Balac et L. Chupin, Analyse et algèbre : cours de mathématiques de deuxième année avec exercices corrigés et illustrations avec Maple, Presses polytechniques et universitaires romandes.
F. Butin, M. Picq, J. Pousin, Mathématiques - Cours, exercices corrigés - 2e année de classes préparatoires intégrées, Collection "Références sciences", Ellipses

PRE-REQUISITES

First year math class

IDENTIFICATION

CODE : FIMI-2-S1-EC-PH-TF
ECTS : 5

HOURS

Cours :	10h
TD :	39.5h
TP :	15h
Projet :	0h
Evaluation :	4.5h
Face à face pédagogique :	69h
Travail personnel :	60h
Total :	129h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals workings.
Multiple-choice questionnaire for autonomous training and self-assessment are available.

English is used only in the SCAN groups (french in all other groups)

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Determine the expression of a vector field as a function of spatial parameters and boundary conditions, from the expression of its law as a partial differential equation, exploiting the symmetries of the sources.
AAv.2 Convert laws and quantities expressed in a local (intensive) formulation into an integral (extensive) formulation and vice versa.
AAv.3 Draw up an energy balance in an electromagnetic system: energy supplied, stored, dissipated.
AAv.4 Identify the different components of an electromagnetic system (resistance, capacitance, inductance) and be able to determine their value when the electric and/or magnetic field is defined in all space.
AAv.5 Determine the action of electromagnetic forces in an electromagnetic or electromechanical system.
AAv.6 Evaluate quantitatively the phenomenon of static or motional induction in a simple electromagnetic or electromechanical system.
AAv.7 Apply the concepts seen in electromagnetism in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write a report.

CONTENT

The third semester of physics is devoted to electromagnetism. A reminder of the mathematical tools necessary to approach electromagnetic field theory is first proposed. Then the following notions are presented: electrostatic field, static charges (capacitor), moving charges (resistance), magnetic field, electromagnetism at interfaces, magnetic energy (inductance), magnetic and electric moments, static and motional induction. Maxwell's equations are revealed and explained as the course progresses. Concrete examples of the application of electromagnetism will be offered, in particular through the study of induction phenomena.

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

This course will use the knowledge and know-how acquired in Mathematical and Numerical Tools for Engineers during the first year (see the corresponding sheets).
All the notions of physics covered in S1 and S2 of the first year will be considered as acquired (including: geometrical optics, dimensions, uncertainties, DC and AC electricity, mechanics, electrical and magnetic forces).

Applications of thermodynamics to physical and chemical systems

IDENTIFICATION

CODE : FIMI-2-S1-EC-CH-TF-SH2
ECTS : 3

HOURS

Cours :	10h
TD :	20h
TP :	15h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	47h
Travail personnel :	30h
Total :	77h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Lecture, tutorial and practical work handouts.
First Cycle Moodle interface: all lecture, tutorial and practical work documents, schedule and organization, exercise corrections, links to internet sites, exam questions and answers in French and in English.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Determine the composition at physical equilibrium liquid/liquid and liquid/vapour of an ideal or non-ideal binary mixture
- by using the law of chemical moments
- by constructing an isobaric diagram of an ideal mixture using Raoult's law
- by interpreting an isobaric diagram of an ideal or non-ideal mixture (with the three cases of total, partial or zero miscibility in the liquid state for the non-ideal mixture).

Determine the evolution towards thermodynamic equilibrium of a multiphase system characterised by one or more chemical equilibria
- by identifying the chemical reaction(s) of interest and the phases of the reactants and products
- by comparing the values obtained for the equilibrium constant K° and the quotient of the reaction Q
- - by determining the system of equations for the chemical reaction(s) of interest. by determining the system of equations which enables the equilibrium state to be defined quantitatively
- by using Le Chatelier's principle to predict the qualitative effect on equilibrium of the parameters influencing the yield of a reaction (T, P, excess reagents, etc.).

Predict the spontaneous or forced nature of an electrochemical (redox) reaction
- by determining the free enthalpy and standard free enthalpy of a redox reaction from the standard potentials of the pairs and Nernst's law
- by describing and justifying the operation of an electrochemical cell: battery and electrolyser

Adapt a simple experimental approach in order to produce reliable experimental measurements
- by drawing on knowledge acquired in the first year and on the body of knowledge in the second year
- by designing an experimental protocol to solve a complex problem
- by identifying and quantifying sources of error and uncertainties

Use experimental measurements to determine the equilibrium composition of a system
- by choosing an appropriate analytical model
- by clearly presenting the measurements or experimental data (e.g. : graph or table)
- by calculating uncertainties using a logarithmic and/or graphical method on the basis of sources of error and analytical relationships

Write a scientific report following an experimental session
- by justifying the theoretical model of the experiment
- by justifying the experimental approach chosen
- by presenting and analysing the results obtained
- by criticising the results in relation to theoretical expectations and sources of systematic error

CONTENT

Lectures, tutorial classes and practical work in CHEMISTRY 2
To apply the thermodynamic laws to physical heterogeneous systems containing several constituents, main types of binary diagrams concerning the liquid-vapor equilibriums.
To apply the thermodynamic laws to chemical systems: thermo chemistry, qualitative and quantitative laws of equilibriums, application to equilibriums in aqueous media (acid-base, redox, solubility, complexation reaction) and to electrochemical cells.

BIBLIOGRAPHY

- Cours de Chimie-Physique et Exercices résolus de Chimie-Physique : P. Arnaud (Ed. Dunod)
- Thermodynamique Chimique 2ème année PC-PC* : P. Durupthy, C. Mesnil, T. Zobiri, collection H Prépa (Ed. Hachette)
- Thermodynamique Chimique: F. Brenon, C. Busquet, C. Mesnil, Ed. Hachette Supérieur.
- Chimie : Thermodynamique et Cinétique Chimique, Equilibres chimiques en solution, J. Mesplède, Ed. Bréal
- http://chimie.net.free.fr/index2.htm

IDENTIFICATION

CODE : FIMI-2-S1-EC-CP-TF
ECTS : –

HOURS

Cours :	0h
TD :	12h
TP :	56h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	69h
Travail personnel :	25h
Total :	94h

ASSESMENT METHOD

Continuous assessment of knowledge and skills

TEACHING AIDS

1 - Design-prototyping handout
2 - Teaching resources on FIMI's Moodle workspace
3 - Design handout 1A-2A

TEACHING LANGUAGE

French

CONTACT

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AIMS

This EC is part of the Mechanical Systems, Environment and Production (ME) teaching unit.
AAv. 1. 3D modeling of assemblies: Based on specifications and an initial version of a mechanism, design and optimize the 3D modeling of a mechanical assembly, taking into account geometric, functional and assembly constraints, while integrating an eco-responsible approach.
AAv. 2. Understanding manufacturing processes: Know the capabilities, limits and tolerances of the manufacturing processes used, including turning, milling, 3D printing, multi-material laser cutting, steel laser cutting, bending and welding. Know how to adapt the geometry of the parts to be manufactured to the chosen process.
AAv. 3 Making a mechanical system: Make and assemble a mechanical system in the workshop from a 3D digital model, taking into account the constraints and limitations of the chosen processes.
AAv. 4 Programming and implementing a mechatronic system: Develop an Arduino program from a basic algorithm, adapting it to the requirements of the specifications and validating its correct operation on the real system studied.
AAv. 5 Workshop collaboration and safety: Work effectively in a team and independently in a prototyping workshop, applying safety rules, good manufacturing practices and rigorous organization to guarantee a safe and productive working environment.

CONTENT

By enabling the student-engineer to work on and be assessed on the following knowledge :
- safety instructions in a production workshop
- knowledge of one of the following 2 processes for producing traditional parts:
* either material-removal machining (turning, milling, drilling),
* metal construction and deformation processes (rolling, bending, folding, laser cutting) and assembly (gluing, welding, riveting).
- knowledge of various rapid part production processes - agile prototyping:
* additive manufacturing (3D printing)
* multi-material laser cutting processes (wood, acrylic)
- be familiar with agile design concepts and their implementation
- know the characteristics of a communicating control system
- programming logic of an event-driven system
- understand the interaction between production-manufacturing and system design
- the possibilities offered by agile prototyping of a system
- know the concepts of system design on CAD tools

BIBLIOGRAPHY

PRE-REQUISITES

CAD, Technical analysis, Reading and drawing technical drawings, Dimensioning, Materials (1st year Design course).

System Mechanics 1

IDENTIFICATION

CODE : FIMI-2-S1-EC-MS-TF-SH1
ECTS : 3.00

HOURS

Cours :	10h
TD :	21h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	32.5h
Travail personnel :	30h
Total :	62.5h

ASSESMENT METHOD

- 1 Written Tests (WT1 of 1.5 hours)
- 1 Final Test (FT1) of 2 hours.
Average : (WT1*1.5+FT1*2)/3.5

TEACHING AIDS

- Lecture notes and presentations
- Exercises book (the same for all the 2nd year students)
Documents available on Moodle

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Target Learning Outcomes (AvA):

AAv.1: Identify the characteristics of a mechanical system, schematize it and graphically construct the velocity fields

AAv.2: Model a real mechanical system of bounded complexity including specific static behavior laws (ex: spring, inter-solid contact, belt...)

AAv.3: Perform a complete mechanical balance, establish and solve equilibrium equations (static)

AAv.4: Establish the characteristics of a mechanical system on the basis of established equations and verify the dimensional homogeneity of the results obtained

CONTENT

WRENCH/SCREWS: Introduction and definitions: sliding vectors, system of sliding vectors, vectorial coordinates (sum, moment), scalar invariants, special wrenches/ screws, central axis, Delassus theorem on equiprojectivity.

STATICS: Fundamental principle, notion of isolated system, mechanical actions, wrench of mechanical actions associated with classic joints, analytical statics.

KINEMATICS :
- Location of a free solid, kinematics of particles, frame of reference and frame of expression, kinematics of rigid-solids, kinematic screw, time differentiation of vectors and moving basis formula, acceleration field for rigid solids, fundamental motions.
- Geometry and kinematics of joints, frame and parameter definition for mechanisms, constraint equations, mobility, combination of motions.
- Contact kinematics, sliding, rolling and pitching, kinematic constraint equations, instant motion of solids.

BIBLIOGRAPHY

AGATI Mécanique Industrielle Dunod
BEGHIN Cours de mécanique théorique Gauthier-Villar
BELLET Problème de mécanique Cepadues editions
BERKELEY Cours de Physique 1 Armand Colin
BONCOMPAIN Méca. des Syst. Indus. (T2) Dunod
BROSSARD Mécanique Générale Tech. de l'Ingénieur AF4
BROUSSE Cours de mécanique Collection U
BONE Mécanique Générale (crs et ap.) Dunod U
CAZIN Cours de mécanique générale Gauthier-Villar
ROY Mécanique du solide rigide Dunod
LASSIA Cinématique Ellipse
LASSIA-BARD Dynamique Ellipse

PRE-REQUISITES

- Vectors and Linear algebra
- Mechanical design
- Point mechanics

IDENTIFICATION

CODE : FIMI-2-S1-EC-ETRE-TF-SH2

ECTS : 2

HOURS

Cours :	0h
TD :	8h
TP :	2h
Projet :	14h
Evaluation :	0.016666666666666666h
Face à face pédagogique :	10.016666666666666h
Travail personnel :	25h
Total :	49.016666666666666h

ASSESMENT METHOD

Continuous assessment. Three summative assessments are organised:
- the biodiversity mission will result in a graded group presentation based on a powerpoint presentation.
- the "Et si..." project gives rise to the writing of a graded fiction (in groups), as well as a graded literary presentation. The mark may be individualised.
- An individual written test, at the End of Semester, marks the end of FIMI's ETRE sequence, by examining students on all the skills acquired during the 2 semesters S2 and S3.

TEACHING AIDS

Course materials and exercises.
1st Cycle Moodle platform: all course and planning and organization, links to resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

This teaching sequence, in S3, is the second part of a program that will continue throughout
the studies, with the aim of training engineers who are aware of the challenges of the ecological transition.
In its February 26, 2020 letter of intent, INSA Lyon stated that "the courses in Sustainable
Development and Social Responsibility (SDRS) courses combine the following training objectives :
* in terms of cross-disciplinary skills
* in terms of themes to be addressed: climate change, energy, raw materials resources, and
damage to living organisms and human health.
Two cross-cutting themes are addressed: links between science, technology and society, and
the dynamics of change.

The targeted learning outcomes are thus :
1) Use a multi-disciplinary body of knowledge to provide reasoned, qualitative and quantitative answers to advanced questions on the challenges of ecological transition in relation to resources and living organisms.
2) Associate human actions with their consequences on the planet's habitability, based on planetary limits and the finitude of resources.
3) Illustrate (explain) the systemic nature of socio-ecological issues; integrate the central role of living organisms and the human-nature relationship into the reasoning.
4) Using scientific data and a decentralized approach, imagine, design and present a forward-looking narrative on a given theme of socio-ecological transition.

CONTENT

The students will work on the following knowledge:
- Understand the issues associated with the erosion of biodiversity.
- Understand resource-related issues.
- Realise a synthesis of the 2 semesters of ETRE, through the construction of imaginary worlds and paths towards desirable futures.
The sequence will be structured as follows:
- 2h introduction: remobilisation of knowledge acquired in S2
- 8 hours of project work, involving a mission to assess the quality of the ecosystem of the campus
- 2 hours of cross-disciplinary practical work on copper resources
- and finally, 12 hours of supervised project "Et si...", the deliverables of which (in groups) are a fiction and a literary presentation.
IMPORTANT: the teachers work in pairs on each group of students: 16 hours are taught by the SPI (Sciences Pour l'Ingénieur) teacher, 4 hours by the Human Sciences teacher, and the final presentation of 2 hours is assessed by the 2 teachers.

BIBLIOGRAPHY

General Biodiversity Inventory - Doua Campus
U.S. Geological Survey, Mineral Commodity Summaries, January 2020
Ecotopia - Ernest Callenbach - Gallimard - 2021
(...)

PRE-REQUISITES

S2 curriculum for ETRE (2nd semester of 1st year).
Associated secondary school curricula (2nd, 1st and final year) on sustainable development and social responsibility.
The various 1st year INSA courses (Engineering Sciences and Human Sciences) are called upon more in terms of methods than knowledge.

IDENTIFICATION

CODE : FIMI-2-S1-EC-CSS-FI
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

An individual written assignment and a group assessment.

For example, for the classic audio project, an individual written assignment involving problematisation and assessment of research, and the ability to plan a medium-term project
A group audio project, with listening to the productions, critical feedback and assessment during the final session.

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

CT2 - WORK, LEARN, GROW IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a reasoned manner
3.2 - Situate one's original speech using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3. 5 - Manage conflicts, balance individual and collective interests
3.6 - Take part in a group project: build and run a project, develop it; be aware of your role and responsibilities
4. 1 - Develop a creative approach, including artistic
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions...
CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in speech, attitudes and behaviour
7.3 - Putting values, beliefs and behaviour into perspective
7.4 - Integrating cultural diversity into group work

CONTENT

AM/AS/EU programme:
The project consists of the design and production of an 8 minute audio document on a free subject outside the "hard and technical sciences", by an international group of 3 or 4 students.

1) Culture
- sharpen your intellectual curiosity and your openness to the world
- develop a problematic around a freely chosen subject
- know how to carry out in-depth documentary research
- know how to design and then carry out an investigation with several interviews
- learn how to question reality and link knowledge
- analyse and organise a radio discourse
- work in a team on a project lasting several weeks and listen to each other.

2) Mastering audio communication in relation to a thematic issue
- researching the subject; finding witnesses and resource people
- writing research reports, synopses, scripts
- working on sound recording, interviews
- sound processing, meaningful editing
- taking part in a group project in synergy.

Introduction to the software used: Audacity

The programme may be adapted to the specific needs of a given international section.

SCAN programme:
The group project consists of the research and development of a scripted debate around a geopolitical issue of choice tied to a theme common to the class. The group will also be required to furnish an annotated bibliography. The individual project consists of an essay synthesizing the elements from multiple sources: group research, classmate debates, multiple sources furnished by the teacher. The project means to incite intellectual curiosity and openness to the world around a freely chosen subject.

SCAN learning outcomes:
- present multiple complex points of view, cite reasoning and evidence, develop counter arguments to opposing opinions
- carry out in-depth documentary research, evaluate credibility of sources and usefulness of material

BIBLIOGRAPHY

IDENTIFICATION

CODE : FIMI-2-S1-EC-TH-SH1
ECTS : 2

HOURS

Cours :	7h
TD :	19h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	27.5h
Travail personnel :	20h
Total :	47.5h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Lesson and exercise handouts
- Moodle Internet interface (course supplements and examination papers with answer keys)

TEACHING LANGUAGE

French

CONTACT

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M. Kuhni Manuel :
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M. Garnier Vincent :
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AIMS

Apply the general methods of thermodynamics in simple situations
- By using the appropriate vocabulary (system, transformation, isotherm, etc.)
- By applying the first and second principles to typical transformations of closed systems, using the concepts of reversibility, heat, work and state function (internal energy, enthalpy, entropy, free enthalpy, etc.)

Establish the properties of a pure substance using :
- the temperature and pressure of a gas, and the perfect gas model for a single gas or a mixture of gases;
- the boiling temperature of a pure substance, its saturation vapour pressure and its heat capacity according to its physical state;
- Clapeyron's relation with the quantities associated with changes of state and making the relevant simplification assumptions
- the particularities of the (P,V) and (P,T) diagrams for typical transformations.

Describe and analyse a simple thermal machine:
- By using (definitions of) motor or receiver cycles,
- By using a cycle of transformations represented on a (P,V) diagram
- By calculating the coefficient of performance in the case of ideal and real operation

Analyse a chemical reaction:
- Identify the parameters of the standard state of reaction, the product formation reactions and the heat of reaction
- Use Hess's law to calculate the standard reaction quantities (internal energy, enthalpy and entropy)
- Use the principle of adiabatic calorimetry to determine a heat of reaction, a heat capacity and a flame temperature (put in all the expected values), by applying a material balance and a heat balance.

CONTENT

The engineering student will work and will be evaluated on the following knowledge:
- Gaseous state
- System characterization and evolution
- The different forms of energy
- The first law: application to the transformations of an ideal gas and to thermo chemistry
- The second law as an evolution criterion
- Theoretical uses of the two laws to homogeneous physical systems. Thermodynamic coefficients.
- The two laws applied specifically to gases.

BIBLIOGRAPHY

P. ARNAUD, Cours de Chimie Physique, Eds Dunod
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique PC, Eds Bréal
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique Prépas MP SI PC SI, Eds Bréal
P. GRECIAS, Exercices et problèmes de Thermodynamique Physique, 2ème édition, Collection de sciences physiques, Eds Lavoisier Tec et Doc
H Prépa, Thermodynamique 2ème année MP-MP* PT-PT*, Eds Hachette Supérieur (Chapitre 1 pour le corps pur)
P. BONNET, Cours de Thermodynamique ; Eds Ellipses
J. P. PEREZ, Thermodynamique. Fondements et Applications. Eds
M. HULIN, N. HULIN, M. VEYSSIE. Thermodynamique. Eds Dunod

PRE-REQUISITES

-Several variable functions, differentials, partial derivatives (Math-Physics interdisciplinary teaching)
-Mastery of units
-General high school chemistry, physics and mechanics knowledge.

IDENTIFICATION

CODE : FIMI-2-S1-EC-PH-SH1
ECTS : 4

HOURS

Cours :	12h
TD :	40h
TP :	8h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	63h
Travail personnel :	55h
Total :	118h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical exams.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Make a circuit from a diagram and vice versa, and model a 1st order continuous or transient electrical circuit.
AAv.2 Determine currents, voltages and energy quantities in a 1st order continuous or transient circuit from the characteristics of the components.
AAv.3 Apply the concepts seen in DC/transient electricity in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis.
AAv.4 Determine the expression of a vector field as a function of spatial parameters and boundary conditions, from the expression of its law as a partial differential equation, exploiting the symmetries of the sources.
AAv.5 Convert laws and quantities expressed in a local (intensive) formulation into an integral (extensive) formulation and vice versa.
AAv.6 Draw up an energy balance in an electromagnetic system: energy supplied, stored, dissipated.
AAv.7 Identify the different components of an electromagnetic system (resistance, capacitance, inductance) and be able to determine their value when the electric and/or magnetic field is defined in all space.

CONTENT

- Electricity in continuous and transient regimes
- Electomagnetism: Maxwell's equations, electrostatic field, static charges (capacitor), moving charges (resistance), magnetic field, electromagnetism at interfaces, magnetic energy (inductance)

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors¿), statistics (average and standard deviation), data and functions plots.
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.
All the physics concepts covered in S1 and S2 will be considered as acquired.

Informatics and numerical society 3

IDENTIFICATION

CODE : FIMI-2-S1-EC-ISN-SH1
ECTS : toto - comme a dit Sophie

HOURS

Cours :	3h
TD :	23h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	28h
Travail personnel :	25h
Total :	53h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French

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AIMS

Targeted learning outcomes :

AAv2.1 : At the end of semester, students will be able to follow a simple development method using functional decomposition, including a test plan.

AAv2.2 : At the end of semester, students are able to use iterative and recursive programming on simple cases.

AAv2.3 : At the end of semester students will be able to develop a small team project in Python based on given specifications.

AAv2.4 : At the end of semester, students will be able to describe the general operation of a computer network, particularly in the case of loading a Web page.

CONTENT

- Modular programming
- Dictionnaries
- Files
- Networks 101

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-1-S2-EC-ISN-SH

IDENTIFICATION

CODE : FIMI-2-S1-EC-MA-SH1
ECTS : 5

HOURS

Cours :	22h
TD :	41h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	66h
Travail personnel :	65h
Total :	131h

ASSESMENT METHOD

The evaluation consists:
- Two written tests (IE1, IE2) 1:30 each coefficient 1/4
- A written interrogation 3:00 (IE3) coefficient 1/2

TEACHING AIDS

lecture notes

TEACHING LANGUAGE

French

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AIMS

Most of the first semester is devoted to the study of linear algebra, in which the students will handle some more abstract mathematical objects than what they had encountered so far.

This EC appears in the Unité d'Enseignement Sciences Pures. It contributes to the following abilities in
Engeneer School :
C1 - analyse a system or issue
C2 - Exploit a Real or Virtual system Model
C6 - Communicate an analysis, a scientific path, in an argued and ogical discussion
In this frame, the student will work and be tested on the following abilities
C111 - To split up a problem or a system into its component parts in interaction
C14 - To build a scheme of the system or the problem
C15 - To identify problematics or objectives
C16 - To build a proof.
C21 - To compute by graphical resolution an exact or approximate solution
C23 - To estimate errors induced by the model implementation
C54 - To interpret some results.

CONTENT

Linear algebra : vector spaces, subspaces, bases, dimension, linear mappings, matrices, determinants, diagonalization.

BIBLIOGRAPHY

E. Azoulay et J. Avignant : Mathématiques II. Analyse, IV. Algèbre, V. Géométrie (McGraw-Hill)
D. Guinin, F. Aubonnet, B. Joppin : Précis de Mathématiques, tome 4 : Analyse 2 (Bréal)
P. Thuillier et J.C. Belloc : Mathématiques, Algèbre (Masson)

PRE-REQUISITES

1st year Mathematics

System Mechanics 1

IDENTIFICATION

CODE : FIMI-2-S1-EC-MS-TF-SH1
ECTS : 3.00

HOURS

Cours :	10h
TD :	21h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	32.5h
Travail personnel :	30h
Total :	62.5h

ASSESMENT METHOD

- 1 Written Tests (WT1 of 1.5 hours)
- 1 Final Test (FT1) of 2 hours.
Average : (WT1*1.5+FT1*2)/3.5

TEACHING AIDS

- Lecture notes and presentations
- Exercises book (the same for all the 2nd year students)
Documents available on Moodle

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Target Learning Outcomes (AvA):

AAv.1: Identify the characteristics of a mechanical system, schematize it and graphically construct the velocity fields

AAv.2: Model a real mechanical system of bounded complexity including specific static behavior laws (ex: spring, inter-solid contact, belt...)

AAv.3: Perform a complete mechanical balance, establish and solve equilibrium equations (static)

AAv.4: Establish the characteristics of a mechanical system on the basis of established equations and verify the dimensional homogeneity of the results obtained

CONTENT

WRENCH/SCREWS: Introduction and definitions: sliding vectors, system of sliding vectors, vectorial coordinates (sum, moment), scalar invariants, special wrenches/ screws, central axis, Delassus theorem on equiprojectivity.

STATICS: Fundamental principle, notion of isolated system, mechanical actions, wrench of mechanical actions associated with classic joints, analytical statics.

KINEMATICS :
- Location of a free solid, kinematics of particles, frame of reference and frame of expression, kinematics of rigid-solids, kinematic screw, time differentiation of vectors and moving basis formula, acceleration field for rigid solids, fundamental motions.
- Geometry and kinematics of joints, frame and parameter definition for mechanisms, constraint equations, mobility, combination of motions.
- Contact kinematics, sliding, rolling and pitching, kinematic constraint equations, instant motion of solids.

BIBLIOGRAPHY

AGATI Mécanique Industrielle Dunod
BEGHIN Cours de mécanique théorique Gauthier-Villar
BELLET Problème de mécanique Cepadues editions
BERKELEY Cours de Physique 1 Armand Colin
BONCOMPAIN Méca. des Syst. Indus. (T2) Dunod
BROSSARD Mécanique Générale Tech. de l'Ingénieur AF4
BROUSSE Cours de mécanique Collection U
BONE Mécanique Générale (crs et ap.) Dunod U
CAZIN Cours de mécanique générale Gauthier-Villar
ROY Mécanique du solide rigide Dunod
LASSIA Cinématique Ellipse
LASSIA-BARD Dynamique Ellipse

PRE-REQUISITES

- Vectors and Linear algebra
- Mechanical design
- Point mechanics

IDENTIFICATION

CODE : FIMI-2-S1-EC-CP-SH1
ECTS : –

HOURS

Cours :	0h
TD :	12h
TP :	28h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	41h
Travail personnel :	17h
Total :	58h

ASSESMENT METHOD

Continuous assessment of knowledge and skills

TEACHING AIDS

1 - Design - prototyping handout
2 - Teaching resources on FIMI's Moodle workspace
3 - Design handout 1A-2A

TEACHING LANGUAGE

French

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AIMS

This EC is part of the Mechanical Systems, Environment and Production (ME) teaching unit.
AAv. 1. 3D modeling of assemblies: Based on specifications and an initial version of a mechanism, design and optimize the 3D modeling of a mechanical assembly, taking into account geometric, functional and assembly constraints, while integrating an eco-responsible approach.
AAv. 4 Programming and implementing a mechatronic system: Develop an Arduino program from a basic algorithm, adapting it to the requirements of the specifications and validating its correct operation on the real system studied.

CONTENT

By enabling the student-engineer to work on and be assessed on the following knowledge :
- knowledge of various rapid part production processes - agile prototyping :
* additive manufacturing (3D printing)
* multi-material laser cutting processes (wood, acrylic)
- knowledge of agile design concepts and their implementation
- know the characteristics of a communicating control system
- programming logic of an event-driven system
- understand the possibilities offered by agile prototyping of a system
- know the concepts of system design on CAD tools

BIBLIOGRAPHY

PRE-REQUISITES

Drawing module, CAD, Technical analysis, Reading and drawing technical drawings, Dimensioning, Materials (1st year Design course).

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I4-TF-SH2

ECTS : *

HOURS

Cours :	45h
TD :	31h
TP :	16h
Projet :	71h
Evaluation :	5h
Face à face pédagogique :	97h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

Lecture notes, course slides, problem sets with solutions.

TEACHING LANGUAGE

French

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AIMS

Currently being finalized, see program below.
Eventually:
List of P2i Learning Outcomes (common and specific)

CONTENT

1. Humanities and Social Sciences Project: Study of a technical system.
2. Project: Design and fabrication of a solar thermal energy recovery system.
3. Introduction to fuel sources.
4. Historical perspectives on energy and energy transition pathways.
5. Performance of energy conversion systems.
6. Mechanical design for renewable energies.

BIBLIOGRAPHY

PRE-REQUISITES

Knowledges and courses from semester 1 of the second year

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I3-TF-SH2

ECTS : undefined

HOURS

Cours :	16h
TD :	70h
TP :	32h
Projet :	70h
Evaluation :	8h
Face à face pédagogique :	126h
Travail personnel :	100h
Total :	296h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Poly, slideshows, tutorials, online answer keys... all the content is available on Moodle.

TEACHING LANGUAGE

French

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AIMS

Propose and design a mechanical system that responds critically to an expressed need, while taking into account the requirements of the system's life cycle, particularly with regard to environmental impact, the societal context of its use, manufacturing requirements and economic constraints.

Situate their design approach within the more general framework of a low-tech approach, the philosophical and practical foundations of which will be illustrated by examples of products/services

Relate their engineering choices to the needs of societal transformation, in particular by characterising the low-tech approach as a lever for action, with its scope and limits, for an economy that is compatible with planetary limits and socially just.

Choose an appropriate production process, taking into account its impact on geometry, choice of material and compatibility with the function

Implement the chosen process, with or without the help of a specialist depending on the degree of complexity identified, adapting the degree of autonomy and choosing a methodology that guarantees the safety of people and the integrity of the means of production.

Analyse a contemporary low-tech issue by means of a collective investigation leading to the writing of a popular science article.

Within a project group, identify and allocate tasks in such a way as to encourage involvement, autonomy and initiative on the part of each member, as well as communication and the quality of exchanges, arguments and collective choices.

Identify key words to find bibliographical sources related to a problem or a project theme, choose and explain the criteria for evaluating documents in terms of reliability, relevance and scientificity and develop an argument for the documents chosen, reference bibliographical sources in a written or oral production.

CONTENT

Knowledge of families of materials and applications to the choice of materials for mechanical design

Strength of materials, dimensioning using beam theory, buckling, basics of finite element modelling and associated applications

Simulation of mechanical behaviour

Lifecycle analysis, methodology and application, creation of environmental data in the case of a forming process

Statistical tools for quality management: linear regression, data manipulation, probabilities, application to measurements

Production management: typology of production systems, management of technical data, type of layout, load-capacity balance of a production system, stock management and planning tools.

Documentary research method

Agile manufacturing: numerically controlled machining (lathe and milling machine), multi-material and metal laser cutting, sheet metal forming by folding, rolling, mechanically welded and mechanically assembled construction.

Exploring the low-tech approach as a means of engineering a profound social and ecological transformation. Training in the popularisation of scientific discourse

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

FORMATION INITIALE AUX METIERS D'INGENIEUR

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Innovation by mechatronics and robotics Course

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I6-TF-SH2

ECTS : undefined

HOURS

Cours :	20h
TD :	67h
TP :	8h
Projet :	72h
Evaluation :	1h
Face à face pédagogique :	96h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

Continuous assessment
Servoing: 1 individual evaluation, 3 sessions over 5 sessions.
Perception / Action: 1 group assessment, TP report on 4h.
Programming & Communication: 1 assessment in situation by binomial, 1 written individual assessment
Design: 1 individual evaluation, CAD rendering, for the duration of the sessions.
Project : 1 individual evaluation throughout the duration of the sessions, 1 individual evaluation by the pairs, 1 group assessment during the Sciences Fair.
Documentary research: 1 individual assessment in writing
Humanities: 1 individual assessment in writing, having to write outside the niches., 1 written group assessment, article to be made.

TEACHING AIDS

LMS Moodle

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized, see program below.
The students will design a prototype using mechatronics and robotics. The project theme is common to all groups and is chosen each year, it addresses the whole field of possibilities of robotics. The chosen theme should: enable a realization at the level of what students can do, allow to find a multitude of solutions, question the role of robotics in society, link the P2I to the real world with a shared project with " clients, "finding a place in the daily life of a young
humanist student.
The creations are made from a functional specification. Each group composed of a dozen students will start the project with a search for solutions with ideation sessions (brainstorming, TRIZ, 6 hats, mental map). The selected solutions are the subject of a mechanical design study with 3D modeling, mechanical simulation, multiphysical modeling, Lego model, validation experiments ...
The prototypes are made by the students in 3 workshops according to the needs: machining, metal construction, additive manufacturing.
The electronics of the prototypes are 80% commercial cards: arduino, power cards, axis servo, video recognition ... Some cards are designed and manufactured by students for specific needs: Lego / electronic interfaces, sound controls...
The control of the prototypes is done in several layers: a real-time layer on a microcontroller and a remote layer for the HMI on PC (Java) or tablet / tel (Android).
Wired communications use serial or I2C protocols, wireless communications use WIFI in UDP or TCP.

CONTENT

Project 78h
Servoing 16h
Programmation & Communication 26h
Sensors /Actuators 12h
Energy 2h
Humanities 30h
Documentary Research 4h

BIBLIOGRAPHY

PRE-REQUISITES

S1, S2 and S3 Mechanical design
S3 Manufacturing
S3 Mechatronics

Bio-based materials, engineering and the environment

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I1-TF-SH2

ECTS : 10

HOURS

Cours :	44h
TD :	86h
TP :	50h
Projet :	10h
Evaluation :	8h
Face à face pédagogique :	188h
Travail personnel :	100h
Total :	298h

ASSESMENT METHOD

1 one-hour individual test per module (including practical work) of core courses.

Individual practical assessment.

Collective writing of an Humanity article.

Documentary and Humanity research (common report with two separate parts) collectively.

Poster or intermediate defense. Project presentation (Poster...) collectively.

Final defense collectively.

Collective evaluations are carried out in groups of 4 to 8 students.

TEACHING AIDS

Lectures
Tutorial
Practical work
Project

TEACHING LANGUAGE

French

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AIMS

Face to environmental issues related to the problems of resource management and protection of our ecosystems, future engineers must be aware of the need to develop new sustainable technologies in the service of man and his environment. This course is suited to sensitize
students to the great challenges of the future related to the environment, energy and resources that specifically address Bioengineering for the production, treatment and recovery in the areas of energy, pollution control ecosystems, bio-based polymer materials and biodegradable.
The purpose of the course part is to introduce some concepts of ecology, biotechnology, polymer materials and process engineering such as 3D printing, to prepare the practicle party that should allow
students to develop projects around a common theme.

CONTENT

Ecology and Environmental Sciences: basics of ecology, environmental issues, methods and tools for sustainable management anthroposystems.
Chemical reaction engineering and process engineering: analytics, chemical kinetics, and enzymology management processes.
Biotechnology DNA Microorganisms, genomes, and gene regulation, DNA biotechnology and synthetic biology databases.
Polymers and bio-based materials: organic chemistry, polymerization, structures and properties of bio-based polymer materials, lifecycle and environment.
Modeling: growth models (EDO), chemostat model (dynamic systems), fitting a model of Michaelis-Menten (inferential statistics).
Humanities and social sciences: innovation process, design, users and sustainable development issues; ethical, imaginary representations.
A cycle of 4 rotating practicles are provided for all students suited to learn the biotechnology, enzymology, modeling and study of polymer materials, whatever the project theme they choose.

BIBLIOGRAPHY

Massardier V, Belhaneche-Bensemra N, Lazaric N (2023) Editorial: Alternative building blocks and new recycling routes for polymers: Challenges for circular economy and triggers for innovations. Front Mater DOI: 10: 1152494.

Sandei B, Massardier V and Brunel R (2022), Alternative building blocks sources for poly (ethylene terephthalate): A short review with socio-economical points of view. Front. Mater. 9:1005770. DOI: 10.3389/fmats.2022.1005770

Léa Barbault, Olivier Brette, Nathalie Lazaric, Valérie Massardier and Valérie Revest (2023), Bio-based Plastics: a 'Sustainable' Alternative for the Plastic Industry; Int J Environ Sci Nat Res 31(5): IJESNR.MS.ID.556325 (2023) DOI: 10.19080/IJESNR.2023.31.556325 https://juniperpublishers.com/ijesnr/

A review to guide eco-design of reactive polymer based materials, Emma Delamarche, Valérie Massardier*, Remy Bayard, and Edson Dos Santos, dans Reactive and Functional Polymers Volume Three, Advanced materials, Editors: Gutierrez, Tomy (Ed.), Octobre 2020. https://www.springer.com/gp/book/9783030504564#aboutBook

Chapter "Recyclable and bio-based materials open up new prospects for polymers : Scientific and social aspects" dans le livre « Environmental impact of polymers ». Ed. Th Hamaide, R. Deterre, JF Feller, Wiley, DOI: 10.1002/9781118827116.ch12 Lavoisier-Hermès, 2014.

Chapter Oil-based and bio-derived thermoplastic polymer blends and composites, in Introduction to Renewable Biomaterials: First Principle and Concepts, A.Quitadamo, V. Massardier, M. Valente, A.S. Ayoub, L.A. Lucia Editeurs Wiley: 2017, pp 239-268.

Chapter "Contribution of reactive extrusion to technological and scientific challenges to eco-friendly circular economy", in "Biomass Extrusion and Reaction Technologies: New Insights, Future Potential, and Principles to Practices",, V. Massardier, A.Quitadamo; A.S. Ayoub, L.A. Lucia Editeurs, ACS, 2018.

PRE-REQUISITES

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I5-TF-SH2

ECTS : undefined

HOURS

Cours :	20h
TD :	40h
TP :	30h
Projet :	90h
Evaluation :	8h
Face à face pédagogique :	98h
Travail personnel :	100h
Total :	288h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Course materials available on moodle.
For the project: numerous resources available on moodle: specifications, instructions, tutorials for software and measurements, etc.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalised, see programme below.

CONTENT

The ultimate objective of this P2i is to learn how to transcribe a health, sports, art, everyday life or work situation (performance, well-being, pathology, etc.) into a problem where engineering can make a contribution in terms of analysis, understanding, solution, improvement or optimisation.
* Project (80h)
* Specific courses for the project:
Anatomy/Mechanics (18h)
Strength of Materials (18h)
Applied Mathematics (12h)
SHS (8h + project)
Literature survey (6h)
Life Sciences (6h)
Imaging (6h)
Physical and Sport Education (4 hrs)
Biomaterials (4 hrs)
External contributors (6h)

BIBLIOGRAPHY

PRE-REQUISITES

Knowledge and skills from FIMI courses, in particular Mathematics, Physics and Systems Mechanics.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I2-TF-SH2

ECTS : -

HOURS

Cours :	12h
TD :	56h
TP :	2h
Projet :	98h
Evaluation :	8h
Face à face pédagogique :	78h
Travail personnel :	100h
Total :	276h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Visual course materials (PowerPoint / PDF)
- Exercise handouts
- Practical work handouts
- Physics and chemistry lab equipment
- Project and prototyping materials
- Computer workstations equipped with necessary software

Documents available on Moodle

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized, see program below

CONTENT

Project Technical Phases:

1) From Physical Phenomenon to Signal: Study and implementation of physical sensors to measure a signal.
2) From Signal to Sensor Data: Development of appropriate electronic acquisition chains (Op-Amps, filters, ADC).
3) Sensor Data Transmission: Programming Arduino modules to create a wireless sensor network (radio transmission, network protocol).
4) Sensor Data Management: Creation of an SQL database and Java programming to import sensor data in real-time.
5) From Sensor Data to Information: Statistical analysis and data mining of the collected data.
6) Finalization: Final integration and testing of the infrastructure.

The project starts in the 2nd week with a half-day session per week and continues with full sessions during the last 4 weeks.
A project demonstration concludes the P2I.

M1: Physical Sensors & Electronic Acquisition Chains
a) General principles of physical sensors
b) Operation of different sensor families
- Environmental sensors (temperature, pH)
- Mechanical strain sensors (force, pressure, deformation)
- Magnetic sensors (motion, orientation)
c) Functions, analysis, and design of an electronic acquisition chain
d) Current technologies and future challenges

M2: Sensor Data Analysis
a) Introduction to signal processing
b) Descriptive statistics
c) Data visualization
d) Introduction to data mining

M3: Telecommunications Networks & Databases for Sensors
a) Principles of networks
b) Introduction to wireless networks
c) Architecture of sensor databases
d) Data querying and multidimensional aspects

M4: SHES Reflections on Data
a) Innovation & society, the role of the user
b) Major societal issues: "Big Data", "Open Data", "Quantified Self", privacy
c) Conferences: business, public institutions

BIBLIOGRAPHY

PRE-REQUISITES

This program is based on the knowledge and skills taught within the FIMI department at INSA Lyon, which will be supplemented or deepened through the modules and applied to the project:

Physics / Chemistry
- Electrokinetics and Electronics Concepts (Physics 1A)
- Electromagnetism (Physics 1A & 2A)
- Thermodynamics (Thermo 1A)

Mathematics
- Probability / Statistics (Maths in High School)
- Vector Spaces (Maths 1A)
- Distances (Maths 2A)

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I8-TF-SH2

ECTS : undefined

HOURS

Cours :	2h
TD :	78h
TP :	24h
Projet :	78h
Evaluation :	8h
Face à face pédagogique :	112h
Travail personnel :	100h
Total :	290h

ASSESMENT METHOD

Continuous assessment
For all the science teaching modules (mathematics, scientific computing, signal processing, physics), a global assessment of 4h will be carried out as written exam.
For the project, each team will have to develop an image analysis program with Python accompanied by a written report.
The evaluation of the project will also be done through an oral defense .
An activity dedicated to the sustainable development and the social responsibility will lead to a specific evaluation.

TEACHING AIDS

For educational modules, brackets will be specific to each subject.
The teaching modules are designed to provide all the necessary knowledge to the project, representing about half of the hours of the course.
The project will be half in computer room and in an experimental room combining different imaging modalities (X-rays, visible, MRI, ultrasound).
Project Description: analysis and automatic extraction of important information stored in an image/a signal whose acquisition/detection has been optimized.
Steps: understanding the imaging method, analysis of influential parameters to optimize image quality, development of automatic treatment programs adapted to signals and images. Reflection on science-technical-society aspects of the project.

TEACHING LANGUAGE

French

CONTACT

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AIMS

In progress

This course is dedicated to the field of medical imaging (eg, ultrasound, radiology, MRI), and Industrial imaging (non- destructive testing and material characterization).
How to verify that an airplane wing contains no crack? how to detect broken glass in a baby food jar? how to verify the presence of all the components on an electronic board? how to detect cancerous tumors? controlling the growth of a fetus? evaluate the impact of treatment on bone microstructure, measuring the velocity of blood in the arteries ... all these issues are being solved (or partly) through waves (elastic, electromagnetic, corpuscular ...) that interact with matter. Analysis of signals or images resulting from the reception of these waves allows then to extract the desired information on the bushing material.
The objective of this course is to understand the main physical methods of image acquisition, and to give the signal processing bases necessary for their acquisition, optimization, and analysis.
This is a highly interdisciplinary course that combines aspects such as "physics and mathematics", "signal and image processing" and "technology and software" for the vision systems in medical or industrial imaging.

CONTENT

Name and Description of modules:
M1: Physics bases of imaging methods (infra-red and visible imaging, ultrasound sonography, X rays-matter interaction , electron microscopy).
M2: Bases and deepening mathematics (complex Fourier series, Fourier transform, functions of several variables).
M3: Signal Processing Basics (continuous and discrete signals and linear systems convolution, sampling, Fourier transform, direct and frequency domains, frequency analysis, filtering).
M4: Introduction to python and numerical computation.
M5: Waves and Science-Technology-Society: reflection on the waves and health, beneficial / harmful aspects of the same phenomenon ... Study of the ethical, social and cultural aspects of the project.
3 practical courses (TP) will be carried out where both physics experiments and digital processing with Python will be used together. Topics: filtering with an RLC circuit, production and synthesis of a musical signal, analog (optical) and digital filtering of an image.

BIBLIOGRAPHY

PRE-REQUISITES

Prerequisite , deepening :
-use and deepening of general knowledge on mechanical and electromagnetic waves ;
-use of complexes , integration of functions of a real variable , serial concept ;
-deepening of the notions of algorithms and data structures in the field of signal and image processing ;
-articulation with the teachings of Cultures, Science, Societies.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I7-TF-SH2

ECTS : undefined

HOURS

Cours :	22h
TD :	57h
TP :	0h
Projet :	88h
Evaluation :	1h
Face à face pédagogique :	80h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

- a written MCQ test (2 hours) on all theoretical and practical modules
- three mini-projects in the form of reports
- a final Engineering Sciences project in the form of a report, defense and evaluation of other students
- a project in the Humanities and Social Sciences, including the writing of an article and the development of the ability to take a step back, particularly when defending a thesis
- a bibliographical report

TEACHING AIDS

All course documents (pdf of courses, python programs, pdf of project subjects, MCQs, etc.) are available in Moodle: https://moodle.insa-lyon.fr/enrol/index.php?id=2562

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized. Please see the program below

CONTENT

- The course will start with 3 modules “from physical phenomena to modeling” in the form of CM and TD: “Particle Dynamics”, “Non-Linear Mechanics” and “Thermal Flows and Transfers”.
- In parallel, 2 Numerical Methods modules will be taught.
- Students will then apply their newly acquired skills in 3 mini-projects associated with the 3 previous modules.
- Finally, they will carry out a final project in groups of 3 to 5 to explore one of the issues raised in the modules, in relation to the world of engineering.
- At the same time, each project group will conduct a human and social science survey to identify the STS (science, technology and society) issues raised by the engineering project.
- Equations and simulations will be solved using the Python language.

BIBLIOGRAPHY

Calcul différentielle et équations différentielle - Dunod - Science Sup (2021)

PRE-REQUISITES

FIMI undergraduate courses: solid dynamics, mathematics, Python programming, thermodynamics....

IDENTIFICATION

CODE : FIMI-2-S2-EC-MA-SH2
ECTS : 3

HOURS

Cours :	7h
TD :	13h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	21.5h
Travail personnel :	30h
Total :	51.5h

ASSESMENT METHOD

The evaluation includes 2 written interrogations of 2 hours

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Following the second semester (S2 SHN0) course, the study of differential calculus will be extended to the second order. Some examples of analytical solving of PDEs will be given.
Extreme values for multivariate functions and the local study of implicit surfaces will also be introduced.

This course will enable the student to develop the following skills :
C11 - To split up a problem or a system into its component parts in interaction
C15 - To identify problematics or objectives
C16 - To build a proof
C25 - To use algebraic and numerical computational techniques.
C54 - To interprate data in the context of a model
C55 - To synthesize intermediate results in response to questioning.
C62 - To be able to speak with a satisfying level of langage aiming at a good balance between a usual and
symbolic langage

CONTENT

Differential Calculus (Differentiability, PDEs, extreme values, implicit function theorem, implicit surfaces)

BIBLIOGRAPHY

- F. Butin, M. Picq, J. Pousin, Mathématiques ¿ cours, exercices corrigés ¿ 2e année de classes préparatoires
itnégrées, Références sciences, Ellipses, Paris, 2013
- S. Balac, L.Chupin, Analyse et Algèbre : cours de mathématiques de deuxième année avec exercices
corrigés et illustrations Maple, PPUR presses polytechniques, 2008

PRE-REQUISITES

Mathematical course of first and second years

Informatics and numerical society

IDENTIFICATION

CODE : FIMI-2-S2-EC-ISN-SH2
ECTS : undefined

HOURS

Cours :	3h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	24h
Travail personnel :	15h
Total :	39h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Targeted learning outcomes :

AAv4.1 : At the end of semester, students will be able to use object-oriented and event-driven deve-lopment paradigms in Python, in particular by creating graphical user interfaces.

AAv4.2 : At the end of semester, students will be able to design and develop, as part of a team, a complex modular Python program to meet a set of specifications they have defined.

AAv4.4 : At the end of semester, students have acquired, through their work in sessions and inde-pendently, the general digital culture skills enabling them to take the Pix certification with an average level of 4.

CONTENT

- POO
- GUI
- Project

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-2-S1-EC-ISN-SH2

IDENTIFICATION

CODE : FIMI-2-S2-EC-PH-SH2
ECTS : 3

HOURS

Cours :	3h
TD :	6.5h
TP :	18.5h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	30h
Total :	59.5h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and reports on practicals.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

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AIMS

Targeted learning outcomes (TLA) :
AAv.1 Determine the expression of the intensity in the case of two-wave interference and predict the interference pattern and use simple interferometric devices to measure physical quantities.
AAv.2 Apply the concepts seen on waves in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, conduct a critical analysis, write a report.

CONTENT

Interference: interference conditions, two-source interference, specificity of light waves

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors), statistics (average and standard deviation), data and functions plots.
This teaching will also use the mathematical tools and skills that will be learnt all along the first year.

System Mechanics 2

IDENTIFICATION

CODE : FIMI-2-S2-EC-MS-TF-SH1
ECTS : 2.00

HOURS

Cours :	7h
TD :	21h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	30h
Total :	59.5h

ASSESMENT METHOD

- 1 Written Test (WT2) of 1.5 hour
- 1 Final Test (FT2) of 2.5 hours.
Average : (WT2*1.5+FT2*2.5)/4

TEACHING AIDS

- lecture notes and presentations
- exercices book (the same for all the 2nd year students)
Documents available on Moodle

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Target Learning Outcomes (AvA):

Aav.1 - Model a real mechanical system of bounded complexity including the specific dynamic behavior laws (ex: shock absorber, motor, intersolid contact...)

Aav.2 - Perform the complete energy balance of the mechanical system, then establish the mechanical equations associated with this balance and verify the dimensional homogeneity of the results obtained

Aav.3 - Perform a complete mechanical balance of the mechanical system, then optimize this balance for the establishment of equations of motion of this system

Aav.4 - Establish the characteristics of the operation of a mechanical system based on the equations established and verify the dimensional homogeneity of the results obtained

CONTENT

MASS GEOMETRY : Notion of mass, center of mass and center of inertia of a solid, operator of inertia, moments and products of inertia, Huygens theorem, principal and central frames of inertia, balancing.

KINETICS: Kinetic, dynamic screws and kinetic energy for one isolated solid, for a set of solids.

DYNAMICS: Fundamental principle of Dynamics and General Theorems (vectorial form), classification of Galilean (Newtonian or Inertial) frames depending on the studied phenomena. Force wrench transferred by joints taking into account friction, Coulombs friction (sum and moment), viscous dissipation, rheology of some usual mechanical components, and mechanical actions by actuators. Selection of the sub-system(s) to be isolated depending on the simulation objective(s): equations of motion and/or mechanical actions. Position of equilibrium, stationary positions and, for systems with a single degree-of mobility, linearized equation of motion and stability. First order equations, power, work, kinetic energy theorem, force and potential, first order equations derived from kinetic energy

BIBLIOGRAPHY

AGATI Mécanique Industrielle Dunod
BEGHIN Cours de mécanique théorique Gauthier-Villar
BELLET Problème de mécanique Cepadues editions
BERKELEY Cours de Physique 1 Armand Colin
BONCOMPAIN Méca. des Syst. Indus. (T2) Dunod
BROSSARD Mécanique Générale Tech. de l'Ingénieur AF4
BROUSSE Cours de mécanique Collection U
BONE Mécanique Générale (crs et ap.) Dunod U
CAZIN Cours de mécanique générale Gauthier-Villar
ROY Mécanique du solide rigide Dunod
LASSIA Cinématique Ellipse
LASSIA-BARD Dynamique Ellipse

PRE-REQUISITES

- System mechanics 1
- Vectors and Linear algebra
- Ordinary Differential Equations
- Mechanical design.

IDENTIFICATION

CODE : FIMI-2-S2-EC-PH-TF
ECTS : 4

HOURS

Cours :	7h
TD :	33.5h
TP :	16.5h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	59h
Travail personnel :	50h
Total :	109h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical reports.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Establish the propagation equations verified by the quantities characterising a wave, from which deduce the specific impedance.
AAv.2 Deduce the expression and fully characterise a wave propagating in an unlimited and limited medium with or without dissipation.
AAv.3 Express the transported power and identify the experimental conditions for its measurement.
AAv.4 Determine the expression of the intensity in the case of two-wave interference and predict the interference pattern and use simple interferometric devices to measure physical quantities.
AAv.5 Apply the concepts seen on waves in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, conduct a critical analysis, write a report.

CONTENT

The fourth semester is entirely devoted to the propagation of waves. It contains three chapters. The first chapter concerns the propagation of waves in unlimited media with a first part on mechanical waves and a second part on electromagnetic waves (introduction, propagation equation, impedance, power transported). The second chapter deals with propagation in limited media with the notions of reflection and transmission coefficients, superposition of incident and reflected waves. The last chapter deals with interferences (interference conditions, two-source interference, specificity of light waves).

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

This course will also use the mathematical tools and skills that will be learnt all along the first year, and of course the physics curriculum of the first 3 semesters (dimensions, uncertainties, electricity, mechanics, electromagnetism).

IDENTIFICATION

CODE : FIMI-2-S2-EC-STA-TF
ECTS : *

HOURS

Cours :	0h
TD :	0h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	0h
Travail personnel :	25h
Total :	25h

ASSESMENT METHOD

The internship report will be assessed by a lecturing engineer, in charge of monitoring a group in 1A and 2A (in 2A, 1A groups are reformed).

TEACHING AIDS

Two guides will be distributed (in pdf, available on Moodle):
- a guide to finding an internship, in November 1A
- a guide to writing an internship report, in April 1A, with a grading scale.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

This is the first concrete experience of working in a company for INSA Lyon students.
This internship lasts a minimum of 4 weeks and is carried out by students at the end of their 1st year.
It meets a number of key objectives:
- Experience working as part of a team (live the daily life of operators, measure the repetitive nature and arduousness of their tasks).
- Discover, observe and understand corporate life and human relations.
- Observe and study the work environment.

The skills developed revolve around the following points:
- Observe the immediate environment (workstation, team and workshop operations). workshop operations).
- Discovering mechanisms and organizations (technical, social, structural) through exchanges with those involved and by researching authorized and validated documents within the company.
- Gather different points of view, confirm or refute certain assertions.
- Know how to change initial preconceptions.
- Listen to employees to guide your thinking on management perspectives.

CONTENT

- Internship period: during the summer (from the last week of June to July 31), between 1st and 2nd year at INSA Lyon.
- Duration: minimum 4 weeks, explicitly specified in the internship agreement.
- Conditions: teamwork.
- Contractualization: this internship is the subject of an internship agreement signed by INSA Lyon, the host organization and the intern, setting out the commitments and responsibilities of INSA Lyon, the host organization and the student, and specifying the intern's activity during the internship period. Experience in the form of an employment contract (CDD) is also accepted.
- The internship is the subject of an internship report, which is graded by an INSA engineer. This engineer follows a group of students with two presentations in 1A (before the internship) and two in 2A (after the internship). The first is an account of the professions involved, with an approach to the business world, while the second focuses on the internship, respect for the environment, rules and regulations, attitudes to adopt and behavior. The 1st year groups are reformed in the 2nd year for a debriefing session in September/October, and a session to hand in the corrected and graded internship reports in February.

BIBLIOGRAPHY

PRE-REQUISITES

No particular prerequisites for this course.

IDENTIFICATION

CODE : FIMI-2-S2-EC-CSS-FC
ECTS : 2

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- Intermediate assessment: in groups of 2 or 3 students, presentation on a social topic
- Final assessment: individual, short story-style written work of 9,000 characters related to the theme chosen for the presentation.

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Humanities framework:
CT2 - WORK, LEARN, EVOLVE IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on one's own, seeking out the necessary resources
2.4 - Exercise one's critical faculties, think for oneself
CT3 - INTERACT WITH OTHERS, WORK WITH TEAMS
3. 1 - Communicate appropriately: convey a message, listen, show empathy, assert one's point of view, debate in a reasoned manner
3.2 - Situate one's original discourse with explicit references
3.3 - Communicate non-verbally: posture and gestures
CT4 - SHOW CREATIVITY, INNOVATE, ENTREPRENEURE
4. 1 - Develop a creative approach, including artistic ones
4.2 - Mobilize skills and knowledge from various fields to produce an original creation
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5. 1 - Understand the complex issues (in business and society) facing engineers: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.
5.2 - Integrate a responsible dimension (deontology, ethics) into their actions; identify, evaluate and anticipate the consequences of their actions and decisions at different levels of scale.

CONTENT

Around societal themes:
- Analysis of written and iconographic documents
- Methodical training in the production of organized, coherent written texts; writing workshops leading to the writing of an argumentative short story
- Use of oral and written communication.

BIBLIOGRAPHY

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.

PRE-REQUISITES

Ability to organize, synthesize and problematize in writing and orally. Methods acquired in previous semesters.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I4-TF-SH2

ECTS : *

HOURS

Cours :	45h
TD :	31h
TP :	16h
Projet :	71h
Evaluation :	5h
Face à face pédagogique :	97h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

Lecture notes, course slides, problem sets with solutions.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized, see program below.
Eventually:
List of P2i Learning Outcomes (common and specific)

CONTENT

1. Humanities and Social Sciences Project: Study of a technical system.
2. Project: Design and fabrication of a solar thermal energy recovery system.
3. Introduction to fuel sources.
4. Historical perspectives on energy and energy transition pathways.
5. Performance of energy conversion systems.
6. Mechanical design for renewable energies.

BIBLIOGRAPHY

PRE-REQUISITES

Knowledges and courses from semester 1 of the second year

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I3-TF-SH2

ECTS : undefined

HOURS

Cours :	16h
TD :	70h
TP :	32h
Projet :	70h
Evaluation :	8h
Face à face pédagogique :	126h
Travail personnel :	100h
Total :	296h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Poly, slideshows, tutorials, online answer keys... all the content is available on Moodle.

TEACHING LANGUAGE

French

CONTACT

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M. LE GUENNIC Thomas : thomas.le-guennic@insa-lyon.fr

AIMS

Propose and design a mechanical system that responds critically to an expressed need, while taking into account the requirements of the system's life cycle, particularly with regard to environmental impact, the societal context of its use, manufacturing requirements and economic constraints.

Situate their design approach within the more general framework of a low-tech approach, the philosophical and practical foundations of which will be illustrated by examples of products/services

Relate their engineering choices to the needs of societal transformation, in particular by characterising the low-tech approach as a lever for action, with its scope and limits, for an economy that is compatible with planetary limits and socially just.

Choose an appropriate production process, taking into account its impact on geometry, choice of material and compatibility with the function

Implement the chosen process, with or without the help of a specialist depending on the degree of complexity identified, adapting the degree of autonomy and choosing a methodology that guarantees the safety of people and the integrity of the means of production.

Analyse a contemporary low-tech issue by means of a collective investigation leading to the writing of a popular science article.

Within a project group, identify and allocate tasks in such a way as to encourage involvement, autonomy and initiative on the part of each member, as well as communication and the quality of exchanges, arguments and collective choices.

Identify key words to find bibliographical sources related to a problem or a project theme, choose and explain the criteria for evaluating documents in terms of reliability, relevance and scientificity and develop an argument for the documents chosen, reference bibliographical sources in a written or oral production.

CONTENT

Knowledge of families of materials and applications to the choice of materials for mechanical design

Strength of materials, dimensioning using beam theory, buckling, basics of finite element modelling and associated applications

Simulation of mechanical behaviour

Lifecycle analysis, methodology and application, creation of environmental data in the case of a forming process

Statistical tools for quality management: linear regression, data manipulation, probabilities, application to measurements

Production management: typology of production systems, management of technical data, type of layout, load-capacity balance of a production system, stock management and planning tools.

Documentary research method

Agile manufacturing: numerically controlled machining (lathe and milling machine), multi-material and metal laser cutting, sheet metal forming by folding, rolling, mechanically welded and mechanically assembled construction.

Exploring the low-tech approach as a means of engineering a profound social and ecological transformation. Training in the popularisation of scientific discourse

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

FORMATION INITIALE AUX METIERS D'INGENIEUR

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Innovation by mechatronics and robotics Course

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I6-TF-SH2

ECTS : undefined

HOURS

Cours :	20h
TD :	67h
TP :	8h
Projet :	72h
Evaluation :	1h
Face à face pédagogique :	96h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

Continuous assessment
Servoing: 1 individual evaluation, 3 sessions over 5 sessions.
Perception / Action: 1 group assessment, TP report on 4h.
Programming & Communication: 1 assessment in situation by binomial, 1 written individual assessment
Design: 1 individual evaluation, CAD rendering, for the duration of the sessions.
Project : 1 individual evaluation throughout the duration of the sessions, 1 individual evaluation by the pairs, 1 group assessment during the Sciences Fair.
Documentary research: 1 individual assessment in writing
Humanities: 1 individual assessment in writing, having to write outside the niches., 1 written group assessment, article to be made.

TEACHING AIDS

LMS Moodle

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized, see program below.
The students will design a prototype using mechatronics and robotics. The project theme is common to all groups and is chosen each year, it addresses the whole field of possibilities of robotics. The chosen theme should: enable a realization at the level of what students can do, allow to find a multitude of solutions, question the role of robotics in society, link the P2I to the real world with a shared project with " clients, "finding a place in the daily life of a young
humanist student.
The creations are made from a functional specification. Each group composed of a dozen students will start the project with a search for solutions with ideation sessions (brainstorming, TRIZ, 6 hats, mental map). The selected solutions are the subject of a mechanical design study with 3D modeling, mechanical simulation, multiphysical modeling, Lego model, validation experiments ...
The prototypes are made by the students in 3 workshops according to the needs: machining, metal construction, additive manufacturing.
The electronics of the prototypes are 80% commercial cards: arduino, power cards, axis servo, video recognition ... Some cards are designed and manufactured by students for specific needs: Lego / electronic interfaces, sound controls...
The control of the prototypes is done in several layers: a real-time layer on a microcontroller and a remote layer for the HMI on PC (Java) or tablet / tel (Android).
Wired communications use serial or I2C protocols, wireless communications use WIFI in UDP or TCP.

CONTENT

Project 78h
Servoing 16h
Programmation & Communication 26h
Sensors /Actuators 12h
Energy 2h
Humanities 30h
Documentary Research 4h

BIBLIOGRAPHY

PRE-REQUISITES

S1, S2 and S3 Mechanical design
S3 Manufacturing
S3 Mechatronics

Bio-based materials, engineering and the environment

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I1-TF-SH2

ECTS : 10

HOURS

Cours :	44h
TD :	86h
TP :	50h
Projet :	10h
Evaluation :	8h
Face à face pédagogique :	188h
Travail personnel :	100h
Total :	298h

ASSESMENT METHOD

1 one-hour individual test per module (including practical work) of core courses.

Individual practical assessment.

Collective writing of an Humanity article.

Documentary and Humanity research (common report with two separate parts) collectively.

Poster or intermediate defense. Project presentation (Poster...) collectively.

Final defense collectively.

Collective evaluations are carried out in groups of 4 to 8 students.

TEACHING AIDS

Lectures
Tutorial
Practical work
Project

TEACHING LANGUAGE

French

CONTACT

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AIMS

Face to environmental issues related to the problems of resource management and protection of our ecosystems, future engineers must be aware of the need to develop new sustainable technologies in the service of man and his environment. This course is suited to sensitize
students to the great challenges of the future related to the environment, energy and resources that specifically address Bioengineering for the production, treatment and recovery in the areas of energy, pollution control ecosystems, bio-based polymer materials and biodegradable.
The purpose of the course part is to introduce some concepts of ecology, biotechnology, polymer materials and process engineering such as 3D printing, to prepare the practicle party that should allow
students to develop projects around a common theme.

CONTENT

Ecology and Environmental Sciences: basics of ecology, environmental issues, methods and tools for sustainable management anthroposystems.
Chemical reaction engineering and process engineering: analytics, chemical kinetics, and enzymology management processes.
Biotechnology DNA Microorganisms, genomes, and gene regulation, DNA biotechnology and synthetic biology databases.
Polymers and bio-based materials: organic chemistry, polymerization, structures and properties of bio-based polymer materials, lifecycle and environment.
Modeling: growth models (EDO), chemostat model (dynamic systems), fitting a model of Michaelis-Menten (inferential statistics).
Humanities and social sciences: innovation process, design, users and sustainable development issues; ethical, imaginary representations.
A cycle of 4 rotating practicles are provided for all students suited to learn the biotechnology, enzymology, modeling and study of polymer materials, whatever the project theme they choose.

BIBLIOGRAPHY

Massardier V, Belhaneche-Bensemra N, Lazaric N (2023) Editorial: Alternative building blocks and new recycling routes for polymers: Challenges for circular economy and triggers for innovations. Front Mater DOI: 10: 1152494.

Sandei B, Massardier V and Brunel R (2022), Alternative building blocks sources for poly (ethylene terephthalate): A short review with socio-economical points of view. Front. Mater. 9:1005770. DOI: 10.3389/fmats.2022.1005770

Léa Barbault, Olivier Brette, Nathalie Lazaric, Valérie Massardier and Valérie Revest (2023), Bio-based Plastics: a 'Sustainable' Alternative for the Plastic Industry; Int J Environ Sci Nat Res 31(5): IJESNR.MS.ID.556325 (2023) DOI: 10.19080/IJESNR.2023.31.556325 https://juniperpublishers.com/ijesnr/

A review to guide eco-design of reactive polymer based materials, Emma Delamarche, Valérie Massardier*, Remy Bayard, and Edson Dos Santos, dans Reactive and Functional Polymers Volume Three, Advanced materials, Editors: Gutierrez, Tomy (Ed.), Octobre 2020. https://www.springer.com/gp/book/9783030504564#aboutBook

Chapter "Recyclable and bio-based materials open up new prospects for polymers : Scientific and social aspects" dans le livre « Environmental impact of polymers ». Ed. Th Hamaide, R. Deterre, JF Feller, Wiley, DOI: 10.1002/9781118827116.ch12 Lavoisier-Hermès, 2014.

Chapter Oil-based and bio-derived thermoplastic polymer blends and composites, in Introduction to Renewable Biomaterials: First Principle and Concepts, A.Quitadamo, V. Massardier, M. Valente, A.S. Ayoub, L.A. Lucia Editeurs Wiley: 2017, pp 239-268.

Chapter "Contribution of reactive extrusion to technological and scientific challenges to eco-friendly circular economy", in "Biomass Extrusion and Reaction Technologies: New Insights, Future Potential, and Principles to Practices",, V. Massardier, A.Quitadamo; A.S. Ayoub, L.A. Lucia Editeurs, ACS, 2018.

PRE-REQUISITES

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I5-TF-SH2

ECTS : undefined

HOURS

Cours :	20h
TD :	40h
TP :	30h
Projet :	90h
Evaluation :	8h
Face à face pédagogique :	98h
Travail personnel :	100h
Total :	288h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Course materials available on moodle.
For the project: numerous resources available on moodle: specifications, instructions, tutorials for software and measurements, etc.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalised, see programme below.

CONTENT

The ultimate objective of this P2i is to learn how to transcribe a health, sports, art, everyday life or work situation (performance, well-being, pathology, etc.) into a problem where engineering can make a contribution in terms of analysis, understanding, solution, improvement or optimisation.
* Project (80h)
* Specific courses for the project:
Anatomy/Mechanics (18h)
Strength of Materials (18h)
Applied Mathematics (12h)
SHS (8h + project)
Literature survey (6h)
Life Sciences (6h)
Imaging (6h)
Physical and Sport Education (4 hrs)
Biomaterials (4 hrs)
External contributors (6h)

BIBLIOGRAPHY

PRE-REQUISITES

Knowledge and skills from FIMI courses, in particular Mathematics, Physics and Systems Mechanics.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I2-TF-SH2

ECTS : -

HOURS

Cours :	12h
TD :	56h
TP :	2h
Projet :	98h
Evaluation :	8h
Face à face pédagogique :	78h
Travail personnel :	100h
Total :	276h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Visual course materials (PowerPoint / PDF)
- Exercise handouts
- Practical work handouts
- Physics and chemistry lab equipment
- Project and prototyping materials
- Computer workstations equipped with necessary software

Documents available on Moodle

TEACHING LANGUAGE

French

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AIMS

Currently being finalized, see program below

CONTENT

Project Technical Phases:

1) From Physical Phenomenon to Signal: Study and implementation of physical sensors to measure a signal.
2) From Signal to Sensor Data: Development of appropriate electronic acquisition chains (Op-Amps, filters, ADC).
3) Sensor Data Transmission: Programming Arduino modules to create a wireless sensor network (radio transmission, network protocol).
4) Sensor Data Management: Creation of an SQL database and Java programming to import sensor data in real-time.
5) From Sensor Data to Information: Statistical analysis and data mining of the collected data.
6) Finalization: Final integration and testing of the infrastructure.

The project starts in the 2nd week with a half-day session per week and continues with full sessions during the last 4 weeks.
A project demonstration concludes the P2I.

M1: Physical Sensors & Electronic Acquisition Chains
a) General principles of physical sensors
b) Operation of different sensor families
- Environmental sensors (temperature, pH)
- Mechanical strain sensors (force, pressure, deformation)
- Magnetic sensors (motion, orientation)
c) Functions, analysis, and design of an electronic acquisition chain
d) Current technologies and future challenges

M2: Sensor Data Analysis
a) Introduction to signal processing
b) Descriptive statistics
c) Data visualization
d) Introduction to data mining

M3: Telecommunications Networks & Databases for Sensors
a) Principles of networks
b) Introduction to wireless networks
c) Architecture of sensor databases
d) Data querying and multidimensional aspects

M4: SHES Reflections on Data
a) Innovation & society, the role of the user
b) Major societal issues: "Big Data", "Open Data", "Quantified Self", privacy
c) Conferences: business, public institutions

BIBLIOGRAPHY

PRE-REQUISITES

This program is based on the knowledge and skills taught within the FIMI department at INSA Lyon, which will be supplemented or deepened through the modules and applied to the project:

Physics / Chemistry
- Electrokinetics and Electronics Concepts (Physics 1A)
- Electromagnetism (Physics 1A & 2A)
- Thermodynamics (Thermo 1A)

Mathematics
- Probability / Statistics (Maths in High School)
- Vector Spaces (Maths 1A)
- Distances (Maths 2A)

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I8-TF-SH2

ECTS : undefined

HOURS

Cours :	2h
TD :	78h
TP :	24h
Projet :	78h
Evaluation :	8h
Face à face pédagogique :	112h
Travail personnel :	100h
Total :	290h

ASSESMENT METHOD

Continuous assessment
For all the science teaching modules (mathematics, scientific computing, signal processing, physics), a global assessment of 4h will be carried out as written exam.
For the project, each team will have to develop an image analysis program with Python accompanied by a written report.
The evaluation of the project will also be done through an oral defense .
An activity dedicated to the sustainable development and the social responsibility will lead to a specific evaluation.

TEACHING AIDS

For educational modules, brackets will be specific to each subject.
The teaching modules are designed to provide all the necessary knowledge to the project, representing about half of the hours of the course.
The project will be half in computer room and in an experimental room combining different imaging modalities (X-rays, visible, MRI, ultrasound).
Project Description: analysis and automatic extraction of important information stored in an image/a signal whose acquisition/detection has been optimized.
Steps: understanding the imaging method, analysis of influential parameters to optimize image quality, development of automatic treatment programs adapted to signals and images. Reflection on science-technical-society aspects of the project.

TEACHING LANGUAGE

French

CONTACT

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AIMS

In progress

This course is dedicated to the field of medical imaging (eg, ultrasound, radiology, MRI), and Industrial imaging (non- destructive testing and material characterization).
How to verify that an airplane wing contains no crack? how to detect broken glass in a baby food jar? how to verify the presence of all the components on an electronic board? how to detect cancerous tumors? controlling the growth of a fetus? evaluate the impact of treatment on bone microstructure, measuring the velocity of blood in the arteries ... all these issues are being solved (or partly) through waves (elastic, electromagnetic, corpuscular ...) that interact with matter. Analysis of signals or images resulting from the reception of these waves allows then to extract the desired information on the bushing material.
The objective of this course is to understand the main physical methods of image acquisition, and to give the signal processing bases necessary for their acquisition, optimization, and analysis.
This is a highly interdisciplinary course that combines aspects such as "physics and mathematics", "signal and image processing" and "technology and software" for the vision systems in medical or industrial imaging.

CONTENT

Name and Description of modules:
M1: Physics bases of imaging methods (infra-red and visible imaging, ultrasound sonography, X rays-matter interaction , electron microscopy).
M2: Bases and deepening mathematics (complex Fourier series, Fourier transform, functions of several variables).
M3: Signal Processing Basics (continuous and discrete signals and linear systems convolution, sampling, Fourier transform, direct and frequency domains, frequency analysis, filtering).
M4: Introduction to python and numerical computation.
M5: Waves and Science-Technology-Society: reflection on the waves and health, beneficial / harmful aspects of the same phenomenon ... Study of the ethical, social and cultural aspects of the project.
3 practical courses (TP) will be carried out where both physics experiments and digital processing with Python will be used together. Topics: filtering with an RLC circuit, production and synthesis of a musical signal, analog (optical) and digital filtering of an image.

BIBLIOGRAPHY

PRE-REQUISITES

Prerequisite , deepening :
-use and deepening of general knowledge on mechanical and electromagnetic waves ;
-use of complexes , integration of functions of a real variable , serial concept ;
-deepening of the notions of algorithms and data structures in the field of signal and image processing ;
-articulation with the teachings of Cultures, Science, Societies.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I7-TF-SH2

ECTS : undefined

HOURS

Cours :	22h
TD :	57h
TP :	0h
Projet :	88h
Evaluation :	1h
Face à face pédagogique :	80h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

- a written MCQ test (2 hours) on all theoretical and practical modules
- three mini-projects in the form of reports
- a final Engineering Sciences project in the form of a report, defense and evaluation of other students
- a project in the Humanities and Social Sciences, including the writing of an article and the development of the ability to take a step back, particularly when defending a thesis
- a bibliographical report

TEACHING AIDS

All course documents (pdf of courses, python programs, pdf of project subjects, MCQs, etc.) are available in Moodle: https://moodle.insa-lyon.fr/enrol/index.php?id=2562

TEACHING LANGUAGE

French

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AIMS

Currently being finalized. Please see the program below

CONTENT

- The course will start with 3 modules “from physical phenomena to modeling” in the form of CM and TD: “Particle Dynamics”, “Non-Linear Mechanics” and “Thermal Flows and Transfers”.
- In parallel, 2 Numerical Methods modules will be taught.
- Students will then apply their newly acquired skills in 3 mini-projects associated with the 3 previous modules.
- Finally, they will carry out a final project in groups of 3 to 5 to explore one of the issues raised in the modules, in relation to the world of engineering.
- At the same time, each project group will conduct a human and social science survey to identify the STS (science, technology and society) issues raised by the engineering project.
- Equations and simulations will be solved using the Python language.

BIBLIOGRAPHY

Calcul différentielle et équations différentielle - Dunod - Science Sup (2021)

PRE-REQUISITES

FIMI undergraduate courses: solid dynamics, mathematics, Python programming, thermodynamics....

IDENTIFICATION

CODE : FIMI-2-S2-EC-MA-TF
ECTS : 5

HOURS

Cours :	19.5h
TD :	35h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	56.5h
Travail personnel :	80h
Total :	136.5h

ASSESMENT METHOD

The evaluation includes 2 written interrogations of 2 hours

TEACHING AIDS

Moodle

TEACHING LANGUAGE

French
English

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AIMS

AAv4.1 – Determine the power series expansion of a given function.
AAv4.2 – Use power series to solve a linear differential equation with polynomial coefficients.
AAv4.3 – Determine the quadratic form associated with a bilinear form, and vice versa.
AAv4.4 – Perform the reduction and diagonalization of a quadratic form.
AAv4.5 – Determine the orthogonal complement of a vector subspace and compute an orthonormal basis with respect to a given inner product.
AAv4.6 – Use the notion of projection to solve certain optimization problems involving an inner product.
AAv4.7 – Study the continuity of a multivariable function and compute directional derivatives when they exist.
AAv4.8 – Use the differential and the Hessian to compute the second-order Taylor expansion (DL2) of a multivariable function, especially to study the nature of critical points.

CONTENT

Power series (2)
Bilinear algebra
Differential Calculus 2 (extreme values, implicit function theorem, implicit surfaces)

BIBLIOGRAPHY

(1) Analyse et algèbre : cours de mathématiques de deuxième année avec exercices corrigés et illustrations avec Maple, Stéphane Balac et Laurent Chupin , Presses polytechniques et universitaires romandes.
(2) F. Butin, M. Picq et J. Pousin : Mathématiques, cours et exercices corrigés - 2ème année de classes préparatoires (Ellipse) 2013.

PRE-REQUISITES

Mathematics Syllabus for PC-S3-MA-AEMP

Informatics and numerical society 4

IDENTIFICATION

CODE : FIMI-2-S2-EC-ISN-TF
ECTS : toto

HOURS

Cours :	4h
TD :	27.5h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	33h
Travail personnel :	20h
Total :	53h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes :

AAv4.1 : At the end of S4, students will be able to use object-oriented and event-driven deve-lopment paradigms in Python, in particular by creating graphical user interfaces.

AAv4.2 : At the end of S4, students will be able to design and develop, as part of a team, a complex modular Python program to meet a set of specifications they have defined.

AAv4.3 : At the end of S4, students will be able to identify the economic, social, political and imaginary issues involved in using a specific digital technology in a real-life situation.

AAv4.4 : At the end of S4, students have acquired, through their work in sessions and inde-pendently, the general digital culture skills enabling them to take the Pix certification with an average level of 4.

CONTENT

1 - Object-oriented programming

2 - Matching algorithms, algorithmic properties and social issues

3 - Development of graphical user interfaces

4 - Project (in groups of four): definition of a mini-specification, analysis and definition of a solution, use of third-party libraries, identification of an algorithmic problem, realization in Python.

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-2-S1-EC-ISN

System Mechanics 2

IDENTIFICATION

CODE : FIMI-2-S2-EC-MS-TF-SH1
ECTS : 2.00

HOURS

Cours :	7h
TD :	21h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	30h
Total :	59.5h

ASSESMENT METHOD

- 1 Written Test (WT2) of 1.5 hour
- 1 Final Test (FT2) of 2.5 hours.
Average : (WT2*1.5+FT2*2.5)/4

TEACHING AIDS

- lecture notes and presentations
- exercices book (the same for all the 2nd year students)
Documents available on Moodle

TEACHING LANGUAGE

French
English

CONTACT

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M. Saulot Aurélien :
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AIMS

Target Learning Outcomes (AvA):

Aav.1 - Model a real mechanical system of bounded complexity including the specific dynamic behavior laws (ex: shock absorber, motor, intersolid contact...)

Aav.2 - Perform the complete energy balance of the mechanical system, then establish the mechanical equations associated with this balance and verify the dimensional homogeneity of the results obtained

Aav.3 - Perform a complete mechanical balance of the mechanical system, then optimize this balance for the establishment of equations of motion of this system

Aav.4 - Establish the characteristics of the operation of a mechanical system based on the equations established and verify the dimensional homogeneity of the results obtained

CONTENT

MASS GEOMETRY : Notion of mass, center of mass and center of inertia of a solid, operator of inertia, moments and products of inertia, Huygens theorem, principal and central frames of inertia, balancing.

KINETICS: Kinetic, dynamic screws and kinetic energy for one isolated solid, for a set of solids.

DYNAMICS: Fundamental principle of Dynamics and General Theorems (vectorial form), classification of Galilean (Newtonian or Inertial) frames depending on the studied phenomena. Force wrench transferred by joints taking into account friction, Coulombs friction (sum and moment), viscous dissipation, rheology of some usual mechanical components, and mechanical actions by actuators. Selection of the sub-system(s) to be isolated depending on the simulation objective(s): equations of motion and/or mechanical actions. Position of equilibrium, stationary positions and, for systems with a single degree-of mobility, linearized equation of motion and stability. First order equations, power, work, kinetic energy theorem, force and potential, first order equations derived from kinetic energy

BIBLIOGRAPHY

AGATI Mécanique Industrielle Dunod
BEGHIN Cours de mécanique théorique Gauthier-Villar
BELLET Problème de mécanique Cepadues editions
BERKELEY Cours de Physique 1 Armand Colin
BONCOMPAIN Méca. des Syst. Indus. (T2) Dunod
BROSSARD Mécanique Générale Tech. de l'Ingénieur AF4
BROUSSE Cours de mécanique Collection U
BONE Mécanique Générale (crs et ap.) Dunod U
CAZIN Cours de mécanique générale Gauthier-Villar
ROY Mécanique du solide rigide Dunod
LASSIA Cinématique Ellipse
LASSIA-BARD Dynamique Ellipse

PRE-REQUISITES

- System mechanics 1
- Vectors and Linear algebra
- Ordinary Differential Equations
- Mechanical design.

IDENTIFICATION

CODE : FIMI-2-S2-EC-PH-TF
ECTS : 4

HOURS

Cours :	7h
TD :	33.5h
TP :	16.5h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	59h
Travail personnel :	50h
Total :	109h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical reports.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Establish the propagation equations verified by the quantities characterising a wave, from which deduce the specific impedance.
AAv.2 Deduce the expression and fully characterise a wave propagating in an unlimited and limited medium with or without dissipation.
AAv.3 Express the transported power and identify the experimental conditions for its measurement.
AAv.4 Determine the expression of the intensity in the case of two-wave interference and predict the interference pattern and use simple interferometric devices to measure physical quantities.
AAv.5 Apply the concepts seen on waves in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, conduct a critical analysis, write a report.

CONTENT

The fourth semester is entirely devoted to the propagation of waves. It contains three chapters. The first chapter concerns the propagation of waves in unlimited media with a first part on mechanical waves and a second part on electromagnetic waves (introduction, propagation equation, impedance, power transported). The second chapter deals with propagation in limited media with the notions of reflection and transmission coefficients, superposition of incident and reflected waves. The last chapter deals with interferences (interference conditions, two-source interference, specificity of light waves).

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

This course will also use the mathematical tools and skills that will be learnt all along the first year, and of course the physics curriculum of the first 3 semesters (dimensions, uncertainties, electricity, mechanics, electromagnetism).

IDENTIFICATION

CODE : FIMI-2-S2-EC-STA-TF
ECTS : *

HOURS

Cours :	0h
TD :	0h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	0h
Travail personnel :	25h
Total :	25h

ASSESMENT METHOD

The internship report will be assessed by a lecturing engineer, in charge of monitoring a group in 1A and 2A (in 2A, 1A groups are reformed).

TEACHING AIDS

Two guides will be distributed (in pdf, available on Moodle):
- a guide to finding an internship, in November 1A
- a guide to writing an internship report, in April 1A, with a grading scale.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

This is the first concrete experience of working in a company for INSA Lyon students.
This internship lasts a minimum of 4 weeks and is carried out by students at the end of their 1st year.
It meets a number of key objectives:
- Experience working as part of a team (live the daily life of operators, measure the repetitive nature and arduousness of their tasks).
- Discover, observe and understand corporate life and human relations.
- Observe and study the work environment.

The skills developed revolve around the following points:
- Observe the immediate environment (workstation, team and workshop operations). workshop operations).
- Discovering mechanisms and organizations (technical, social, structural) through exchanges with those involved and by researching authorized and validated documents within the company.
- Gather different points of view, confirm or refute certain assertions.
- Know how to change initial preconceptions.
- Listen to employees to guide your thinking on management perspectives.

CONTENT

- Internship period: during the summer (from the last week of June to July 31), between 1st and 2nd year at INSA Lyon.
- Duration: minimum 4 weeks, explicitly specified in the internship agreement.
- Conditions: teamwork.
- Contractualization: this internship is the subject of an internship agreement signed by INSA Lyon, the host organization and the intern, setting out the commitments and responsibilities of INSA Lyon, the host organization and the student, and specifying the intern's activity during the internship period. Experience in the form of an employment contract (CDD) is also accepted.
- The internship is the subject of an internship report, which is graded by an INSA engineer. This engineer follows a group of students with two presentations in 1A (before the internship) and two in 2A (after the internship). The first is an account of the professions involved, with an approach to the business world, while the second focuses on the internship, respect for the environment, rules and regulations, attitudes to adopt and behavior. The 1st year groups are reformed in the 2nd year for a debriefing session in September/October, and a session to hand in the corrected and graded internship reports in February.

BIBLIOGRAPHY

PRE-REQUISITES

No particular prerequisites for this course.

Spanish Language and Civilisation

IDENTIFICATION

CODE : FIMI-2-S2-EC-LCE
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- editing and public broadcast of the report (80%)
- presentation and defence of the report (20%)

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

SKILLS

Targeted
CT4: SHOW CREATIVITY

Mobilised
CT2: WORK, LEARN, DEVELOP IN AN AUTONOMOUS WAY
CT3: INTERACT WITH OTHERS, WORK AS PART OF A TEAM
CT7: WORK IN AN INTERNATIONAL AND CULTURAL CONTEXT

CONTENT

Classes are taught solely in Spanish. The LCE course consists of a language course (see description in the Spanish course offer) and a Spanish Civilisation course during which a video project will be produced during the study trip (5 to 6 days) to Spain.
The audiovisual project that the students will have to produce during their stay in Spain will be done in groups of four. The students will have one year to work on a societal issue that interests them; this issue may be directly linked to the city in which we will be staying or may be broader in scope: the question of independence, gender equality, bullfighting, etc. The video production may be a short documentary or a short film. The video production could be a short documentary or a report on the chosen issue. Part of the report will consist of interviews with specialists in the field (canvassed by the students).
The first semester is devoted to choosing the destination, organising the trip, researching the subject beforehand (problematisation of a subject, researching specialists), an introduction to photography (types of shots, meanings, use of equipment) and preparing a precise shooting plan.

The stay of a few days (in February, at the very beginning of S2) will be devoted to discovering the city and its culture, and several compulsory cultural activities will take place. The students will be given complete autonomy to conduct interviews with specialists as well as strangers, to fuel discussion on the subject.
On their return, the second semester will be devoted to selecting the images, sounds and interviews that will appear in the report, editing it and producing French subtitles (particularly in language classes).

BIBLIOGRAPHY

PRE-REQUISITES

Be enrolled in Spanish in 1st year. At least A2 level, but B1/B2 is strongly recommended for interviews. Selection based on a letter of application in Spanish (from the previous May).

German language and culture

IDENTIFICATION

CODE : FIMI-2-S2-EC-OPAL
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- Language: continuous assessment + B1 and B2 level tests (internal or Goethe Institut).
- in civilisation: continuous assessment + presentations in German on themes related to the project; progress reports on the project
- Audiovisual project: presentation of the project (screening of the report) to a panel of PC and Humanities teachers.

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Humanities reference framework:
CT2 - WORK, LEARN, DEVELOP IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK WITH TEAMS
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a well-argued way

3.2 - Situate one's original discourse using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3.5 - Manage conflicts, balance individual and collective interests
3. 6 - Take part in a group project: build and run a project, develop it; be aware of his/her role and responsibilities
4.1 - Develop a creative approach, including artistic ones
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5. 1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.

CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in discourse, attitudes and behaviour
7.3 - Relativising values, beliefs and behaviour
7.4 - Integrating cultural diversity into group work

CONTENT

- become familiar with the use of the German language as a means of communication
- analyse cultural, political and artistic aspects of German-speaking countries
- learn how to set up and manage a Franco-German project in the field of science and technology or in the social and cultural field
- produce audio-visual reports in German in line with the year's theme
- learn how to present the results to the public (exhibition, round table, etc.).)

Semester 3: Definition and implementation of the project:
Language course: Study of the German language with the aim of acquiring a fluent language and a minimum level of B1 (according to the European reference framework); level B2 targeted. The aim is for the students to communicate with their partners, to conduct interviews and reports in German and to present INSA in German to secondary school pupils.
Civilisation classes: classes are held in German. They focus on German civilisation + exchanges with partners in Germany but also on current political and cultural events. The course is based on cultural activities in the Lyon region (theatre, exhibitions, conferences, etc.) relating to German culture
Audiovisual project: preparation of an audiovisual report: work on audiovisual language, interview techniques, technical aspects, etc.

BIBLIOGRAPHY

- CALLA Cécile, Tour de Franz - Mein Rendezvous mit dem Deutschen, Hamburg: Ullstein 2009,
- CHAPOUTEAU Johann: Histoire de l'Allemagne (1806 à nos jours) Paris : PUF,2014, 128p
- HUGHES Pascale , Marthe et Mathilde, Hamburg :Rowohlt TB, 2010 .
- MEYER Michel , Le roman de l'Allemagne : Ou l'histoire secrète d'une renaissance...; Paris 2013, 344p
- TOURNIER Michel , Le bonheur en Allemagne ?, Paris :Folio 2004,
- de la VAISSIERE Jean-Louis: Qui sont les Allemands ? Préface de Volker Schlöndorff Paris : Max Milo, 2011 384 p.
- WICKERT Ulrich, Frankreich die wunderbare Illusion, München: Heyne, 1998,
- In addition, there is a specific bibliography based on the theme studied during the year

For more information, visit the OPAL option website:
http://leshumas.insa-lyon.fr/langues/allemand/page_allemande/engager/opal/1_opal.html

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

FORMATION INITIALE AUX METIERS D'INGENIEUR

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

European Identities and Cultures

IDENTIFICATION

CODE : FIMI-2-S2-EC-CUID
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

Production of audio-visual reports

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Humanities reference framework:
CT2 - WORK, LEARN, DEVELOP IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK WITH TEAMS
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a reasoned way

3.2 - Situate one's original speech using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3. 5 - Manage conflicts, balance individual and collective interests
3.6 - Take part in a group project: build and run a project, develop it; be aware of your role and responsibilities
4. 1 - Develop a creative approach, including an artistic one
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.

CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in discourse, attitudes and
behaviour
7.3 - Putting values, beliefs and behaviour into perspective
7.4 - Integrating cultural diversity into group work

CONTENT

Examination of the concept of identity and, more specifically, European cultural identity.
- Raising awareness of inter-cultural issues
- Study of European current affairs and in-depth examination of a number of specific issues (immigration, minorities, sovereign debts, etc.)
- Conduct of a collective study and travel project in conjunction with partners in one of the "European cultural capitals"
- Production of video reports in one of the cultural capitals on a variety of subjects (cultural, political, social or other)

Semester 3: Definition and implementation of the project:

Initially, students will examine the very notion of culture.
This awareness-raising work on a personal and concrete scale will serve as a basis for investigating the issues highlighted by the European Capitals of Culture.

Contacts will be established with partners involved in reflection on European issues. Regular exchanges on the issue of cultural identity will be held with them. Information evenings and debates may be organised. A special website or blog will be set up on which work in progress and the results will be posted.

BIBLIOGRAPHY

CARPENTIER Jean, LEBRUN François (directions), Histoire de l'Europe, Paris, Seuil, 1990
CAUTRES Bruno : Les Européens aiment-ils (toujours) l'Europe ? Paris : La Documentation Française, 2014, 214p
ECO Umberto, La Recherche De La Langue Parfaite Dans La Culture Européenne, Paris, Seuil, 1994
KRISTEVA Julia, Europe Des Cultures Et Culture Européenne : Communauté Et Diversité, Paris, Hachette, 2008
MATTEI Jean-François, Le Regard Vide. Essai Sur L'épuisement De La Culture Européenne, Paris, Flammarion, 2007
MAK Geert : Voyage d¿un Européen à travers le XXe siècle Paris : Gallimard, 2004 (éd.frç.:2010), 944p
RODAN Martin, Notre culture européenne, cette inconnue, Bern, Peter Lang, 2009
SAPIRO Gisèle (dir.), L'espace intellectuel en Europe. De la formation des Etats-nations à la mondialisation XIXè-XXIè siècles, Paris, La Découverte, 2009
THIESSE Anne-Marie : la création des identités nationales Paris :Seuil 2001, 212 p
TODD Emmanuel, L'invention de l'Europe, Paris, Seuil, 1990

There is also a specific bibliography based on the countries studied during the year

A regularly updated bibliography can be consulted on the website: http://leshumas.insa-lyon.fr/cuid

PRE-REQUISITES

The course must have been taken in S3.

INSA LYON
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Civilisation - projects 2

IDENTIFICATION

CODE : FIMI-2-S2-EC-CIP
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- a group podcast
- an individual piece of writing

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Skills
* Targeted
- INSA, Humanities Competency Framework
5. Acting responsibly in a complex world
7. Working in an international and intercultural context.
* Mobilised
- CEFR
- Written and oral comprehension and expression (CEFR)
- INSA, Humanities skills reference framework
3. Interacting with others, working in a team.

CONTENT

This course is designed as a continuation of the 1st year Contemporary Latin American Civilisations course, with two distinct but complementary parts: a theoretical and documentation part (history course, 1 hour per week) and a practical part (four humanitarian projects that students will take part in each year: also 1 hour per week).
The theoretical part will focus on the establishment of the nation-state in Latin America from the 19th century onwards, as an exogenous model (Western and European) imposed by a sector of the population. In S3 we will be looking in particular at the continuities of the colonial past that persist to the present day and are reflected in a socio-economic structure that still retains very strong traces of colonial racism. At the same time, we will also look at the breaks with this colonial past and how there are specific features in this region of the world, particularly with regard to certain vulnerable population groups (women, indigenous communities, LGBT groups, migrants).
In parallel, for the practical part (S3 and S4), students will be in charge of various humanitarian projects and will organise different activities to publicise these associations on campus. They will learn how to manage an association and its treasury, how to deal with other associations and institutions, how to disseminate information and work with social networks, how to create a website, etc.

BIBLIOGRAPHY

- Amérique latine : introduction à l'Extrême-Occident, Alain Rouquié (1987)
- Naissance des nations, Clément Thibaud (2007)
- Race et colonialité du pouvoir, Anibal Quijano (2007)
- Histoire de l'Etat-Nation : de la politique d'intégration en Amérique Latine et en Europe, J. Gonzalez (2010)

PRE-REQUISITES

The course must have been taken in S3

Cultures, Sciences and Societies

IDENTIFICATION

CODE : FIMI-2-S2-EC-CSS-FI
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

1 individual or group written statement of intent, interim research report and annotated bibliography
1 group oral presentation such as a dramatised lecture

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

CT2 - WORK, LEARN, GROW IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a reasoned way
3.2 - Situate one's original speech using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3. 5 - Manage conflicts, balance individual and collective interests
3.6 - Take part in a group project: build and run a project, develop it; be aware of your role and responsibilities
4. 1 - Develop a creative approach, including artistic
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions...
CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in discourse, attitudes and behaviour
7.3 - Relativising one's values, beliefs and behaviour
7.4 - Integrating cultural diversity in the workplace

CONTENT

In line with the arts and culture policy, this final SHS course is an opportunity to combine the approach developed in the first semester around the question of 'how the social world works and how it affects us'. The themes may vary depending on the course, but the framework is the same: each sub-group produces
research on a specific theme with a written statement of intent, and presents the answers to their questions in the form of dramatised lectures or a forum theatre.

BIBLIOGRAPHY

Biblio-webography provided by the teacher

PRE-REQUISITES

The prerequisites are the skills acquired in the previous semesters in Social Sciences and Humanities courses.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I4-TF-SH2

ECTS : *

HOURS

Cours :	45h
TD :	31h
TP :	16h
Projet :	71h
Evaluation :	5h
Face à face pédagogique :	97h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

Lecture notes, course slides, problem sets with solutions.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized, see program below.
Eventually:
List of P2i Learning Outcomes (common and specific)

CONTENT

1. Humanities and Social Sciences Project: Study of a technical system.
2. Project: Design and fabrication of a solar thermal energy recovery system.
3. Introduction to fuel sources.
4. Historical perspectives on energy and energy transition pathways.
5. Performance of energy conversion systems.
6. Mechanical design for renewable energies.

BIBLIOGRAPHY

PRE-REQUISITES

Knowledges and courses from semester 1 of the second year

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I3-TF-SH2

ECTS : undefined

HOURS

Cours :	16h
TD :	70h
TP :	32h
Projet :	70h
Evaluation :	8h
Face à face pédagogique :	126h
Travail personnel :	100h
Total :	296h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Poly, slideshows, tutorials, online answer keys... all the content is available on Moodle.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Propose and design a mechanical system that responds critically to an expressed need, while taking into account the requirements of the system's life cycle, particularly with regard to environmental impact, the societal context of its use, manufacturing requirements and economic constraints.

Situate their design approach within the more general framework of a low-tech approach, the philosophical and practical foundations of which will be illustrated by examples of products/services

Relate their engineering choices to the needs of societal transformation, in particular by characterising the low-tech approach as a lever for action, with its scope and limits, for an economy that is compatible with planetary limits and socially just.

Choose an appropriate production process, taking into account its impact on geometry, choice of material and compatibility with the function

Implement the chosen process, with or without the help of a specialist depending on the degree of complexity identified, adapting the degree of autonomy and choosing a methodology that guarantees the safety of people and the integrity of the means of production.

Analyse a contemporary low-tech issue by means of a collective investigation leading to the writing of a popular science article.

Within a project group, identify and allocate tasks in such a way as to encourage involvement, autonomy and initiative on the part of each member, as well as communication and the quality of exchanges, arguments and collective choices.

Identify key words to find bibliographical sources related to a problem or a project theme, choose and explain the criteria for evaluating documents in terms of reliability, relevance and scientificity and develop an argument for the documents chosen, reference bibliographical sources in a written or oral production.

CONTENT

Knowledge of families of materials and applications to the choice of materials for mechanical design

Strength of materials, dimensioning using beam theory, buckling, basics of finite element modelling and associated applications

Simulation of mechanical behaviour

Lifecycle analysis, methodology and application, creation of environmental data in the case of a forming process

Statistical tools for quality management: linear regression, data manipulation, probabilities, application to measurements

Production management: typology of production systems, management of technical data, type of layout, load-capacity balance of a production system, stock management and planning tools.

Documentary research method

Agile manufacturing: numerically controlled machining (lathe and milling machine), multi-material and metal laser cutting, sheet metal forming by folding, rolling, mechanically welded and mechanically assembled construction.

Exploring the low-tech approach as a means of engineering a profound social and ecological transformation. Training in the popularisation of scientific discourse

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

FORMATION INITIALE AUX METIERS D'INGENIEUR

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Innovation by mechatronics and robotics Course

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I6-TF-SH2

ECTS : undefined

HOURS

Cours :	20h
TD :	67h
TP :	8h
Projet :	72h
Evaluation :	1h
Face à face pédagogique :	96h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

Continuous assessment
Servoing: 1 individual evaluation, 3 sessions over 5 sessions.
Perception / Action: 1 group assessment, TP report on 4h.
Programming & Communication: 1 assessment in situation by binomial, 1 written individual assessment
Design: 1 individual evaluation, CAD rendering, for the duration of the sessions.
Project : 1 individual evaluation throughout the duration of the sessions, 1 individual evaluation by the pairs, 1 group assessment during the Sciences Fair.
Documentary research: 1 individual assessment in writing
Humanities: 1 individual assessment in writing, having to write outside the niches., 1 written group assessment, article to be made.

TEACHING AIDS

LMS Moodle

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized, see program below.
The students will design a prototype using mechatronics and robotics. The project theme is common to all groups and is chosen each year, it addresses the whole field of possibilities of robotics. The chosen theme should: enable a realization at the level of what students can do, allow to find a multitude of solutions, question the role of robotics in society, link the P2I to the real world with a shared project with " clients, "finding a place in the daily life of a young
humanist student.
The creations are made from a functional specification. Each group composed of a dozen students will start the project with a search for solutions with ideation sessions (brainstorming, TRIZ, 6 hats, mental map). The selected solutions are the subject of a mechanical design study with 3D modeling, mechanical simulation, multiphysical modeling, Lego model, validation experiments ...
The prototypes are made by the students in 3 workshops according to the needs: machining, metal construction, additive manufacturing.
The electronics of the prototypes are 80% commercial cards: arduino, power cards, axis servo, video recognition ... Some cards are designed and manufactured by students for specific needs: Lego / electronic interfaces, sound controls...
The control of the prototypes is done in several layers: a real-time layer on a microcontroller and a remote layer for the HMI on PC (Java) or tablet / tel (Android).
Wired communications use serial or I2C protocols, wireless communications use WIFI in UDP or TCP.

CONTENT

Project 78h
Servoing 16h
Programmation & Communication 26h
Sensors /Actuators 12h
Energy 2h
Humanities 30h
Documentary Research 4h

BIBLIOGRAPHY

PRE-REQUISITES

S1, S2 and S3 Mechanical design
S3 Manufacturing
S3 Mechatronics

Bio-based materials, engineering and the environment

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I1-TF-SH2

ECTS : 10

HOURS

Cours :	44h
TD :	86h
TP :	50h
Projet :	10h
Evaluation :	8h
Face à face pédagogique :	188h
Travail personnel :	100h
Total :	298h

ASSESMENT METHOD

1 one-hour individual test per module (including practical work) of core courses.

Individual practical assessment.

Collective writing of an Humanity article.

Documentary and Humanity research (common report with two separate parts) collectively.

Poster or intermediate defense. Project presentation (Poster...) collectively.

Final defense collectively.

Collective evaluations are carried out in groups of 4 to 8 students.

TEACHING AIDS

Lectures
Tutorial
Practical work
Project

TEACHING LANGUAGE

French

CONTACT

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AIMS

Face to environmental issues related to the problems of resource management and protection of our ecosystems, future engineers must be aware of the need to develop new sustainable technologies in the service of man and his environment. This course is suited to sensitize
students to the great challenges of the future related to the environment, energy and resources that specifically address Bioengineering for the production, treatment and recovery in the areas of energy, pollution control ecosystems, bio-based polymer materials and biodegradable.
The purpose of the course part is to introduce some concepts of ecology, biotechnology, polymer materials and process engineering such as 3D printing, to prepare the practicle party that should allow
students to develop projects around a common theme.

CONTENT

Ecology and Environmental Sciences: basics of ecology, environmental issues, methods and tools for sustainable management anthroposystems.
Chemical reaction engineering and process engineering: analytics, chemical kinetics, and enzymology management processes.
Biotechnology DNA Microorganisms, genomes, and gene regulation, DNA biotechnology and synthetic biology databases.
Polymers and bio-based materials: organic chemistry, polymerization, structures and properties of bio-based polymer materials, lifecycle and environment.
Modeling: growth models (EDO), chemostat model (dynamic systems), fitting a model of Michaelis-Menten (inferential statistics).
Humanities and social sciences: innovation process, design, users and sustainable development issues; ethical, imaginary representations.
A cycle of 4 rotating practicles are provided for all students suited to learn the biotechnology, enzymology, modeling and study of polymer materials, whatever the project theme they choose.

BIBLIOGRAPHY

Massardier V, Belhaneche-Bensemra N, Lazaric N (2023) Editorial: Alternative building blocks and new recycling routes for polymers: Challenges for circular economy and triggers for innovations. Front Mater DOI: 10: 1152494.

Sandei B, Massardier V and Brunel R (2022), Alternative building blocks sources for poly (ethylene terephthalate): A short review with socio-economical points of view. Front. Mater. 9:1005770. DOI: 10.3389/fmats.2022.1005770

Léa Barbault, Olivier Brette, Nathalie Lazaric, Valérie Massardier and Valérie Revest (2023), Bio-based Plastics: a 'Sustainable' Alternative for the Plastic Industry; Int J Environ Sci Nat Res 31(5): IJESNR.MS.ID.556325 (2023) DOI: 10.19080/IJESNR.2023.31.556325 https://juniperpublishers.com/ijesnr/

A review to guide eco-design of reactive polymer based materials, Emma Delamarche, Valérie Massardier*, Remy Bayard, and Edson Dos Santos, dans Reactive and Functional Polymers Volume Three, Advanced materials, Editors: Gutierrez, Tomy (Ed.), Octobre 2020. https://www.springer.com/gp/book/9783030504564#aboutBook

Chapter "Recyclable and bio-based materials open up new prospects for polymers : Scientific and social aspects" dans le livre « Environmental impact of polymers ». Ed. Th Hamaide, R. Deterre, JF Feller, Wiley, DOI: 10.1002/9781118827116.ch12 Lavoisier-Hermès, 2014.

Chapter Oil-based and bio-derived thermoplastic polymer blends and composites, in Introduction to Renewable Biomaterials: First Principle and Concepts, A.Quitadamo, V. Massardier, M. Valente, A.S. Ayoub, L.A. Lucia Editeurs Wiley: 2017, pp 239-268.

Chapter "Contribution of reactive extrusion to technological and scientific challenges to eco-friendly circular economy", in "Biomass Extrusion and Reaction Technologies: New Insights, Future Potential, and Principles to Practices",, V. Massardier, A.Quitadamo; A.S. Ayoub, L.A. Lucia Editeurs, ACS, 2018.

PRE-REQUISITES

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I5-TF-SH2

ECTS : undefined

HOURS

Cours :	20h
TD :	40h
TP :	30h
Projet :	90h
Evaluation :	8h
Face à face pédagogique :	98h
Travail personnel :	100h
Total :	288h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Course materials available on moodle.
For the project: numerous resources available on moodle: specifications, instructions, tutorials for software and measurements, etc.

TEACHING LANGUAGE

French

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AIMS

Currently being finalised, see programme below.

CONTENT

The ultimate objective of this P2i is to learn how to transcribe a health, sports, art, everyday life or work situation (performance, well-being, pathology, etc.) into a problem where engineering can make a contribution in terms of analysis, understanding, solution, improvement or optimisation.
* Project (80h)
* Specific courses for the project:
Anatomy/Mechanics (18h)
Strength of Materials (18h)
Applied Mathematics (12h)
SHS (8h + project)
Literature survey (6h)
Life Sciences (6h)
Imaging (6h)
Physical and Sport Education (4 hrs)
Biomaterials (4 hrs)
External contributors (6h)

BIBLIOGRAPHY

PRE-REQUISITES

Knowledge and skills from FIMI courses, in particular Mathematics, Physics and Systems Mechanics.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I2-TF-SH2

ECTS : -

HOURS

Cours :	12h
TD :	56h
TP :	2h
Projet :	98h
Evaluation :	8h
Face à face pédagogique :	78h
Travail personnel :	100h
Total :	276h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Visual course materials (PowerPoint / PDF)
- Exercise handouts
- Practical work handouts
- Physics and chemistry lab equipment
- Project and prototyping materials
- Computer workstations equipped with necessary software

Documents available on Moodle

TEACHING LANGUAGE

French

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AIMS

Currently being finalized, see program below

CONTENT

Project Technical Phases:

1) From Physical Phenomenon to Signal: Study and implementation of physical sensors to measure a signal.
2) From Signal to Sensor Data: Development of appropriate electronic acquisition chains (Op-Amps, filters, ADC).
3) Sensor Data Transmission: Programming Arduino modules to create a wireless sensor network (radio transmission, network protocol).
4) Sensor Data Management: Creation of an SQL database and Java programming to import sensor data in real-time.
5) From Sensor Data to Information: Statistical analysis and data mining of the collected data.
6) Finalization: Final integration and testing of the infrastructure.

The project starts in the 2nd week with a half-day session per week and continues with full sessions during the last 4 weeks.
A project demonstration concludes the P2I.

M1: Physical Sensors & Electronic Acquisition Chains
a) General principles of physical sensors
b) Operation of different sensor families
- Environmental sensors (temperature, pH)
- Mechanical strain sensors (force, pressure, deformation)
- Magnetic sensors (motion, orientation)
c) Functions, analysis, and design of an electronic acquisition chain
d) Current technologies and future challenges

M2: Sensor Data Analysis
a) Introduction to signal processing
b) Descriptive statistics
c) Data visualization
d) Introduction to data mining

M3: Telecommunications Networks & Databases for Sensors
a) Principles of networks
b) Introduction to wireless networks
c) Architecture of sensor databases
d) Data querying and multidimensional aspects

M4: SHES Reflections on Data
a) Innovation & society, the role of the user
b) Major societal issues: "Big Data", "Open Data", "Quantified Self", privacy
c) Conferences: business, public institutions

BIBLIOGRAPHY

PRE-REQUISITES

This program is based on the knowledge and skills taught within the FIMI department at INSA Lyon, which will be supplemented or deepened through the modules and applied to the project:

Physics / Chemistry
- Electrokinetics and Electronics Concepts (Physics 1A)
- Electromagnetism (Physics 1A & 2A)
- Thermodynamics (Thermo 1A)

Mathematics
- Probability / Statistics (Maths in High School)
- Vector Spaces (Maths 1A)
- Distances (Maths 2A)

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I8-TF-SH2

ECTS : undefined

HOURS

Cours :	2h
TD :	78h
TP :	24h
Projet :	78h
Evaluation :	8h
Face à face pédagogique :	112h
Travail personnel :	100h
Total :	290h

ASSESMENT METHOD

Continuous assessment
For all the science teaching modules (mathematics, scientific computing, signal processing, physics), a global assessment of 4h will be carried out as written exam.
For the project, each team will have to develop an image analysis program with Python accompanied by a written report.
The evaluation of the project will also be done through an oral defense .
An activity dedicated to the sustainable development and the social responsibility will lead to a specific evaluation.

TEACHING AIDS

For educational modules, brackets will be specific to each subject.
The teaching modules are designed to provide all the necessary knowledge to the project, representing about half of the hours of the course.
The project will be half in computer room and in an experimental room combining different imaging modalities (X-rays, visible, MRI, ultrasound).
Project Description: analysis and automatic extraction of important information stored in an image/a signal whose acquisition/detection has been optimized.
Steps: understanding the imaging method, analysis of influential parameters to optimize image quality, development of automatic treatment programs adapted to signals and images. Reflection on science-technical-society aspects of the project.

TEACHING LANGUAGE

French

CONTACT

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AIMS

In progress

This course is dedicated to the field of medical imaging (eg, ultrasound, radiology, MRI), and Industrial imaging (non- destructive testing and material characterization).
How to verify that an airplane wing contains no crack? how to detect broken glass in a baby food jar? how to verify the presence of all the components on an electronic board? how to detect cancerous tumors? controlling the growth of a fetus? evaluate the impact of treatment on bone microstructure, measuring the velocity of blood in the arteries ... all these issues are being solved (or partly) through waves (elastic, electromagnetic, corpuscular ...) that interact with matter. Analysis of signals or images resulting from the reception of these waves allows then to extract the desired information on the bushing material.
The objective of this course is to understand the main physical methods of image acquisition, and to give the signal processing bases necessary for their acquisition, optimization, and analysis.
This is a highly interdisciplinary course that combines aspects such as "physics and mathematics", "signal and image processing" and "technology and software" for the vision systems in medical or industrial imaging.

CONTENT

Name and Description of modules:
M1: Physics bases of imaging methods (infra-red and visible imaging, ultrasound sonography, X rays-matter interaction , electron microscopy).
M2: Bases and deepening mathematics (complex Fourier series, Fourier transform, functions of several variables).
M3: Signal Processing Basics (continuous and discrete signals and linear systems convolution, sampling, Fourier transform, direct and frequency domains, frequency analysis, filtering).
M4: Introduction to python and numerical computation.
M5: Waves and Science-Technology-Society: reflection on the waves and health, beneficial / harmful aspects of the same phenomenon ... Study of the ethical, social and cultural aspects of the project.
3 practical courses (TP) will be carried out where both physics experiments and digital processing with Python will be used together. Topics: filtering with an RLC circuit, production and synthesis of a musical signal, analog (optical) and digital filtering of an image.

BIBLIOGRAPHY

PRE-REQUISITES

Prerequisite , deepening :
-use and deepening of general knowledge on mechanical and electromagnetic waves ;
-use of complexes , integration of functions of a real variable , serial concept ;
-deepening of the notions of algorithms and data structures in the field of signal and image processing ;
-articulation with the teachings of Cultures, Science, Societies.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I7-TF-SH2

ECTS : undefined

HOURS

Cours :	22h
TD :	57h
TP :	0h
Projet :	88h
Evaluation :	1h
Face à face pédagogique :	80h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

- a written MCQ test (2 hours) on all theoretical and practical modules
- three mini-projects in the form of reports
- a final Engineering Sciences project in the form of a report, defense and evaluation of other students
- a project in the Humanities and Social Sciences, including the writing of an article and the development of the ability to take a step back, particularly when defending a thesis
- a bibliographical report

TEACHING AIDS

All course documents (pdf of courses, python programs, pdf of project subjects, MCQs, etc.) are available in Moodle: https://moodle.insa-lyon.fr/enrol/index.php?id=2562

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized. Please see the program below

CONTENT

- The course will start with 3 modules “from physical phenomena to modeling” in the form of CM and TD: “Particle Dynamics”, “Non-Linear Mechanics” and “Thermal Flows and Transfers”.
- In parallel, 2 Numerical Methods modules will be taught.
- Students will then apply their newly acquired skills in 3 mini-projects associated with the 3 previous modules.
- Finally, they will carry out a final project in groups of 3 to 5 to explore one of the issues raised in the modules, in relation to the world of engineering.
- At the same time, each project group will conduct a human and social science survey to identify the STS (science, technology and society) issues raised by the engineering project.
- Equations and simulations will be solved using the Python language.

BIBLIOGRAPHY

Calcul différentielle et équations différentielle - Dunod - Science Sup (2021)

PRE-REQUISITES

FIMI undergraduate courses: solid dynamics, mathematics, Python programming, thermodynamics....

IDENTIFICATION

CODE : FIMI-2-S2-EC-MA-TF
ECTS : 5

HOURS

Cours :	19.5h
TD :	35h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	56.5h
Travail personnel :	80h
Total :	136.5h

ASSESMENT METHOD

The evaluation includes 2 written interrogations of 2 hours

TEACHING AIDS

Moodle

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

AAv4.1 – Determine the power series expansion of a given function.
AAv4.2 – Use power series to solve a linear differential equation with polynomial coefficients.
AAv4.3 – Determine the quadratic form associated with a bilinear form, and vice versa.
AAv4.4 – Perform the reduction and diagonalization of a quadratic form.
AAv4.5 – Determine the orthogonal complement of a vector subspace and compute an orthonormal basis with respect to a given inner product.
AAv4.6 – Use the notion of projection to solve certain optimization problems involving an inner product.
AAv4.7 – Study the continuity of a multivariable function and compute directional derivatives when they exist.
AAv4.8 – Use the differential and the Hessian to compute the second-order Taylor expansion (DL2) of a multivariable function, especially to study the nature of critical points.

CONTENT

Power series (2)
Bilinear algebra
Differential Calculus 2 (extreme values, implicit function theorem, implicit surfaces)

BIBLIOGRAPHY

(1) Analyse et algèbre : cours de mathématiques de deuxième année avec exercices corrigés et illustrations avec Maple, Stéphane Balac et Laurent Chupin , Presses polytechniques et universitaires romandes.
(2) F. Butin, M. Picq et J. Pousin : Mathématiques, cours et exercices corrigés - 2ème année de classes préparatoires (Ellipse) 2013.

PRE-REQUISITES

Mathematics Syllabus for PC-S3-MA-AEMP

Informatics and numerical society 4

IDENTIFICATION

CODE : FIMI-2-S2-EC-ISN-TF
ECTS : toto

HOURS

Cours :	4h
TD :	27.5h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	33h
Travail personnel :	20h
Total :	53h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

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AIMS

Targeted learning outcomes :

AAv4.1 : At the end of S4, students will be able to use object-oriented and event-driven deve-lopment paradigms in Python, in particular by creating graphical user interfaces.

AAv4.2 : At the end of S4, students will be able to design and develop, as part of a team, a complex modular Python program to meet a set of specifications they have defined.

AAv4.3 : At the end of S4, students will be able to identify the economic, social, political and imaginary issues involved in using a specific digital technology in a real-life situation.

AAv4.4 : At the end of S4, students have acquired, through their work in sessions and inde-pendently, the general digital culture skills enabling them to take the Pix certification with an average level of 4.

CONTENT

1 - Object-oriented programming

2 - Matching algorithms, algorithmic properties and social issues

3 - Development of graphical user interfaces

4 - Project (in groups of four): definition of a mini-specification, analysis and definition of a solution, use of third-party libraries, identification of an algorithmic problem, realization in Python.

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-2-S1-EC-ISN

System Mechanics 2

IDENTIFICATION

CODE : FIMI-2-S2-EC-MS-TF-SH1
ECTS : 2.00

HOURS

Cours :	7h
TD :	21h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	30h
Total :	59.5h

ASSESMENT METHOD

- 1 Written Test (WT2) of 1.5 hour
- 1 Final Test (FT2) of 2.5 hours.
Average : (WT2*1.5+FT2*2.5)/4

TEACHING AIDS

- lecture notes and presentations
- exercices book (the same for all the 2nd year students)
Documents available on Moodle

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Target Learning Outcomes (AvA):

Aav.1 - Model a real mechanical system of bounded complexity including the specific dynamic behavior laws (ex: shock absorber, motor, intersolid contact...)

Aav.2 - Perform the complete energy balance of the mechanical system, then establish the mechanical equations associated with this balance and verify the dimensional homogeneity of the results obtained

Aav.3 - Perform a complete mechanical balance of the mechanical system, then optimize this balance for the establishment of equations of motion of this system

Aav.4 - Establish the characteristics of the operation of a mechanical system based on the equations established and verify the dimensional homogeneity of the results obtained

CONTENT

MASS GEOMETRY : Notion of mass, center of mass and center of inertia of a solid, operator of inertia, moments and products of inertia, Huygens theorem, principal and central frames of inertia, balancing.

KINETICS: Kinetic, dynamic screws and kinetic energy for one isolated solid, for a set of solids.

DYNAMICS: Fundamental principle of Dynamics and General Theorems (vectorial form), classification of Galilean (Newtonian or Inertial) frames depending on the studied phenomena. Force wrench transferred by joints taking into account friction, Coulombs friction (sum and moment), viscous dissipation, rheology of some usual mechanical components, and mechanical actions by actuators. Selection of the sub-system(s) to be isolated depending on the simulation objective(s): equations of motion and/or mechanical actions. Position of equilibrium, stationary positions and, for systems with a single degree-of mobility, linearized equation of motion and stability. First order equations, power, work, kinetic energy theorem, force and potential, first order equations derived from kinetic energy

BIBLIOGRAPHY

AGATI Mécanique Industrielle Dunod
BEGHIN Cours de mécanique théorique Gauthier-Villar
BELLET Problème de mécanique Cepadues editions
BERKELEY Cours de Physique 1 Armand Colin
BONCOMPAIN Méca. des Syst. Indus. (T2) Dunod
BROSSARD Mécanique Générale Tech. de l'Ingénieur AF4
BROUSSE Cours de mécanique Collection U
BONE Mécanique Générale (crs et ap.) Dunod U
CAZIN Cours de mécanique générale Gauthier-Villar
ROY Mécanique du solide rigide Dunod
LASSIA Cinématique Ellipse
LASSIA-BARD Dynamique Ellipse

PRE-REQUISITES

- System mechanics 1
- Vectors and Linear algebra
- Ordinary Differential Equations
- Mechanical design.

IDENTIFICATION

CODE : FIMI-2-S2-EC-PH-TF
ECTS : 4

HOURS

Cours :	7h
TD :	33.5h
TP :	16.5h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	59h
Travail personnel :	50h
Total :	109h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical reports.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French
English

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Establish the propagation equations verified by the quantities characterising a wave, from which deduce the specific impedance.
AAv.2 Deduce the expression and fully characterise a wave propagating in an unlimited and limited medium with or without dissipation.
AAv.3 Express the transported power and identify the experimental conditions for its measurement.
AAv.4 Determine the expression of the intensity in the case of two-wave interference and predict the interference pattern and use simple interferometric devices to measure physical quantities.
AAv.5 Apply the concepts seen on waves in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, conduct a critical analysis, write a report.

CONTENT

The fourth semester is entirely devoted to the propagation of waves. It contains three chapters. The first chapter concerns the propagation of waves in unlimited media with a first part on mechanical waves and a second part on electromagnetic waves (introduction, propagation equation, impedance, power transported). The second chapter deals with propagation in limited media with the notions of reflection and transmission coefficients, superposition of incident and reflected waves. The last chapter deals with interferences (interference conditions, two-source interference, specificity of light waves).

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

This course will also use the mathematical tools and skills that will be learnt all along the first year, and of course the physics curriculum of the first 3 semesters (dimensions, uncertainties, electricity, mechanics, electromagnetism).

IDENTIFICATION

CODE : FIMI-2-S2-EC-STA-TF
ECTS : *

HOURS

Cours :	0h
TD :	0h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	0h
Travail personnel :	25h
Total :	25h

ASSESMENT METHOD

The internship report will be assessed by a lecturing engineer, in charge of monitoring a group in 1A and 2A (in 2A, 1A groups are reformed).

TEACHING AIDS

Two guides will be distributed (in pdf, available on Moodle):
- a guide to finding an internship, in November 1A
- a guide to writing an internship report, in April 1A, with a grading scale.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

This is the first concrete experience of working in a company for INSA Lyon students.
This internship lasts a minimum of 4 weeks and is carried out by students at the end of their 1st year.
It meets a number of key objectives:
- Experience working as part of a team (live the daily life of operators, measure the repetitive nature and arduousness of their tasks).
- Discover, observe and understand corporate life and human relations.
- Observe and study the work environment.

The skills developed revolve around the following points:
- Observe the immediate environment (workstation, team and workshop operations). workshop operations).
- Discovering mechanisms and organizations (technical, social, structural) through exchanges with those involved and by researching authorized and validated documents within the company.
- Gather different points of view, confirm or refute certain assertions.
- Know how to change initial preconceptions.
- Listen to employees to guide your thinking on management perspectives.

CONTENT

- Internship period: during the summer (from the last week of June to July 31), between 1st and 2nd year at INSA Lyon.
- Duration: minimum 4 weeks, explicitly specified in the internship agreement.
- Conditions: teamwork.
- Contractualization: this internship is the subject of an internship agreement signed by INSA Lyon, the host organization and the intern, setting out the commitments and responsibilities of INSA Lyon, the host organization and the student, and specifying the intern's activity during the internship period. Experience in the form of an employment contract (CDD) is also accepted.
- The internship is the subject of an internship report, which is graded by an INSA engineer. This engineer follows a group of students with two presentations in 1A (before the internship) and two in 2A (after the internship). The first is an account of the professions involved, with an approach to the business world, while the second focuses on the internship, respect for the environment, rules and regulations, attitudes to adopt and behavior. The 1st year groups are reformed in the 2nd year for a debriefing session in September/October, and a session to hand in the corrected and graded internship reports in February.

BIBLIOGRAPHY

PRE-REQUISITES

No particular prerequisites for this course.

Cultures, Sciences and Societies

IDENTIFICATION

CODE : FIMI-2-S2-EC-CSS-FI
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

1 individual or group written statement of intent, interim research report and annotated bibliography
1 group oral presentation such as a dramatised lecture

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

CT2 - WORK, LEARN, GROW IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a reasoned way
3.2 - Situate one's original speech using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3. 5 - Manage conflicts, balance individual and collective interests
3.6 - Take part in a group project: build and run a project, develop it; be aware of your role and responsibilities
4. 1 - Develop a creative approach, including artistic
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions...
CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in discourse, attitudes and behaviour
7.3 - Relativising one's values, beliefs and behaviour
7.4 - Integrating cultural diversity in the workplace

CONTENT

In line with the arts and culture policy, this final SHS course is an opportunity to combine the approach developed in the first semester around the question of 'how the social world works and how it affects us'. The themes may vary depending on the course, but the framework is the same: each sub-group produces
research on a specific theme with a written statement of intent, and presents the answers to their questions in the form of dramatised lectures or a forum theatre.

BIBLIOGRAPHY

Biblio-webography provided by the teacher

PRE-REQUISITES

The prerequisites are the skills acquired in the previous semesters in Social Sciences and Humanities courses.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I4-TF-SH2

ECTS : *

HOURS

Cours :	45h
TD :	31h
TP :	16h
Projet :	71h
Evaluation :	5h
Face à face pédagogique :	97h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

Lecture notes, course slides, problem sets with solutions.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized, see program below.
Eventually:
List of P2i Learning Outcomes (common and specific)

CONTENT

1. Humanities and Social Sciences Project: Study of a technical system.
2. Project: Design and fabrication of a solar thermal energy recovery system.
3. Introduction to fuel sources.
4. Historical perspectives on energy and energy transition pathways.
5. Performance of energy conversion systems.
6. Mechanical design for renewable energies.

BIBLIOGRAPHY

PRE-REQUISITES

Knowledges and courses from semester 1 of the second year

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I3-TF-SH2

ECTS : undefined

HOURS

Cours :	16h
TD :	70h
TP :	32h
Projet :	70h
Evaluation :	8h
Face à face pédagogique :	126h
Travail personnel :	100h
Total :	296h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Poly, slideshows, tutorials, online answer keys... all the content is available on Moodle.

TEACHING LANGUAGE

French

CONTACT

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M. LE GUENNIC Thomas : thomas.le-guennic@insa-lyon.fr

AIMS

Propose and design a mechanical system that responds critically to an expressed need, while taking into account the requirements of the system's life cycle, particularly with regard to environmental impact, the societal context of its use, manufacturing requirements and economic constraints.

Situate their design approach within the more general framework of a low-tech approach, the philosophical and practical foundations of which will be illustrated by examples of products/services

Relate their engineering choices to the needs of societal transformation, in particular by characterising the low-tech approach as a lever for action, with its scope and limits, for an economy that is compatible with planetary limits and socially just.

Choose an appropriate production process, taking into account its impact on geometry, choice of material and compatibility with the function

Implement the chosen process, with or without the help of a specialist depending on the degree of complexity identified, adapting the degree of autonomy and choosing a methodology that guarantees the safety of people and the integrity of the means of production.

Analyse a contemporary low-tech issue by means of a collective investigation leading to the writing of a popular science article.

Within a project group, identify and allocate tasks in such a way as to encourage involvement, autonomy and initiative on the part of each member, as well as communication and the quality of exchanges, arguments and collective choices.

Identify key words to find bibliographical sources related to a problem or a project theme, choose and explain the criteria for evaluating documents in terms of reliability, relevance and scientificity and develop an argument for the documents chosen, reference bibliographical sources in a written or oral production.

CONTENT

Knowledge of families of materials and applications to the choice of materials for mechanical design

Strength of materials, dimensioning using beam theory, buckling, basics of finite element modelling and associated applications

Simulation of mechanical behaviour

Lifecycle analysis, methodology and application, creation of environmental data in the case of a forming process

Statistical tools for quality management: linear regression, data manipulation, probabilities, application to measurements

Production management: typology of production systems, management of technical data, type of layout, load-capacity balance of a production system, stock management and planning tools.

Documentary research method

Agile manufacturing: numerically controlled machining (lathe and milling machine), multi-material and metal laser cutting, sheet metal forming by folding, rolling, mechanically welded and mechanically assembled construction.

Exploring the low-tech approach as a means of engineering a profound social and ecological transformation. Training in the popularisation of scientific discourse

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

FORMATION INITIALE AUX METIERS D'INGENIEUR

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Innovation by mechatronics and robotics Course

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I6-TF-SH2

ECTS : undefined

HOURS

Cours :	20h
TD :	67h
TP :	8h
Projet :	72h
Evaluation :	1h
Face à face pédagogique :	96h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

Continuous assessment
Servoing: 1 individual evaluation, 3 sessions over 5 sessions.
Perception / Action: 1 group assessment, TP report on 4h.
Programming & Communication: 1 assessment in situation by binomial, 1 written individual assessment
Design: 1 individual evaluation, CAD rendering, for the duration of the sessions.
Project : 1 individual evaluation throughout the duration of the sessions, 1 individual evaluation by the pairs, 1 group assessment during the Sciences Fair.
Documentary research: 1 individual assessment in writing
Humanities: 1 individual assessment in writing, having to write outside the niches., 1 written group assessment, article to be made.

TEACHING AIDS

LMS Moodle

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized, see program below.
The students will design a prototype using mechatronics and robotics. The project theme is common to all groups and is chosen each year, it addresses the whole field of possibilities of robotics. The chosen theme should: enable a realization at the level of what students can do, allow to find a multitude of solutions, question the role of robotics in society, link the P2I to the real world with a shared project with " clients, "finding a place in the daily life of a young
humanist student.
The creations are made from a functional specification. Each group composed of a dozen students will start the project with a search for solutions with ideation sessions (brainstorming, TRIZ, 6 hats, mental map). The selected solutions are the subject of a mechanical design study with 3D modeling, mechanical simulation, multiphysical modeling, Lego model, validation experiments ...
The prototypes are made by the students in 3 workshops according to the needs: machining, metal construction, additive manufacturing.
The electronics of the prototypes are 80% commercial cards: arduino, power cards, axis servo, video recognition ... Some cards are designed and manufactured by students for specific needs: Lego / electronic interfaces, sound controls...
The control of the prototypes is done in several layers: a real-time layer on a microcontroller and a remote layer for the HMI on PC (Java) or tablet / tel (Android).
Wired communications use serial or I2C protocols, wireless communications use WIFI in UDP or TCP.

CONTENT

Project 78h
Servoing 16h
Programmation & Communication 26h
Sensors /Actuators 12h
Energy 2h
Humanities 30h
Documentary Research 4h

BIBLIOGRAPHY

PRE-REQUISITES

S1, S2 and S3 Mechanical design
S3 Manufacturing
S3 Mechatronics

Bio-based materials, engineering and the environment

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I1-TF-SH2

ECTS : 10

HOURS

Cours :	44h
TD :	86h
TP :	50h
Projet :	10h
Evaluation :	8h
Face à face pédagogique :	188h
Travail personnel :	100h
Total :	298h

ASSESMENT METHOD

1 one-hour individual test per module (including practical work) of core courses.

Individual practical assessment.

Collective writing of an Humanity article.

Documentary and Humanity research (common report with two separate parts) collectively.

Poster or intermediate defense. Project presentation (Poster...) collectively.

Final defense collectively.

Collective evaluations are carried out in groups of 4 to 8 students.

TEACHING AIDS

Lectures
Tutorial
Practical work
Project

TEACHING LANGUAGE

French

CONTACT

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AIMS

Face to environmental issues related to the problems of resource management and protection of our ecosystems, future engineers must be aware of the need to develop new sustainable technologies in the service of man and his environment. This course is suited to sensitize
students to the great challenges of the future related to the environment, energy and resources that specifically address Bioengineering for the production, treatment and recovery in the areas of energy, pollution control ecosystems, bio-based polymer materials and biodegradable.
The purpose of the course part is to introduce some concepts of ecology, biotechnology, polymer materials and process engineering such as 3D printing, to prepare the practicle party that should allow
students to develop projects around a common theme.

CONTENT

Ecology and Environmental Sciences: basics of ecology, environmental issues, methods and tools for sustainable management anthroposystems.
Chemical reaction engineering and process engineering: analytics, chemical kinetics, and enzymology management processes.
Biotechnology DNA Microorganisms, genomes, and gene regulation, DNA biotechnology and synthetic biology databases.
Polymers and bio-based materials: organic chemistry, polymerization, structures and properties of bio-based polymer materials, lifecycle and environment.
Modeling: growth models (EDO), chemostat model (dynamic systems), fitting a model of Michaelis-Menten (inferential statistics).
Humanities and social sciences: innovation process, design, users and sustainable development issues; ethical, imaginary representations.
A cycle of 4 rotating practicles are provided for all students suited to learn the biotechnology, enzymology, modeling and study of polymer materials, whatever the project theme they choose.

BIBLIOGRAPHY

Massardier V, Belhaneche-Bensemra N, Lazaric N (2023) Editorial: Alternative building blocks and new recycling routes for polymers: Challenges for circular economy and triggers for innovations. Front Mater DOI: 10: 1152494.

Sandei B, Massardier V and Brunel R (2022), Alternative building blocks sources for poly (ethylene terephthalate): A short review with socio-economical points of view. Front. Mater. 9:1005770. DOI: 10.3389/fmats.2022.1005770

Léa Barbault, Olivier Brette, Nathalie Lazaric, Valérie Massardier and Valérie Revest (2023), Bio-based Plastics: a 'Sustainable' Alternative for the Plastic Industry; Int J Environ Sci Nat Res 31(5): IJESNR.MS.ID.556325 (2023) DOI: 10.19080/IJESNR.2023.31.556325 https://juniperpublishers.com/ijesnr/

A review to guide eco-design of reactive polymer based materials, Emma Delamarche, Valérie Massardier*, Remy Bayard, and Edson Dos Santos, dans Reactive and Functional Polymers Volume Three, Advanced materials, Editors: Gutierrez, Tomy (Ed.), Octobre 2020. https://www.springer.com/gp/book/9783030504564#aboutBook

Chapter "Recyclable and bio-based materials open up new prospects for polymers : Scientific and social aspects" dans le livre « Environmental impact of polymers ». Ed. Th Hamaide, R. Deterre, JF Feller, Wiley, DOI: 10.1002/9781118827116.ch12 Lavoisier-Hermès, 2014.

Chapter Oil-based and bio-derived thermoplastic polymer blends and composites, in Introduction to Renewable Biomaterials: First Principle and Concepts, A.Quitadamo, V. Massardier, M. Valente, A.S. Ayoub, L.A. Lucia Editeurs Wiley: 2017, pp 239-268.

Chapter "Contribution of reactive extrusion to technological and scientific challenges to eco-friendly circular economy", in "Biomass Extrusion and Reaction Technologies: New Insights, Future Potential, and Principles to Practices",, V. Massardier, A.Quitadamo; A.S. Ayoub, L.A. Lucia Editeurs, ACS, 2018.

PRE-REQUISITES

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I5-TF-SH2

ECTS : undefined

HOURS

Cours :	20h
TD :	40h
TP :	30h
Projet :	90h
Evaluation :	8h
Face à face pédagogique :	98h
Travail personnel :	100h
Total :	288h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Course materials available on moodle.
For the project: numerous resources available on moodle: specifications, instructions, tutorials for software and measurements, etc.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalised, see programme below.

CONTENT

The ultimate objective of this P2i is to learn how to transcribe a health, sports, art, everyday life or work situation (performance, well-being, pathology, etc.) into a problem where engineering can make a contribution in terms of analysis, understanding, solution, improvement or optimisation.
* Project (80h)
* Specific courses for the project:
Anatomy/Mechanics (18h)
Strength of Materials (18h)
Applied Mathematics (12h)
SHS (8h + project)
Literature survey (6h)
Life Sciences (6h)
Imaging (6h)
Physical and Sport Education (4 hrs)
Biomaterials (4 hrs)
External contributors (6h)

BIBLIOGRAPHY

PRE-REQUISITES

Knowledge and skills from FIMI courses, in particular Mathematics, Physics and Systems Mechanics.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I2-TF-SH2

ECTS : -

HOURS

Cours :	12h
TD :	56h
TP :	2h
Projet :	98h
Evaluation :	8h
Face à face pédagogique :	78h
Travail personnel :	100h
Total :	276h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Visual course materials (PowerPoint / PDF)
- Exercise handouts
- Practical work handouts
- Physics and chemistry lab equipment
- Project and prototyping materials
- Computer workstations equipped with necessary software

Documents available on Moodle

TEACHING LANGUAGE

French

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AIMS

Currently being finalized, see program below

CONTENT

Project Technical Phases:

1) From Physical Phenomenon to Signal: Study and implementation of physical sensors to measure a signal.
2) From Signal to Sensor Data: Development of appropriate electronic acquisition chains (Op-Amps, filters, ADC).
3) Sensor Data Transmission: Programming Arduino modules to create a wireless sensor network (radio transmission, network protocol).
4) Sensor Data Management: Creation of an SQL database and Java programming to import sensor data in real-time.
5) From Sensor Data to Information: Statistical analysis and data mining of the collected data.
6) Finalization: Final integration and testing of the infrastructure.

The project starts in the 2nd week with a half-day session per week and continues with full sessions during the last 4 weeks.
A project demonstration concludes the P2I.

M1: Physical Sensors & Electronic Acquisition Chains
a) General principles of physical sensors
b) Operation of different sensor families
- Environmental sensors (temperature, pH)
- Mechanical strain sensors (force, pressure, deformation)
- Magnetic sensors (motion, orientation)
c) Functions, analysis, and design of an electronic acquisition chain
d) Current technologies and future challenges

M2: Sensor Data Analysis
a) Introduction to signal processing
b) Descriptive statistics
c) Data visualization
d) Introduction to data mining

M3: Telecommunications Networks & Databases for Sensors
a) Principles of networks
b) Introduction to wireless networks
c) Architecture of sensor databases
d) Data querying and multidimensional aspects

M4: SHES Reflections on Data
a) Innovation & society, the role of the user
b) Major societal issues: "Big Data", "Open Data", "Quantified Self", privacy
c) Conferences: business, public institutions

BIBLIOGRAPHY

PRE-REQUISITES

This program is based on the knowledge and skills taught within the FIMI department at INSA Lyon, which will be supplemented or deepened through the modules and applied to the project:

Physics / Chemistry
- Electrokinetics and Electronics Concepts (Physics 1A)
- Electromagnetism (Physics 1A & 2A)
- Thermodynamics (Thermo 1A)

Mathematics
- Probability / Statistics (Maths in High School)
- Vector Spaces (Maths 1A)
- Distances (Maths 2A)

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I8-TF-SH2

ECTS : undefined

HOURS

Cours :	2h
TD :	78h
TP :	24h
Projet :	78h
Evaluation :	8h
Face à face pédagogique :	112h
Travail personnel :	100h
Total :	290h

ASSESMENT METHOD

Continuous assessment
For all the science teaching modules (mathematics, scientific computing, signal processing, physics), a global assessment of 4h will be carried out as written exam.
For the project, each team will have to develop an image analysis program with Python accompanied by a written report.
The evaluation of the project will also be done through an oral defense .
An activity dedicated to the sustainable development and the social responsibility will lead to a specific evaluation.

TEACHING AIDS

For educational modules, brackets will be specific to each subject.
The teaching modules are designed to provide all the necessary knowledge to the project, representing about half of the hours of the course.
The project will be half in computer room and in an experimental room combining different imaging modalities (X-rays, visible, MRI, ultrasound).
Project Description: analysis and automatic extraction of important information stored in an image/a signal whose acquisition/detection has been optimized.
Steps: understanding the imaging method, analysis of influential parameters to optimize image quality, development of automatic treatment programs adapted to signals and images. Reflection on science-technical-society aspects of the project.

TEACHING LANGUAGE

French

CONTACT

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AIMS

In progress

This course is dedicated to the field of medical imaging (eg, ultrasound, radiology, MRI), and Industrial imaging (non- destructive testing and material characterization).
How to verify that an airplane wing contains no crack? how to detect broken glass in a baby food jar? how to verify the presence of all the components on an electronic board? how to detect cancerous tumors? controlling the growth of a fetus? evaluate the impact of treatment on bone microstructure, measuring the velocity of blood in the arteries ... all these issues are being solved (or partly) through waves (elastic, electromagnetic, corpuscular ...) that interact with matter. Analysis of signals or images resulting from the reception of these waves allows then to extract the desired information on the bushing material.
The objective of this course is to understand the main physical methods of image acquisition, and to give the signal processing bases necessary for their acquisition, optimization, and analysis.
This is a highly interdisciplinary course that combines aspects such as "physics and mathematics", "signal and image processing" and "technology and software" for the vision systems in medical or industrial imaging.

CONTENT

Name and Description of modules:
M1: Physics bases of imaging methods (infra-red and visible imaging, ultrasound sonography, X rays-matter interaction , electron microscopy).
M2: Bases and deepening mathematics (complex Fourier series, Fourier transform, functions of several variables).
M3: Signal Processing Basics (continuous and discrete signals and linear systems convolution, sampling, Fourier transform, direct and frequency domains, frequency analysis, filtering).
M4: Introduction to python and numerical computation.
M5: Waves and Science-Technology-Society: reflection on the waves and health, beneficial / harmful aspects of the same phenomenon ... Study of the ethical, social and cultural aspects of the project.
3 practical courses (TP) will be carried out where both physics experiments and digital processing with Python will be used together. Topics: filtering with an RLC circuit, production and synthesis of a musical signal, analog (optical) and digital filtering of an image.

BIBLIOGRAPHY

PRE-REQUISITES

Prerequisite , deepening :
-use and deepening of general knowledge on mechanical and electromagnetic waves ;
-use of complexes , integration of functions of a real variable , serial concept ;
-deepening of the notions of algorithms and data structures in the field of signal and image processing ;
-articulation with the teachings of Cultures, Science, Societies.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I7-TF-SH2

ECTS : undefined

HOURS

Cours :	22h
TD :	57h
TP :	0h
Projet :	88h
Evaluation :	1h
Face à face pédagogique :	80h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

- a written MCQ test (2 hours) on all theoretical and practical modules
- three mini-projects in the form of reports
- a final Engineering Sciences project in the form of a report, defense and evaluation of other students
- a project in the Humanities and Social Sciences, including the writing of an article and the development of the ability to take a step back, particularly when defending a thesis
- a bibliographical report

TEACHING AIDS

All course documents (pdf of courses, python programs, pdf of project subjects, MCQs, etc.) are available in Moodle: https://moodle.insa-lyon.fr/enrol/index.php?id=2562

TEACHING LANGUAGE

French

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AIMS

Currently being finalized. Please see the program below

CONTENT

- The course will start with 3 modules “from physical phenomena to modeling” in the form of CM and TD: “Particle Dynamics”, “Non-Linear Mechanics” and “Thermal Flows and Transfers”.
- In parallel, 2 Numerical Methods modules will be taught.
- Students will then apply their newly acquired skills in 3 mini-projects associated with the 3 previous modules.
- Finally, they will carry out a final project in groups of 3 to 5 to explore one of the issues raised in the modules, in relation to the world of engineering.
- At the same time, each project group will conduct a human and social science survey to identify the STS (science, technology and society) issues raised by the engineering project.
- Equations and simulations will be solved using the Python language.

BIBLIOGRAPHY

Calcul différentielle et équations différentielle - Dunod - Science Sup (2021)

PRE-REQUISITES

FIMI undergraduate courses: solid dynamics, mathematics, Python programming, thermodynamics....

IDENTIFICATION

CODE : FIMI-2-S2-EC-MA-TF
ECTS : 5

HOURS

Cours :	19.5h
TD :	35h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	56.5h
Travail personnel :	80h
Total :	136.5h

ASSESMENT METHOD

The evaluation includes 2 written interrogations of 2 hours

TEACHING AIDS

Moodle

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

AAv4.1 – Determine the power series expansion of a given function.
AAv4.2 – Use power series to solve a linear differential equation with polynomial coefficients.
AAv4.3 – Determine the quadratic form associated with a bilinear form, and vice versa.
AAv4.4 – Perform the reduction and diagonalization of a quadratic form.
AAv4.5 – Determine the orthogonal complement of a vector subspace and compute an orthonormal basis with respect to a given inner product.
AAv4.6 – Use the notion of projection to solve certain optimization problems involving an inner product.
AAv4.7 – Study the continuity of a multivariable function and compute directional derivatives when they exist.
AAv4.8 – Use the differential and the Hessian to compute the second-order Taylor expansion (DL2) of a multivariable function, especially to study the nature of critical points.

CONTENT

Power series (2)
Bilinear algebra
Differential Calculus 2 (extreme values, implicit function theorem, implicit surfaces)

BIBLIOGRAPHY

(1) Analyse et algèbre : cours de mathématiques de deuxième année avec exercices corrigés et illustrations avec Maple, Stéphane Balac et Laurent Chupin , Presses polytechniques et universitaires romandes.
(2) F. Butin, M. Picq et J. Pousin : Mathématiques, cours et exercices corrigés - 2ème année de classes préparatoires (Ellipse) 2013.

PRE-REQUISITES

Mathematics Syllabus for PC-S3-MA-AEMP

Informatics and numerical society 4

IDENTIFICATION

CODE : FIMI-2-S2-EC-ISN-TF
ECTS : toto

HOURS

Cours :	4h
TD :	27.5h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	33h
Travail personnel :	20h
Total :	53h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes :

AAv4.1 : At the end of S4, students will be able to use object-oriented and event-driven deve-lopment paradigms in Python, in particular by creating graphical user interfaces.

AAv4.2 : At the end of S4, students will be able to design and develop, as part of a team, a complex modular Python program to meet a set of specifications they have defined.

AAv4.3 : At the end of S4, students will be able to identify the economic, social, political and imaginary issues involved in using a specific digital technology in a real-life situation.

AAv4.4 : At the end of S4, students have acquired, through their work in sessions and inde-pendently, the general digital culture skills enabling them to take the Pix certification with an average level of 4.

CONTENT

1 - Object-oriented programming

2 - Matching algorithms, algorithmic properties and social issues

3 - Development of graphical user interfaces

4 - Project (in groups of four): definition of a mini-specification, analysis and definition of a solution, use of third-party libraries, identification of an algorithmic problem, realization in Python.

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-2-S1-EC-ISN

System Mechanics 2

IDENTIFICATION

CODE : FIMI-2-S2-EC-MS-TF-SH1
ECTS : 2.00

HOURS

Cours :	7h
TD :	21h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	30h
Total :	59.5h

ASSESMENT METHOD

- 1 Written Test (WT2) of 1.5 hour
- 1 Final Test (FT2) of 2.5 hours.
Average : (WT2*1.5+FT2*2.5)/4

TEACHING AIDS

- lecture notes and presentations
- exercices book (the same for all the 2nd year students)
Documents available on Moodle

TEACHING LANGUAGE

French
English

CONTACT

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M. Saulot Aurélien :
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AIMS

Target Learning Outcomes (AvA):

Aav.1 - Model a real mechanical system of bounded complexity including the specific dynamic behavior laws (ex: shock absorber, motor, intersolid contact...)

Aav.2 - Perform the complete energy balance of the mechanical system, then establish the mechanical equations associated with this balance and verify the dimensional homogeneity of the results obtained

Aav.3 - Perform a complete mechanical balance of the mechanical system, then optimize this balance for the establishment of equations of motion of this system

Aav.4 - Establish the characteristics of the operation of a mechanical system based on the equations established and verify the dimensional homogeneity of the results obtained

CONTENT

MASS GEOMETRY : Notion of mass, center of mass and center of inertia of a solid, operator of inertia, moments and products of inertia, Huygens theorem, principal and central frames of inertia, balancing.

KINETICS: Kinetic, dynamic screws and kinetic energy for one isolated solid, for a set of solids.

DYNAMICS: Fundamental principle of Dynamics and General Theorems (vectorial form), classification of Galilean (Newtonian or Inertial) frames depending on the studied phenomena. Force wrench transferred by joints taking into account friction, Coulombs friction (sum and moment), viscous dissipation, rheology of some usual mechanical components, and mechanical actions by actuators. Selection of the sub-system(s) to be isolated depending on the simulation objective(s): equations of motion and/or mechanical actions. Position of equilibrium, stationary positions and, for systems with a single degree-of mobility, linearized equation of motion and stability. First order equations, power, work, kinetic energy theorem, force and potential, first order equations derived from kinetic energy

BIBLIOGRAPHY

AGATI Mécanique Industrielle Dunod
BEGHIN Cours de mécanique théorique Gauthier-Villar
BELLET Problème de mécanique Cepadues editions
BERKELEY Cours de Physique 1 Armand Colin
BONCOMPAIN Méca. des Syst. Indus. (T2) Dunod
BROSSARD Mécanique Générale Tech. de l'Ingénieur AF4
BROUSSE Cours de mécanique Collection U
BONE Mécanique Générale (crs et ap.) Dunod U
CAZIN Cours de mécanique générale Gauthier-Villar
ROY Mécanique du solide rigide Dunod
LASSIA Cinématique Ellipse
LASSIA-BARD Dynamique Ellipse

PRE-REQUISITES

- System mechanics 1
- Vectors and Linear algebra
- Ordinary Differential Equations
- Mechanical design.

IDENTIFICATION

CODE : FIMI-2-S2-EC-PH-TF
ECTS : 4

HOURS

Cours :	7h
TD :	33.5h
TP :	16.5h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	59h
Travail personnel :	50h
Total :	109h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical reports.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Establish the propagation equations verified by the quantities characterising a wave, from which deduce the specific impedance.
AAv.2 Deduce the expression and fully characterise a wave propagating in an unlimited and limited medium with or without dissipation.
AAv.3 Express the transported power and identify the experimental conditions for its measurement.
AAv.4 Determine the expression of the intensity in the case of two-wave interference and predict the interference pattern and use simple interferometric devices to measure physical quantities.
AAv.5 Apply the concepts seen on waves in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, conduct a critical analysis, write a report.

CONTENT

The fourth semester is entirely devoted to the propagation of waves. It contains three chapters. The first chapter concerns the propagation of waves in unlimited media with a first part on mechanical waves and a second part on electromagnetic waves (introduction, propagation equation, impedance, power transported). The second chapter deals with propagation in limited media with the notions of reflection and transmission coefficients, superposition of incident and reflected waves. The last chapter deals with interferences (interference conditions, two-source interference, specificity of light waves).

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

This course will also use the mathematical tools and skills that will be learnt all along the first year, and of course the physics curriculum of the first 3 semesters (dimensions, uncertainties, electricity, mechanics, electromagnetism).

IDENTIFICATION

CODE : FIMI-2-S2-EC-STA-TF
ECTS : *

HOURS

Cours :	0h
TD :	0h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	0h
Travail personnel :	25h
Total :	25h

ASSESMENT METHOD

The internship report will be assessed by a lecturing engineer, in charge of monitoring a group in 1A and 2A (in 2A, 1A groups are reformed).

TEACHING AIDS

Two guides will be distributed (in pdf, available on Moodle):
- a guide to finding an internship, in November 1A
- a guide to writing an internship report, in April 1A, with a grading scale.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

This is the first concrete experience of working in a company for INSA Lyon students.
This internship lasts a minimum of 4 weeks and is carried out by students at the end of their 1st year.
It meets a number of key objectives:
- Experience working as part of a team (live the daily life of operators, measure the repetitive nature and arduousness of their tasks).
- Discover, observe and understand corporate life and human relations.
- Observe and study the work environment.

The skills developed revolve around the following points:
- Observe the immediate environment (workstation, team and workshop operations). workshop operations).
- Discovering mechanisms and organizations (technical, social, structural) through exchanges with those involved and by researching authorized and validated documents within the company.
- Gather different points of view, confirm or refute certain assertions.
- Know how to change initial preconceptions.
- Listen to employees to guide your thinking on management perspectives.

CONTENT

- Internship period: during the summer (from the last week of June to July 31), between 1st and 2nd year at INSA Lyon.
- Duration: minimum 4 weeks, explicitly specified in the internship agreement.
- Conditions: teamwork.
- Contractualization: this internship is the subject of an internship agreement signed by INSA Lyon, the host organization and the intern, setting out the commitments and responsibilities of INSA Lyon, the host organization and the student, and specifying the intern's activity during the internship period. Experience in the form of an employment contract (CDD) is also accepted.
- The internship is the subject of an internship report, which is graded by an INSA engineer. This engineer follows a group of students with two presentations in 1A (before the internship) and two in 2A (after the internship). The first is an account of the professions involved, with an approach to the business world, while the second focuses on the internship, respect for the environment, rules and regulations, attitudes to adopt and behavior. The 1st year groups are reformed in the 2nd year for a debriefing session in September/October, and a session to hand in the corrected and graded internship reports in February.

BIBLIOGRAPHY

PRE-REQUISITES

No particular prerequisites for this course.

Spanish Language and Civilisation

IDENTIFICATION

CODE : FIMI-2-S2-EC-LCE
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- editing and public broadcast of the report (80%)
- presentation and defence of the report (20%)

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

SKILLS

Targeted
CT4: SHOW CREATIVITY

Mobilised
CT2: WORK, LEARN, DEVELOP IN AN AUTONOMOUS WAY
CT3: INTERACT WITH OTHERS, WORK AS PART OF A TEAM
CT7: WORK IN AN INTERNATIONAL AND CULTURAL CONTEXT

CONTENT

Classes are taught solely in Spanish. The LCE course consists of a language course (see description in the Spanish course offer) and a Spanish Civilisation course during which a video project will be produced during the study trip (5 to 6 days) to Spain.
The audiovisual project that the students will have to produce during their stay in Spain will be done in groups of four. The students will have one year to work on a societal issue that interests them; this issue may be directly linked to the city in which we will be staying or may be broader in scope: the question of independence, gender equality, bullfighting, etc. The video production may be a short documentary or a short film. The video production could be a short documentary or a report on the chosen issue. Part of the report will consist of interviews with specialists in the field (canvassed by the students).
The first semester is devoted to choosing the destination, organising the trip, researching the subject beforehand (problematisation of a subject, researching specialists), an introduction to photography (types of shots, meanings, use of equipment) and preparing a precise shooting plan.

The stay of a few days (in February, at the very beginning of S2) will be devoted to discovering the city and its culture, and several compulsory cultural activities will take place. The students will be given complete autonomy to conduct interviews with specialists as well as strangers, to fuel discussion on the subject.
On their return, the second semester will be devoted to selecting the images, sounds and interviews that will appear in the report, editing it and producing French subtitles (particularly in language classes).

BIBLIOGRAPHY

PRE-REQUISITES

Be enrolled in Spanish in 1st year. At least A2 level, but B1/B2 is strongly recommended for interviews. Selection based on a letter of application in Spanish (from the previous May).

German language and culture

IDENTIFICATION

CODE : FIMI-2-S2-EC-OPAL
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- Language: continuous assessment + B1 and B2 level tests (internal or Goethe Institut).
- in civilisation: continuous assessment + presentations in German on themes related to the project; progress reports on the project
- Audiovisual project: presentation of the project (screening of the report) to a panel of PC and Humanities teachers.

TEACHING AIDS

TEACHING LANGUAGE

French

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AIMS

Humanities reference framework:
CT2 - WORK, LEARN, DEVELOP IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK WITH TEAMS
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a well-argued way

3.2 - Situate one's original discourse using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3.5 - Manage conflicts, balance individual and collective interests
3. 6 - Take part in a group project: build and run a project, develop it; be aware of his/her role and responsibilities
4.1 - Develop a creative approach, including artistic ones
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5. 1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.

CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in discourse, attitudes and behaviour
7.3 - Relativising values, beliefs and behaviour
7.4 - Integrating cultural diversity into group work

CONTENT

- become familiar with the use of the German language as a means of communication
- analyse cultural, political and artistic aspects of German-speaking countries
- learn how to set up and manage a Franco-German project in the field of science and technology or in the social and cultural field
- produce audio-visual reports in German in line with the year's theme
- learn how to present the results to the public (exhibition, round table, etc.).)

Semester 3: Definition and implementation of the project:
Language course: Study of the German language with the aim of acquiring a fluent language and a minimum level of B1 (according to the European reference framework); level B2 targeted. The aim is for the students to communicate with their partners, to conduct interviews and reports in German and to present INSA in German to secondary school pupils.
Civilisation classes: classes are held in German. They focus on German civilisation + exchanges with partners in Germany but also on current political and cultural events. The course is based on cultural activities in the Lyon region (theatre, exhibitions, conferences, etc.) relating to German culture
Audiovisual project: preparation of an audiovisual report: work on audiovisual language, interview techniques, technical aspects, etc.

BIBLIOGRAPHY

- CALLA Cécile, Tour de Franz - Mein Rendezvous mit dem Deutschen, Hamburg: Ullstein 2009,
- CHAPOUTEAU Johann: Histoire de l'Allemagne (1806 à nos jours) Paris : PUF,2014, 128p
- HUGHES Pascale , Marthe et Mathilde, Hamburg :Rowohlt TB, 2010 .
- MEYER Michel , Le roman de l'Allemagne : Ou l'histoire secrète d'une renaissance...; Paris 2013, 344p
- TOURNIER Michel , Le bonheur en Allemagne ?, Paris :Folio 2004,
- de la VAISSIERE Jean-Louis: Qui sont les Allemands ? Préface de Volker Schlöndorff Paris : Max Milo, 2011 384 p.
- WICKERT Ulrich, Frankreich die wunderbare Illusion, München: Heyne, 1998,
- In addition, there is a specific bibliography based on the theme studied during the year

For more information, visit the OPAL option website:
http://leshumas.insa-lyon.fr/langues/allemand/page_allemande/engager/opal/1_opal.html

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

FORMATION INITIALE AUX METIERS D'INGENIEUR

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

European Identities and Cultures

IDENTIFICATION

CODE : FIMI-2-S2-EC-CUID
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

Production of audio-visual reports

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Humanities reference framework:
CT2 - WORK, LEARN, DEVELOP IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK WITH TEAMS
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a reasoned way

3.2 - Situate one's original speech using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3. 5 - Manage conflicts, balance individual and collective interests
3.6 - Take part in a group project: build and run a project, develop it; be aware of your role and responsibilities
4. 1 - Develop a creative approach, including an artistic one
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.

CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in discourse, attitudes and
behaviour
7.3 - Putting values, beliefs and behaviour into perspective
7.4 - Integrating cultural diversity into group work

CONTENT

Examination of the concept of identity and, more specifically, European cultural identity.
- Raising awareness of inter-cultural issues
- Study of European current affairs and in-depth examination of a number of specific issues (immigration, minorities, sovereign debts, etc.)
- Conduct of a collective study and travel project in conjunction with partners in one of the "European cultural capitals"
- Production of video reports in one of the cultural capitals on a variety of subjects (cultural, political, social or other)

Semester 3: Definition and implementation of the project:

Initially, students will examine the very notion of culture.
This awareness-raising work on a personal and concrete scale will serve as a basis for investigating the issues highlighted by the European Capitals of Culture.

Contacts will be established with partners involved in reflection on European issues. Regular exchanges on the issue of cultural identity will be held with them. Information evenings and debates may be organised. A special website or blog will be set up on which work in progress and the results will be posted.

BIBLIOGRAPHY

CARPENTIER Jean, LEBRUN François (directions), Histoire de l'Europe, Paris, Seuil, 1990
CAUTRES Bruno : Les Européens aiment-ils (toujours) l'Europe ? Paris : La Documentation Française, 2014, 214p
ECO Umberto, La Recherche De La Langue Parfaite Dans La Culture Européenne, Paris, Seuil, 1994
KRISTEVA Julia, Europe Des Cultures Et Culture Européenne : Communauté Et Diversité, Paris, Hachette, 2008
MATTEI Jean-François, Le Regard Vide. Essai Sur L'épuisement De La Culture Européenne, Paris, Flammarion, 2007
MAK Geert : Voyage d¿un Européen à travers le XXe siècle Paris : Gallimard, 2004 (éd.frç.:2010), 944p
RODAN Martin, Notre culture européenne, cette inconnue, Bern, Peter Lang, 2009
SAPIRO Gisèle (dir.), L'espace intellectuel en Europe. De la formation des Etats-nations à la mondialisation XIXè-XXIè siècles, Paris, La Découverte, 2009
THIESSE Anne-Marie : la création des identités nationales Paris :Seuil 2001, 212 p
TODD Emmanuel, L'invention de l'Europe, Paris, Seuil, 1990

There is also a specific bibliography based on the countries studied during the year

A regularly updated bibliography can be consulted on the website: http://leshumas.insa-lyon.fr/cuid

PRE-REQUISITES

The course must have been taken in S3.

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Civilisation - projects 2

IDENTIFICATION

CODE : FIMI-2-S2-EC-CIP
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- a group podcast
- an individual piece of writing

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Skills
* Targeted
- INSA, Humanities Competency Framework
5. Acting responsibly in a complex world
7. Working in an international and intercultural context.
* Mobilised
- CEFR
- Written and oral comprehension and expression (CEFR)
- INSA, Humanities skills reference framework
3. Interacting with others, working in a team.

CONTENT

This course is designed as a continuation of the 1st year Contemporary Latin American Civilisations course, with two distinct but complementary parts: a theoretical and documentation part (history course, 1 hour per week) and a practical part (four humanitarian projects that students will take part in each year: also 1 hour per week).
The theoretical part will focus on the establishment of the nation-state in Latin America from the 19th century onwards, as an exogenous model (Western and European) imposed by a sector of the population. In S3 we will be looking in particular at the continuities of the colonial past that persist to the present day and are reflected in a socio-economic structure that still retains very strong traces of colonial racism. At the same time, we will also look at the breaks with this colonial past and how there are specific features in this region of the world, particularly with regard to certain vulnerable population groups (women, indigenous communities, LGBT groups, migrants).
In parallel, for the practical part (S3 and S4), students will be in charge of various humanitarian projects and will organise different activities to publicise these associations on campus. They will learn how to manage an association and its treasury, how to deal with other associations and institutions, how to disseminate information and work with social networks, how to create a website, etc.

BIBLIOGRAPHY

- Amérique latine : introduction à l'Extrême-Occident, Alain Rouquié (1987)
- Naissance des nations, Clément Thibaud (2007)
- Race et colonialité du pouvoir, Anibal Quijano (2007)
- Histoire de l'Etat-Nation : de la politique d'intégration en Amérique Latine et en Europe, J. Gonzalez (2010)

PRE-REQUISITES

The course must have been taken in S3

Cultures, Sciences and Societies

IDENTIFICATION

CODE : FIMI-2-S2-EC-CSS-FI
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

1 individual or group written statement of intent, interim research report and annotated bibliography
1 group oral presentation such as a dramatised lecture

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

CT2 - WORK, LEARN, GROW IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a reasoned way
3.2 - Situate one's original speech using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3. 5 - Manage conflicts, balance individual and collective interests
3.6 - Take part in a group project: build and run a project, develop it; be aware of your role and responsibilities
4. 1 - Develop a creative approach, including artistic
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions...
CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in discourse, attitudes and behaviour
7.3 - Relativising one's values, beliefs and behaviour
7.4 - Integrating cultural diversity in the workplace

CONTENT

In line with the arts and culture policy, this final SHS course is an opportunity to combine the approach developed in the first semester around the question of 'how the social world works and how it affects us'. The themes may vary depending on the course, but the framework is the same: each sub-group produces
research on a specific theme with a written statement of intent, and presents the answers to their questions in the form of dramatised lectures or a forum theatre.

BIBLIOGRAPHY

Biblio-webography provided by the teacher

PRE-REQUISITES

The prerequisites are the skills acquired in the previous semesters in Social Sciences and Humanities courses.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I4-TF-SH2

ECTS : *

HOURS

Cours :	45h
TD :	31h
TP :	16h
Projet :	71h
Evaluation :	5h
Face à face pédagogique :	97h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

Lecture notes, course slides, problem sets with solutions.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized, see program below.
Eventually:
List of P2i Learning Outcomes (common and specific)

CONTENT

1. Humanities and Social Sciences Project: Study of a technical system.
2. Project: Design and fabrication of a solar thermal energy recovery system.
3. Introduction to fuel sources.
4. Historical perspectives on energy and energy transition pathways.
5. Performance of energy conversion systems.
6. Mechanical design for renewable energies.

BIBLIOGRAPHY

PRE-REQUISITES

Knowledges and courses from semester 1 of the second year

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I3-TF-SH2

ECTS : undefined

HOURS

Cours :	16h
TD :	70h
TP :	32h
Projet :	70h
Evaluation :	8h
Face à face pédagogique :	126h
Travail personnel :	100h
Total :	296h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Poly, slideshows, tutorials, online answer keys... all the content is available on Moodle.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Propose and design a mechanical system that responds critically to an expressed need, while taking into account the requirements of the system's life cycle, particularly with regard to environmental impact, the societal context of its use, manufacturing requirements and economic constraints.

Situate their design approach within the more general framework of a low-tech approach, the philosophical and practical foundations of which will be illustrated by examples of products/services

Relate their engineering choices to the needs of societal transformation, in particular by characterising the low-tech approach as a lever for action, with its scope and limits, for an economy that is compatible with planetary limits and socially just.

Choose an appropriate production process, taking into account its impact on geometry, choice of material and compatibility with the function

Implement the chosen process, with or without the help of a specialist depending on the degree of complexity identified, adapting the degree of autonomy and choosing a methodology that guarantees the safety of people and the integrity of the means of production.

Analyse a contemporary low-tech issue by means of a collective investigation leading to the writing of a popular science article.

Within a project group, identify and allocate tasks in such a way as to encourage involvement, autonomy and initiative on the part of each member, as well as communication and the quality of exchanges, arguments and collective choices.

Identify key words to find bibliographical sources related to a problem or a project theme, choose and explain the criteria for evaluating documents in terms of reliability, relevance and scientificity and develop an argument for the documents chosen, reference bibliographical sources in a written or oral production.

CONTENT

Knowledge of families of materials and applications to the choice of materials for mechanical design

Strength of materials, dimensioning using beam theory, buckling, basics of finite element modelling and associated applications

Simulation of mechanical behaviour

Lifecycle analysis, methodology and application, creation of environmental data in the case of a forming process

Statistical tools for quality management: linear regression, data manipulation, probabilities, application to measurements

Production management: typology of production systems, management of technical data, type of layout, load-capacity balance of a production system, stock management and planning tools.

Documentary research method

Agile manufacturing: numerically controlled machining (lathe and milling machine), multi-material and metal laser cutting, sheet metal forming by folding, rolling, mechanically welded and mechanically assembled construction.

Exploring the low-tech approach as a means of engineering a profound social and ecological transformation. Training in the popularisation of scientific discourse

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

FORMATION INITIALE AUX METIERS D'INGENIEUR

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Innovation by mechatronics and robotics Course

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I6-TF-SH2

ECTS : undefined

HOURS

Cours :	20h
TD :	67h
TP :	8h
Projet :	72h
Evaluation :	1h
Face à face pédagogique :	96h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

Continuous assessment
Servoing: 1 individual evaluation, 3 sessions over 5 sessions.
Perception / Action: 1 group assessment, TP report on 4h.
Programming & Communication: 1 assessment in situation by binomial, 1 written individual assessment
Design: 1 individual evaluation, CAD rendering, for the duration of the sessions.
Project : 1 individual evaluation throughout the duration of the sessions, 1 individual evaluation by the pairs, 1 group assessment during the Sciences Fair.
Documentary research: 1 individual assessment in writing
Humanities: 1 individual assessment in writing, having to write outside the niches., 1 written group assessment, article to be made.

TEACHING AIDS

LMS Moodle

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized, see program below.
The students will design a prototype using mechatronics and robotics. The project theme is common to all groups and is chosen each year, it addresses the whole field of possibilities of robotics. The chosen theme should: enable a realization at the level of what students can do, allow to find a multitude of solutions, question the role of robotics in society, link the P2I to the real world with a shared project with " clients, "finding a place in the daily life of a young
humanist student.
The creations are made from a functional specification. Each group composed of a dozen students will start the project with a search for solutions with ideation sessions (brainstorming, TRIZ, 6 hats, mental map). The selected solutions are the subject of a mechanical design study with 3D modeling, mechanical simulation, multiphysical modeling, Lego model, validation experiments ...
The prototypes are made by the students in 3 workshops according to the needs: machining, metal construction, additive manufacturing.
The electronics of the prototypes are 80% commercial cards: arduino, power cards, axis servo, video recognition ... Some cards are designed and manufactured by students for specific needs: Lego / electronic interfaces, sound controls...
The control of the prototypes is done in several layers: a real-time layer on a microcontroller and a remote layer for the HMI on PC (Java) or tablet / tel (Android).
Wired communications use serial or I2C protocols, wireless communications use WIFI in UDP or TCP.

CONTENT

Project 78h
Servoing 16h
Programmation & Communication 26h
Sensors /Actuators 12h
Energy 2h
Humanities 30h
Documentary Research 4h

BIBLIOGRAPHY

PRE-REQUISITES

S1, S2 and S3 Mechanical design
S3 Manufacturing
S3 Mechatronics

Bio-based materials, engineering and the environment

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I1-TF-SH2

ECTS : 10

HOURS

Cours :	44h
TD :	86h
TP :	50h
Projet :	10h
Evaluation :	8h
Face à face pédagogique :	188h
Travail personnel :	100h
Total :	298h

ASSESMENT METHOD

1 one-hour individual test per module (including practical work) of core courses.

Individual practical assessment.

Collective writing of an Humanity article.

Documentary and Humanity research (common report with two separate parts) collectively.

Poster or intermediate defense. Project presentation (Poster...) collectively.

Final defense collectively.

Collective evaluations are carried out in groups of 4 to 8 students.

TEACHING AIDS

Lectures
Tutorial
Practical work
Project

TEACHING LANGUAGE

French

CONTACT

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AIMS

Face to environmental issues related to the problems of resource management and protection of our ecosystems, future engineers must be aware of the need to develop new sustainable technologies in the service of man and his environment. This course is suited to sensitize
students to the great challenges of the future related to the environment, energy and resources that specifically address Bioengineering for the production, treatment and recovery in the areas of energy, pollution control ecosystems, bio-based polymer materials and biodegradable.
The purpose of the course part is to introduce some concepts of ecology, biotechnology, polymer materials and process engineering such as 3D printing, to prepare the practicle party that should allow
students to develop projects around a common theme.

CONTENT

Ecology and Environmental Sciences: basics of ecology, environmental issues, methods and tools for sustainable management anthroposystems.
Chemical reaction engineering and process engineering: analytics, chemical kinetics, and enzymology management processes.
Biotechnology DNA Microorganisms, genomes, and gene regulation, DNA biotechnology and synthetic biology databases.
Polymers and bio-based materials: organic chemistry, polymerization, structures and properties of bio-based polymer materials, lifecycle and environment.
Modeling: growth models (EDO), chemostat model (dynamic systems), fitting a model of Michaelis-Menten (inferential statistics).
Humanities and social sciences: innovation process, design, users and sustainable development issues; ethical, imaginary representations.
A cycle of 4 rotating practicles are provided for all students suited to learn the biotechnology, enzymology, modeling and study of polymer materials, whatever the project theme they choose.

BIBLIOGRAPHY

Massardier V, Belhaneche-Bensemra N, Lazaric N (2023) Editorial: Alternative building blocks and new recycling routes for polymers: Challenges for circular economy and triggers for innovations. Front Mater DOI: 10: 1152494.

Sandei B, Massardier V and Brunel R (2022), Alternative building blocks sources for poly (ethylene terephthalate): A short review with socio-economical points of view. Front. Mater. 9:1005770. DOI: 10.3389/fmats.2022.1005770

Léa Barbault, Olivier Brette, Nathalie Lazaric, Valérie Massardier and Valérie Revest (2023), Bio-based Plastics: a 'Sustainable' Alternative for the Plastic Industry; Int J Environ Sci Nat Res 31(5): IJESNR.MS.ID.556325 (2023) DOI: 10.19080/IJESNR.2023.31.556325 https://juniperpublishers.com/ijesnr/

A review to guide eco-design of reactive polymer based materials, Emma Delamarche, Valérie Massardier*, Remy Bayard, and Edson Dos Santos, dans Reactive and Functional Polymers Volume Three, Advanced materials, Editors: Gutierrez, Tomy (Ed.), Octobre 2020. https://www.springer.com/gp/book/9783030504564#aboutBook

Chapter "Recyclable and bio-based materials open up new prospects for polymers : Scientific and social aspects" dans le livre « Environmental impact of polymers ». Ed. Th Hamaide, R. Deterre, JF Feller, Wiley, DOI: 10.1002/9781118827116.ch12 Lavoisier-Hermès, 2014.

Chapter Oil-based and bio-derived thermoplastic polymer blends and composites, in Introduction to Renewable Biomaterials: First Principle and Concepts, A.Quitadamo, V. Massardier, M. Valente, A.S. Ayoub, L.A. Lucia Editeurs Wiley: 2017, pp 239-268.

Chapter "Contribution of reactive extrusion to technological and scientific challenges to eco-friendly circular economy", in "Biomass Extrusion and Reaction Technologies: New Insights, Future Potential, and Principles to Practices",, V. Massardier, A.Quitadamo; A.S. Ayoub, L.A. Lucia Editeurs, ACS, 2018.

PRE-REQUISITES

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I5-TF-SH2

ECTS : undefined

HOURS

Cours :	20h
TD :	40h
TP :	30h
Projet :	90h
Evaluation :	8h
Face à face pédagogique :	98h
Travail personnel :	100h
Total :	288h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Course materials available on moodle.
For the project: numerous resources available on moodle: specifications, instructions, tutorials for software and measurements, etc.

TEACHING LANGUAGE

French

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AIMS

Currently being finalised, see programme below.

CONTENT

The ultimate objective of this P2i is to learn how to transcribe a health, sports, art, everyday life or work situation (performance, well-being, pathology, etc.) into a problem where engineering can make a contribution in terms of analysis, understanding, solution, improvement or optimisation.
* Project (80h)
* Specific courses for the project:
Anatomy/Mechanics (18h)
Strength of Materials (18h)
Applied Mathematics (12h)
SHS (8h + project)
Literature survey (6h)
Life Sciences (6h)
Imaging (6h)
Physical and Sport Education (4 hrs)
Biomaterials (4 hrs)
External contributors (6h)

BIBLIOGRAPHY

PRE-REQUISITES

Knowledge and skills from FIMI courses, in particular Mathematics, Physics and Systems Mechanics.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I2-TF-SH2

ECTS : -

HOURS

Cours :	12h
TD :	56h
TP :	2h
Projet :	98h
Evaluation :	8h
Face à face pédagogique :	78h
Travail personnel :	100h
Total :	276h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Visual course materials (PowerPoint / PDF)
- Exercise handouts
- Practical work handouts
- Physics and chemistry lab equipment
- Project and prototyping materials
- Computer workstations equipped with necessary software

Documents available on Moodle

TEACHING LANGUAGE

French

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AIMS

Currently being finalized, see program below

CONTENT

Project Technical Phases:

1) From Physical Phenomenon to Signal: Study and implementation of physical sensors to measure a signal.
2) From Signal to Sensor Data: Development of appropriate electronic acquisition chains (Op-Amps, filters, ADC).
3) Sensor Data Transmission: Programming Arduino modules to create a wireless sensor network (radio transmission, network protocol).
4) Sensor Data Management: Creation of an SQL database and Java programming to import sensor data in real-time.
5) From Sensor Data to Information: Statistical analysis and data mining of the collected data.
6) Finalization: Final integration and testing of the infrastructure.

The project starts in the 2nd week with a half-day session per week and continues with full sessions during the last 4 weeks.
A project demonstration concludes the P2I.

M1: Physical Sensors & Electronic Acquisition Chains
a) General principles of physical sensors
b) Operation of different sensor families
- Environmental sensors (temperature, pH)
- Mechanical strain sensors (force, pressure, deformation)
- Magnetic sensors (motion, orientation)
c) Functions, analysis, and design of an electronic acquisition chain
d) Current technologies and future challenges

M2: Sensor Data Analysis
a) Introduction to signal processing
b) Descriptive statistics
c) Data visualization
d) Introduction to data mining

M3: Telecommunications Networks & Databases for Sensors
a) Principles of networks
b) Introduction to wireless networks
c) Architecture of sensor databases
d) Data querying and multidimensional aspects

M4: SHES Reflections on Data
a) Innovation & society, the role of the user
b) Major societal issues: "Big Data", "Open Data", "Quantified Self", privacy
c) Conferences: business, public institutions

BIBLIOGRAPHY

PRE-REQUISITES

This program is based on the knowledge and skills taught within the FIMI department at INSA Lyon, which will be supplemented or deepened through the modules and applied to the project:

Physics / Chemistry
- Electrokinetics and Electronics Concepts (Physics 1A)
- Electromagnetism (Physics 1A & 2A)
- Thermodynamics (Thermo 1A)

Mathematics
- Probability / Statistics (Maths in High School)
- Vector Spaces (Maths 1A)
- Distances (Maths 2A)

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I8-TF-SH2

ECTS : undefined

HOURS

Cours :	2h
TD :	78h
TP :	24h
Projet :	78h
Evaluation :	8h
Face à face pédagogique :	112h
Travail personnel :	100h
Total :	290h

ASSESMENT METHOD

Continuous assessment
For all the science teaching modules (mathematics, scientific computing, signal processing, physics), a global assessment of 4h will be carried out as written exam.
For the project, each team will have to develop an image analysis program with Python accompanied by a written report.
The evaluation of the project will also be done through an oral defense .
An activity dedicated to the sustainable development and the social responsibility will lead to a specific evaluation.

TEACHING AIDS

For educational modules, brackets will be specific to each subject.
The teaching modules are designed to provide all the necessary knowledge to the project, representing about half of the hours of the course.
The project will be half in computer room and in an experimental room combining different imaging modalities (X-rays, visible, MRI, ultrasound).
Project Description: analysis and automatic extraction of important information stored in an image/a signal whose acquisition/detection has been optimized.
Steps: understanding the imaging method, analysis of influential parameters to optimize image quality, development of automatic treatment programs adapted to signals and images. Reflection on science-technical-society aspects of the project.

TEACHING LANGUAGE

French

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AIMS

In progress

This course is dedicated to the field of medical imaging (eg, ultrasound, radiology, MRI), and Industrial imaging (non- destructive testing and material characterization).
How to verify that an airplane wing contains no crack? how to detect broken glass in a baby food jar? how to verify the presence of all the components on an electronic board? how to detect cancerous tumors? controlling the growth of a fetus? evaluate the impact of treatment on bone microstructure, measuring the velocity of blood in the arteries ... all these issues are being solved (or partly) through waves (elastic, electromagnetic, corpuscular ...) that interact with matter. Analysis of signals or images resulting from the reception of these waves allows then to extract the desired information on the bushing material.
The objective of this course is to understand the main physical methods of image acquisition, and to give the signal processing bases necessary for their acquisition, optimization, and analysis.
This is a highly interdisciplinary course that combines aspects such as "physics and mathematics", "signal and image processing" and "technology and software" for the vision systems in medical or industrial imaging.

CONTENT

Name and Description of modules:
M1: Physics bases of imaging methods (infra-red and visible imaging, ultrasound sonography, X rays-matter interaction , electron microscopy).
M2: Bases and deepening mathematics (complex Fourier series, Fourier transform, functions of several variables).
M3: Signal Processing Basics (continuous and discrete signals and linear systems convolution, sampling, Fourier transform, direct and frequency domains, frequency analysis, filtering).
M4: Introduction to python and numerical computation.
M5: Waves and Science-Technology-Society: reflection on the waves and health, beneficial / harmful aspects of the same phenomenon ... Study of the ethical, social and cultural aspects of the project.
3 practical courses (TP) will be carried out where both physics experiments and digital processing with Python will be used together. Topics: filtering with an RLC circuit, production and synthesis of a musical signal, analog (optical) and digital filtering of an image.

BIBLIOGRAPHY

PRE-REQUISITES

Prerequisite , deepening :
-use and deepening of general knowledge on mechanical and electromagnetic waves ;
-use of complexes , integration of functions of a real variable , serial concept ;
-deepening of the notions of algorithms and data structures in the field of signal and image processing ;
-articulation with the teachings of Cultures, Science, Societies.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I7-TF-SH2

ECTS : undefined

HOURS

Cours :	22h
TD :	57h
TP :	0h
Projet :	88h
Evaluation :	1h
Face à face pédagogique :	80h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

- a written MCQ test (2 hours) on all theoretical and practical modules
- three mini-projects in the form of reports
- a final Engineering Sciences project in the form of a report, defense and evaluation of other students
- a project in the Humanities and Social Sciences, including the writing of an article and the development of the ability to take a step back, particularly when defending a thesis
- a bibliographical report

TEACHING AIDS

All course documents (pdf of courses, python programs, pdf of project subjects, MCQs, etc.) are available in Moodle: https://moodle.insa-lyon.fr/enrol/index.php?id=2562

TEACHING LANGUAGE

French

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AIMS

Currently being finalized. Please see the program below

CONTENT

- The course will start with 3 modules “from physical phenomena to modeling” in the form of CM and TD: “Particle Dynamics”, “Non-Linear Mechanics” and “Thermal Flows and Transfers”.
- In parallel, 2 Numerical Methods modules will be taught.
- Students will then apply their newly acquired skills in 3 mini-projects associated with the 3 previous modules.
- Finally, they will carry out a final project in groups of 3 to 5 to explore one of the issues raised in the modules, in relation to the world of engineering.
- At the same time, each project group will conduct a human and social science survey to identify the STS (science, technology and society) issues raised by the engineering project.
- Equations and simulations will be solved using the Python language.

BIBLIOGRAPHY

Calcul différentielle et équations différentielle - Dunod - Science Sup (2021)

PRE-REQUISITES

FIMI undergraduate courses: solid dynamics, mathematics, Python programming, thermodynamics....

IDENTIFICATION

CODE : FIMI-2-S2-EC-MA-TF
ECTS : 5

HOURS

Cours :	19.5h
TD :	35h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	56.5h
Travail personnel :	80h
Total :	136.5h

ASSESMENT METHOD

The evaluation includes 2 written interrogations of 2 hours

TEACHING AIDS

Moodle

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

AAv4.1 – Determine the power series expansion of a given function.
AAv4.2 – Use power series to solve a linear differential equation with polynomial coefficients.
AAv4.3 – Determine the quadratic form associated with a bilinear form, and vice versa.
AAv4.4 – Perform the reduction and diagonalization of a quadratic form.
AAv4.5 – Determine the orthogonal complement of a vector subspace and compute an orthonormal basis with respect to a given inner product.
AAv4.6 – Use the notion of projection to solve certain optimization problems involving an inner product.
AAv4.7 – Study the continuity of a multivariable function and compute directional derivatives when they exist.
AAv4.8 – Use the differential and the Hessian to compute the second-order Taylor expansion (DL2) of a multivariable function, especially to study the nature of critical points.

CONTENT

Power series (2)
Bilinear algebra
Differential Calculus 2 (extreme values, implicit function theorem, implicit surfaces)

BIBLIOGRAPHY

(1) Analyse et algèbre : cours de mathématiques de deuxième année avec exercices corrigés et illustrations avec Maple, Stéphane Balac et Laurent Chupin , Presses polytechniques et universitaires romandes.
(2) F. Butin, M. Picq et J. Pousin : Mathématiques, cours et exercices corrigés - 2ème année de classes préparatoires (Ellipse) 2013.

PRE-REQUISITES

Mathematics Syllabus for PC-S3-MA-AEMP

Informatics and numerical society 4

IDENTIFICATION

CODE : FIMI-2-S2-EC-ISN-TF
ECTS : toto

HOURS

Cours :	4h
TD :	27.5h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	33h
Travail personnel :	20h
Total :	53h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes :

AAv4.1 : At the end of S4, students will be able to use object-oriented and event-driven deve-lopment paradigms in Python, in particular by creating graphical user interfaces.

AAv4.2 : At the end of S4, students will be able to design and develop, as part of a team, a complex modular Python program to meet a set of specifications they have defined.

AAv4.3 : At the end of S4, students will be able to identify the economic, social, political and imaginary issues involved in using a specific digital technology in a real-life situation.

AAv4.4 : At the end of S4, students have acquired, through their work in sessions and inde-pendently, the general digital culture skills enabling them to take the Pix certification with an average level of 4.

CONTENT

1 - Object-oriented programming

2 - Matching algorithms, algorithmic properties and social issues

3 - Development of graphical user interfaces

4 - Project (in groups of four): definition of a mini-specification, analysis and definition of a solution, use of third-party libraries, identification of an algorithmic problem, realization in Python.

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-2-S1-EC-ISN

System Mechanics 2

IDENTIFICATION

CODE : FIMI-2-S2-EC-MS-TF-SH1
ECTS : 2.00

HOURS

Cours :	7h
TD :	21h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	30h
Total :	59.5h

ASSESMENT METHOD

- 1 Written Test (WT2) of 1.5 hour
- 1 Final Test (FT2) of 2.5 hours.
Average : (WT2*1.5+FT2*2.5)/4

TEACHING AIDS

- lecture notes and presentations
- exercices book (the same for all the 2nd year students)
Documents available on Moodle

TEACHING LANGUAGE

French
English

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AIMS

Target Learning Outcomes (AvA):

Aav.1 - Model a real mechanical system of bounded complexity including the specific dynamic behavior laws (ex: shock absorber, motor, intersolid contact...)

Aav.2 - Perform the complete energy balance of the mechanical system, then establish the mechanical equations associated with this balance and verify the dimensional homogeneity of the results obtained

Aav.3 - Perform a complete mechanical balance of the mechanical system, then optimize this balance for the establishment of equations of motion of this system

Aav.4 - Establish the characteristics of the operation of a mechanical system based on the equations established and verify the dimensional homogeneity of the results obtained

CONTENT

MASS GEOMETRY : Notion of mass, center of mass and center of inertia of a solid, operator of inertia, moments and products of inertia, Huygens theorem, principal and central frames of inertia, balancing.

KINETICS: Kinetic, dynamic screws and kinetic energy for one isolated solid, for a set of solids.

DYNAMICS: Fundamental principle of Dynamics and General Theorems (vectorial form), classification of Galilean (Newtonian or Inertial) frames depending on the studied phenomena. Force wrench transferred by joints taking into account friction, Coulombs friction (sum and moment), viscous dissipation, rheology of some usual mechanical components, and mechanical actions by actuators. Selection of the sub-system(s) to be isolated depending on the simulation objective(s): equations of motion and/or mechanical actions. Position of equilibrium, stationary positions and, for systems with a single degree-of mobility, linearized equation of motion and stability. First order equations, power, work, kinetic energy theorem, force and potential, first order equations derived from kinetic energy

BIBLIOGRAPHY

AGATI Mécanique Industrielle Dunod
BEGHIN Cours de mécanique théorique Gauthier-Villar
BELLET Problème de mécanique Cepadues editions
BERKELEY Cours de Physique 1 Armand Colin
BONCOMPAIN Méca. des Syst. Indus. (T2) Dunod
BROSSARD Mécanique Générale Tech. de l'Ingénieur AF4
BROUSSE Cours de mécanique Collection U
BONE Mécanique Générale (crs et ap.) Dunod U
CAZIN Cours de mécanique générale Gauthier-Villar
ROY Mécanique du solide rigide Dunod
LASSIA Cinématique Ellipse
LASSIA-BARD Dynamique Ellipse

PRE-REQUISITES

- System mechanics 1
- Vectors and Linear algebra
- Ordinary Differential Equations
- Mechanical design.

IDENTIFICATION

CODE : FIMI-2-S2-EC-PH-TF
ECTS : 4

HOURS

Cours :	7h
TD :	33.5h
TP :	16.5h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	59h
Travail personnel :	50h
Total :	109h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests and practical reports.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French
English

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Establish the propagation equations verified by the quantities characterising a wave, from which deduce the specific impedance.
AAv.2 Deduce the expression and fully characterise a wave propagating in an unlimited and limited medium with or without dissipation.
AAv.3 Express the transported power and identify the experimental conditions for its measurement.
AAv.4 Determine the expression of the intensity in the case of two-wave interference and predict the interference pattern and use simple interferometric devices to measure physical quantities.
AAv.5 Apply the concepts seen on waves in an experimental context: propose then implement an experimental protocol, present the results, compare the experiment and the model, conduct a critical analysis, write a report.

CONTENT

The fourth semester is entirely devoted to the propagation of waves. It contains three chapters. The first chapter concerns the propagation of waves in unlimited media with a first part on mechanical waves and a second part on electromagnetic waves (introduction, propagation equation, impedance, power transported). The second chapter deals with propagation in limited media with the notions of reflection and transmission coefficients, superposition of incident and reflected waves. The last chapter deals with interferences (interference conditions, two-source interference, specificity of light waves).

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

This course will also use the mathematical tools and skills that will be learnt all along the first year, and of course the physics curriculum of the first 3 semesters (dimensions, uncertainties, electricity, mechanics, electromagnetism).

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I4-TF-SH2

ECTS : *

HOURS

Cours :	45h
TD :	31h
TP :	16h
Projet :	71h
Evaluation :	5h
Face à face pédagogique :	97h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

Lecture notes, course slides, problem sets with solutions.

TEACHING LANGUAGE

French

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AIMS

Currently being finalized, see program below.
Eventually:
List of P2i Learning Outcomes (common and specific)

CONTENT

1. Humanities and Social Sciences Project: Study of a technical system.
2. Project: Design and fabrication of a solar thermal energy recovery system.
3. Introduction to fuel sources.
4. Historical perspectives on energy and energy transition pathways.
5. Performance of energy conversion systems.
6. Mechanical design for renewable energies.

BIBLIOGRAPHY

PRE-REQUISITES

Knowledges and courses from semester 1 of the second year

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I3-TF-SH2

ECTS : undefined

HOURS

Cours :	16h
TD :	70h
TP :	32h
Projet :	70h
Evaluation :	8h
Face à face pédagogique :	126h
Travail personnel :	100h
Total :	296h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

Poly, slideshows, tutorials, online answer keys... all the content is available on Moodle.

TEACHING LANGUAGE

French

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M. LE GUENNIC Thomas : thomas.le-guennic@insa-lyon.fr

AIMS

Propose and design a mechanical system that responds critically to an expressed need, while taking into account the requirements of the system's life cycle, particularly with regard to environmental impact, the societal context of its use, manufacturing requirements and economic constraints.

Situate their design approach within the more general framework of a low-tech approach, the philosophical and practical foundations of which will be illustrated by examples of products/services

Relate their engineering choices to the needs of societal transformation, in particular by characterising the low-tech approach as a lever for action, with its scope and limits, for an economy that is compatible with planetary limits and socially just.

Choose an appropriate production process, taking into account its impact on geometry, choice of material and compatibility with the function

Implement the chosen process, with or without the help of a specialist depending on the degree of complexity identified, adapting the degree of autonomy and choosing a methodology that guarantees the safety of people and the integrity of the means of production.

Analyse a contemporary low-tech issue by means of a collective investigation leading to the writing of a popular science article.

Within a project group, identify and allocate tasks in such a way as to encourage involvement, autonomy and initiative on the part of each member, as well as communication and the quality of exchanges, arguments and collective choices.

Identify key words to find bibliographical sources related to a problem or a project theme, choose and explain the criteria for evaluating documents in terms of reliability, relevance and scientificity and develop an argument for the documents chosen, reference bibliographical sources in a written or oral production.

CONTENT

Knowledge of families of materials and applications to the choice of materials for mechanical design

Strength of materials, dimensioning using beam theory, buckling, basics of finite element modelling and associated applications

Simulation of mechanical behaviour

Lifecycle analysis, methodology and application, creation of environmental data in the case of a forming process

Statistical tools for quality management: linear regression, data manipulation, probabilities, application to measurements

Production management: typology of production systems, management of technical data, type of layout, load-capacity balance of a production system, stock management and planning tools.

Documentary research method

Agile manufacturing: numerically controlled machining (lathe and milling machine), multi-material and metal laser cutting, sheet metal forming by folding, rolling, mechanically welded and mechanically assembled construction.

Exploring the low-tech approach as a means of engineering a profound social and ecological transformation. Training in the popularisation of scientific discourse

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

FORMATION INITIALE AUX METIERS D'INGENIEUR

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Innovation by mechatronics and robotics Course

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I6-TF-SH2

ECTS : undefined

HOURS

Cours :	20h
TD :	67h
TP :	8h
Projet :	72h
Evaluation :	1h
Face à face pédagogique :	96h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

Continuous assessment
Servoing: 1 individual evaluation, 3 sessions over 5 sessions.
Perception / Action: 1 group assessment, TP report on 4h.
Programming & Communication: 1 assessment in situation by binomial, 1 written individual assessment
Design: 1 individual evaluation, CAD rendering, for the duration of the sessions.
Project : 1 individual evaluation throughout the duration of the sessions, 1 individual evaluation by the pairs, 1 group assessment during the Sciences Fair.
Documentary research: 1 individual assessment in writing
Humanities: 1 individual assessment in writing, having to write outside the niches., 1 written group assessment, article to be made.

TEACHING AIDS

LMS Moodle

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized, see program below.
The students will design a prototype using mechatronics and robotics. The project theme is common to all groups and is chosen each year, it addresses the whole field of possibilities of robotics. The chosen theme should: enable a realization at the level of what students can do, allow to find a multitude of solutions, question the role of robotics in society, link the P2I to the real world with a shared project with " clients, "finding a place in the daily life of a young
humanist student.
The creations are made from a functional specification. Each group composed of a dozen students will start the project with a search for solutions with ideation sessions (brainstorming, TRIZ, 6 hats, mental map). The selected solutions are the subject of a mechanical design study with 3D modeling, mechanical simulation, multiphysical modeling, Lego model, validation experiments ...
The prototypes are made by the students in 3 workshops according to the needs: machining, metal construction, additive manufacturing.
The electronics of the prototypes are 80% commercial cards: arduino, power cards, axis servo, video recognition ... Some cards are designed and manufactured by students for specific needs: Lego / electronic interfaces, sound controls...
The control of the prototypes is done in several layers: a real-time layer on a microcontroller and a remote layer for the HMI on PC (Java) or tablet / tel (Android).
Wired communications use serial or I2C protocols, wireless communications use WIFI in UDP or TCP.

CONTENT

Project 78h
Servoing 16h
Programmation & Communication 26h
Sensors /Actuators 12h
Energy 2h
Humanities 30h
Documentary Research 4h

BIBLIOGRAPHY

PRE-REQUISITES

S1, S2 and S3 Mechanical design
S3 Manufacturing
S3 Mechatronics

Bio-based materials, engineering and the environment

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I1-TF-SH2

ECTS : 10

HOURS

Cours :	44h
TD :	86h
TP :	50h
Projet :	10h
Evaluation :	8h
Face à face pédagogique :	188h
Travail personnel :	100h
Total :	298h

ASSESMENT METHOD

1 one-hour individual test per module (including practical work) of core courses.

Individual practical assessment.

Collective writing of an Humanity article.

Documentary and Humanity research (common report with two separate parts) collectively.

Poster or intermediate defense. Project presentation (Poster...) collectively.

Final defense collectively.

Collective evaluations are carried out in groups of 4 to 8 students.

TEACHING AIDS

Lectures
Tutorial
Practical work
Project

TEACHING LANGUAGE

French

CONTACT

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AIMS

Face to environmental issues related to the problems of resource management and protection of our ecosystems, future engineers must be aware of the need to develop new sustainable technologies in the service of man and his environment. This course is suited to sensitize
students to the great challenges of the future related to the environment, energy and resources that specifically address Bioengineering for the production, treatment and recovery in the areas of energy, pollution control ecosystems, bio-based polymer materials and biodegradable.
The purpose of the course part is to introduce some concepts of ecology, biotechnology, polymer materials and process engineering such as 3D printing, to prepare the practicle party that should allow
students to develop projects around a common theme.

CONTENT

Ecology and Environmental Sciences: basics of ecology, environmental issues, methods and tools for sustainable management anthroposystems.
Chemical reaction engineering and process engineering: analytics, chemical kinetics, and enzymology management processes.
Biotechnology DNA Microorganisms, genomes, and gene regulation, DNA biotechnology and synthetic biology databases.
Polymers and bio-based materials: organic chemistry, polymerization, structures and properties of bio-based polymer materials, lifecycle and environment.
Modeling: growth models (EDO), chemostat model (dynamic systems), fitting a model of Michaelis-Menten (inferential statistics).
Humanities and social sciences: innovation process, design, users and sustainable development issues; ethical, imaginary representations.
A cycle of 4 rotating practicles are provided for all students suited to learn the biotechnology, enzymology, modeling and study of polymer materials, whatever the project theme they choose.

BIBLIOGRAPHY

Massardier V, Belhaneche-Bensemra N, Lazaric N (2023) Editorial: Alternative building blocks and new recycling routes for polymers: Challenges for circular economy and triggers for innovations. Front Mater DOI: 10: 1152494.

Sandei B, Massardier V and Brunel R (2022), Alternative building blocks sources for poly (ethylene terephthalate): A short review with socio-economical points of view. Front. Mater. 9:1005770. DOI: 10.3389/fmats.2022.1005770

Léa Barbault, Olivier Brette, Nathalie Lazaric, Valérie Massardier and Valérie Revest (2023), Bio-based Plastics: a 'Sustainable' Alternative for the Plastic Industry; Int J Environ Sci Nat Res 31(5): IJESNR.MS.ID.556325 (2023) DOI: 10.19080/IJESNR.2023.31.556325 https://juniperpublishers.com/ijesnr/

A review to guide eco-design of reactive polymer based materials, Emma Delamarche, Valérie Massardier*, Remy Bayard, and Edson Dos Santos, dans Reactive and Functional Polymers Volume Three, Advanced materials, Editors: Gutierrez, Tomy (Ed.), Octobre 2020. https://www.springer.com/gp/book/9783030504564#aboutBook

Chapter "Recyclable and bio-based materials open up new prospects for polymers : Scientific and social aspects" dans le livre « Environmental impact of polymers ». Ed. Th Hamaide, R. Deterre, JF Feller, Wiley, DOI: 10.1002/9781118827116.ch12 Lavoisier-Hermès, 2014.

Chapter Oil-based and bio-derived thermoplastic polymer blends and composites, in Introduction to Renewable Biomaterials: First Principle and Concepts, A.Quitadamo, V. Massardier, M. Valente, A.S. Ayoub, L.A. Lucia Editeurs Wiley: 2017, pp 239-268.

Chapter "Contribution of reactive extrusion to technological and scientific challenges to eco-friendly circular economy", in "Biomass Extrusion and Reaction Technologies: New Insights, Future Potential, and Principles to Practices",, V. Massardier, A.Quitadamo; A.S. Ayoub, L.A. Lucia Editeurs, ACS, 2018.

PRE-REQUISITES

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I5-TF-SH2

ECTS : undefined

HOURS

Cours :	20h
TD :	40h
TP :	30h
Projet :	90h
Evaluation :	8h
Face à face pédagogique :	98h
Travail personnel :	100h
Total :	288h

ASSESMENT METHOD

Continuous assessment.

TEACHING AIDS

Course materials available on moodle.
For the project: numerous resources available on moodle: specifications, instructions, tutorials for software and measurements, etc.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalised, see programme below.

CONTENT

The ultimate objective of this P2i is to learn how to transcribe a health, sports, art, everyday life or work situation (performance, well-being, pathology, etc.) into a problem where engineering can make a contribution in terms of analysis, understanding, solution, improvement or optimisation.
* Project (80h)
* Specific courses for the project:
Anatomy/Mechanics (18h)
Strength of Materials (18h)
Applied Mathematics (12h)
SHS (8h + project)
Literature survey (6h)
Life Sciences (6h)
Imaging (6h)
Physical and Sport Education (4 hrs)
Biomaterials (4 hrs)
External contributors (6h)

BIBLIOGRAPHY

PRE-REQUISITES

Knowledge and skills from FIMI courses, in particular Mathematics, Physics and Systems Mechanics.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I2-TF-SH2

ECTS : -

HOURS

Cours :	12h
TD :	56h
TP :	2h
Projet :	98h
Evaluation :	8h
Face à face pédagogique :	78h
Travail personnel :	100h
Total :	276h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Visual course materials (PowerPoint / PDF)
- Exercise handouts
- Practical work handouts
- Physics and chemistry lab equipment
- Project and prototyping materials
- Computer workstations equipped with necessary software

Documents available on Moodle

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized, see program below

CONTENT

Project Technical Phases:

1) From Physical Phenomenon to Signal: Study and implementation of physical sensors to measure a signal.
2) From Signal to Sensor Data: Development of appropriate electronic acquisition chains (Op-Amps, filters, ADC).
3) Sensor Data Transmission: Programming Arduino modules to create a wireless sensor network (radio transmission, network protocol).
4) Sensor Data Management: Creation of an SQL database and Java programming to import sensor data in real-time.
5) From Sensor Data to Information: Statistical analysis and data mining of the collected data.
6) Finalization: Final integration and testing of the infrastructure.

The project starts in the 2nd week with a half-day session per week and continues with full sessions during the last 4 weeks.
A project demonstration concludes the P2I.

M1: Physical Sensors & Electronic Acquisition Chains
a) General principles of physical sensors
b) Operation of different sensor families
- Environmental sensors (temperature, pH)
- Mechanical strain sensors (force, pressure, deformation)
- Magnetic sensors (motion, orientation)
c) Functions, analysis, and design of an electronic acquisition chain
d) Current technologies and future challenges

M2: Sensor Data Analysis
a) Introduction to signal processing
b) Descriptive statistics
c) Data visualization
d) Introduction to data mining

M3: Telecommunications Networks & Databases for Sensors
a) Principles of networks
b) Introduction to wireless networks
c) Architecture of sensor databases
d) Data querying and multidimensional aspects

M4: SHES Reflections on Data
a) Innovation & society, the role of the user
b) Major societal issues: "Big Data", "Open Data", "Quantified Self", privacy
c) Conferences: business, public institutions

BIBLIOGRAPHY

PRE-REQUISITES

This program is based on the knowledge and skills taught within the FIMI department at INSA Lyon, which will be supplemented or deepened through the modules and applied to the project:

Physics / Chemistry
- Electrokinetics and Electronics Concepts (Physics 1A)
- Electromagnetism (Physics 1A & 2A)
- Thermodynamics (Thermo 1A)

Mathematics
- Probability / Statistics (Maths in High School)
- Vector Spaces (Maths 1A)
- Distances (Maths 2A)

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I8-TF-SH2

ECTS : undefined

HOURS

Cours :	2h
TD :	78h
TP :	24h
Projet :	78h
Evaluation :	8h
Face à face pédagogique :	112h
Travail personnel :	100h
Total :	290h

ASSESMENT METHOD

Continuous assessment
For all the science teaching modules (mathematics, scientific computing, signal processing, physics), a global assessment of 4h will be carried out as written exam.
For the project, each team will have to develop an image analysis program with Python accompanied by a written report.
The evaluation of the project will also be done through an oral defense .
An activity dedicated to the sustainable development and the social responsibility will lead to a specific evaluation.

TEACHING AIDS

For educational modules, brackets will be specific to each subject.
The teaching modules are designed to provide all the necessary knowledge to the project, representing about half of the hours of the course.
The project will be half in computer room and in an experimental room combining different imaging modalities (X-rays, visible, MRI, ultrasound).
Project Description: analysis and automatic extraction of important information stored in an image/a signal whose acquisition/detection has been optimized.
Steps: understanding the imaging method, analysis of influential parameters to optimize image quality, development of automatic treatment programs adapted to signals and images. Reflection on science-technical-society aspects of the project.

TEACHING LANGUAGE

French

CONTACT

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AIMS

In progress

This course is dedicated to the field of medical imaging (eg, ultrasound, radiology, MRI), and Industrial imaging (non- destructive testing and material characterization).
How to verify that an airplane wing contains no crack? how to detect broken glass in a baby food jar? how to verify the presence of all the components on an electronic board? how to detect cancerous tumors? controlling the growth of a fetus? evaluate the impact of treatment on bone microstructure, measuring the velocity of blood in the arteries ... all these issues are being solved (or partly) through waves (elastic, electromagnetic, corpuscular ...) that interact with matter. Analysis of signals or images resulting from the reception of these waves allows then to extract the desired information on the bushing material.
The objective of this course is to understand the main physical methods of image acquisition, and to give the signal processing bases necessary for their acquisition, optimization, and analysis.
This is a highly interdisciplinary course that combines aspects such as "physics and mathematics", "signal and image processing" and "technology and software" for the vision systems in medical or industrial imaging.

CONTENT

Name and Description of modules:
M1: Physics bases of imaging methods (infra-red and visible imaging, ultrasound sonography, X rays-matter interaction , electron microscopy).
M2: Bases and deepening mathematics (complex Fourier series, Fourier transform, functions of several variables).
M3: Signal Processing Basics (continuous and discrete signals and linear systems convolution, sampling, Fourier transform, direct and frequency domains, frequency analysis, filtering).
M4: Introduction to python and numerical computation.
M5: Waves and Science-Technology-Society: reflection on the waves and health, beneficial / harmful aspects of the same phenomenon ... Study of the ethical, social and cultural aspects of the project.
3 practical courses (TP) will be carried out where both physics experiments and digital processing with Python will be used together. Topics: filtering with an RLC circuit, production and synthesis of a musical signal, analog (optical) and digital filtering of an image.

BIBLIOGRAPHY

PRE-REQUISITES

Prerequisite , deepening :
-use and deepening of general knowledge on mechanical and electromagnetic waves ;
-use of complexes , integration of functions of a real variable , serial concept ;
-deepening of the notions of algorithms and data structures in the field of signal and image processing ;
-articulation with the teachings of Cultures, Science, Societies.

IDENTIFICATION

CODE :FIMI-2-S2-EC-P2I7-TF-SH2

ECTS : undefined

HOURS

Cours :	22h
TD :	57h
TP :	0h
Projet :	88h
Evaluation :	1h
Face à face pédagogique :	80h
Travail personnel :	100h
Total :	268h

ASSESMENT METHOD

- a written MCQ test (2 hours) on all theoretical and practical modules
- three mini-projects in the form of reports
- a final Engineering Sciences project in the form of a report, defense and evaluation of other students
- a project in the Humanities and Social Sciences, including the writing of an article and the development of the ability to take a step back, particularly when defending a thesis
- a bibliographical report

TEACHING AIDS

All course documents (pdf of courses, python programs, pdf of project subjects, MCQs, etc.) are available in Moodle: https://moodle.insa-lyon.fr/enrol/index.php?id=2562

TEACHING LANGUAGE

French

CONTACT

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AIMS

Currently being finalized. Please see the program below

CONTENT

- The course will start with 3 modules “from physical phenomena to modeling” in the form of CM and TD: “Particle Dynamics”, “Non-Linear Mechanics” and “Thermal Flows and Transfers”.
- In parallel, 2 Numerical Methods modules will be taught.
- Students will then apply their newly acquired skills in 3 mini-projects associated with the 3 previous modules.
- Finally, they will carry out a final project in groups of 3 to 5 to explore one of the issues raised in the modules, in relation to the world of engineering.
- At the same time, each project group will conduct a human and social science survey to identify the STS (science, technology and society) issues raised by the engineering project.
- Equations and simulations will be solved using the Python language.

BIBLIOGRAPHY

Calcul différentielle et équations différentielle - Dunod - Science Sup (2021)

PRE-REQUISITES

FIMI undergraduate courses: solid dynamics, mathematics, Python programming, thermodynamics....

IDENTIFICATION

CODE : FIMI-2-S2-EC-STA-TF
ECTS : *

HOURS

Cours :	0h
TD :	0h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	0h
Travail personnel :	25h
Total :	25h

ASSESMENT METHOD

The internship report will be assessed by a lecturing engineer, in charge of monitoring a group in 1A and 2A (in 2A, 1A groups are reformed).

TEACHING AIDS

Two guides will be distributed (in pdf, available on Moodle):
- a guide to finding an internship, in November 1A
- a guide to writing an internship report, in April 1A, with a grading scale.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

This is the first concrete experience of working in a company for INSA Lyon students.
This internship lasts a minimum of 4 weeks and is carried out by students at the end of their 1st year.
It meets a number of key objectives:
- Experience working as part of a team (live the daily life of operators, measure the repetitive nature and arduousness of their tasks).
- Discover, observe and understand corporate life and human relations.
- Observe and study the work environment.

The skills developed revolve around the following points:
- Observe the immediate environment (workstation, team and workshop operations). workshop operations).
- Discovering mechanisms and organizations (technical, social, structural) through exchanges with those involved and by researching authorized and validated documents within the company.
- Gather different points of view, confirm or refute certain assertions.
- Know how to change initial preconceptions.
- Listen to employees to guide your thinking on management perspectives.

CONTENT

- Internship period: during the summer (from the last week of June to July 31), between 1st and 2nd year at INSA Lyon.
- Duration: minimum 4 weeks, explicitly specified in the internship agreement.
- Conditions: teamwork.
- Contractualization: this internship is the subject of an internship agreement signed by INSA Lyon, the host organization and the intern, setting out the commitments and responsibilities of INSA Lyon, the host organization and the student, and specifying the intern's activity during the internship period. Experience in the form of an employment contract (CDD) is also accepted.
- The internship is the subject of an internship report, which is graded by an INSA engineer. This engineer follows a group of students with two presentations in 1A (before the internship) and two in 2A (after the internship). The first is an account of the professions involved, with an approach to the business world, while the second focuses on the internship, respect for the environment, rules and regulations, attitudes to adopt and behavior. The 1st year groups are reformed in the 2nd year for a debriefing session in September/October, and a session to hand in the corrected and graded internship reports in February.

BIBLIOGRAPHY

PRE-REQUISITES

No particular prerequisites for this course.

Cultures, Sciences and Societies

IDENTIFICATION

CODE : FIMI-2-S2-EC-CSS-FI
ECTS : undefined

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

1 individual or group written statement of intent, interim research report and annotated bibliography
1 group oral presentation such as a dramatised lecture

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

CT2 - WORK, LEARN, GROW IN AN AUTONOMOUS WAY
2.3 - Acquire new skills on their own by seeking out the necessary resources
2.4 - Exercise their critical faculties, think for themselves
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3. 1 - Communicate appropriately: pass on a message, listen,
show empathy, assert one's point of view, debate in a reasoned way
3.2 - Situate one's original speech using explicit references
3.4 - Integrate into a group, position oneself, build a dynamic relationship with the group, integrate new members
3. 5 - Manage conflicts, balance individual and collective interests
3.6 - Take part in a group project: build and run a project, develop it; be aware of your role and responsibilities
4. 1 - Develop a creative approach, including artistic
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions...
CT7 - WORKING IN AN INTERNATIONAL AND CULTURAL CONTEXT
7.1 - Communicating and interacting in foreign languages
7.2 - Decoding cultural references in discourse, attitudes and behaviour
7.3 - Relativising one's values, beliefs and behaviour
7.4 - Integrating cultural diversity in the workplace

CONTENT

In line with the arts and culture policy, this final SHS course is an opportunity to combine the approach developed in the first semester around the question of 'how the social world works and how it affects us'. The themes may vary depending on the course, but the framework is the same: each sub-group produces
research on a specific theme with a written statement of intent, and presents the answers to their questions in the form of dramatised lectures or a forum theatre.

BIBLIOGRAPHY

Biblio-webography provided by the teacher

PRE-REQUISITES

The prerequisites are the skills acquired in the previous semesters in Social Sciences and Humanities courses.

IDENTIFICATION

CODE : FIMI-2-S2-EC-MA-TF
ECTS : 5

HOURS

Cours :	19.5h
TD :	35h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	56.5h
Travail personnel :	80h
Total :	136.5h

ASSESMENT METHOD

The evaluation includes 2 written interrogations of 2 hours

TEACHING AIDS

Moodle

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

AAv4.1 – Determine the power series expansion of a given function.
AAv4.2 – Use power series to solve a linear differential equation with polynomial coefficients.
AAv4.3 – Determine the quadratic form associated with a bilinear form, and vice versa.
AAv4.4 – Perform the reduction and diagonalization of a quadratic form.
AAv4.5 – Determine the orthogonal complement of a vector subspace and compute an orthonormal basis with respect to a given inner product.
AAv4.6 – Use the notion of projection to solve certain optimization problems involving an inner product.
AAv4.7 – Study the continuity of a multivariable function and compute directional derivatives when they exist.
AAv4.8 – Use the differential and the Hessian to compute the second-order Taylor expansion (DL2) of a multivariable function, especially to study the nature of critical points.

CONTENT

Power series (2)
Bilinear algebra
Differential Calculus 2 (extreme values, implicit function theorem, implicit surfaces)

BIBLIOGRAPHY

(1) Analyse et algèbre : cours de mathématiques de deuxième année avec exercices corrigés et illustrations avec Maple, Stéphane Balac et Laurent Chupin , Presses polytechniques et universitaires romandes.
(2) F. Butin, M. Picq et J. Pousin : Mathématiques, cours et exercices corrigés - 2ème année de classes préparatoires (Ellipse) 2013.

PRE-REQUISITES

Mathematics Syllabus for PC-S3-MA-AEMP

Informatics and numerical society 4

IDENTIFICATION

CODE : FIMI-2-S2-EC-ISN-TF
ECTS : toto

HOURS

Cours :	4h
TD :	27.5h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	33h
Travail personnel :	20h
Total :	53h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Targeted learning outcomes :

AAv4.1 : At the end of S4, students will be able to use object-oriented and event-driven deve-lopment paradigms in Python, in particular by creating graphical user interfaces.

AAv4.2 : At the end of S4, students will be able to design and develop, as part of a team, a complex modular Python program to meet a set of specifications they have defined.

AAv4.3 : At the end of S4, students will be able to identify the economic, social, political and imaginary issues involved in using a specific digital technology in a real-life situation.

AAv4.4 : At the end of S4, students have acquired, through their work in sessions and inde-pendently, the general digital culture skills enabling them to take the Pix certification with an average level of 4.

CONTENT

1 - Object-oriented programming

2 - Matching algorithms, algorithmic properties and social issues

3 - Development of graphical user interfaces

4 - Project (in groups of four): definition of a mini-specification, analysis and definition of a solution, use of third-party libraries, identification of an algorithmic problem, realization in Python.

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-2-S1-EC-ISN

IDENTIFICATION

CODE : FIMI-2-S2-EC-CSS-SH1
ECTS : 2

HOURS

Cours :	0h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	22h
Travail personnel :	15h
Total :	37h

ASSESMENT METHOD

- A continuous assessment section including the following exercises: presentation of a one-hour presentation-debate in a small group, and a written exercise in personal reflection.
- A 2-hour exam at the end of the semester (text study followed by an argumentative essay).

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

Humanities framework:
CT2 - WORK, LEARN, EVOLVE AUTONOMOUSLY
2.3 - Acquire new skills on one's own, seeking out the necessary resources
2.4 - Exercise one's critical faculties, think for oneself
CT3 - INTERACT WITH OTHERS, WORK AS PART OF A TEAM
3.1 - Communicate appropriately: convey a message, listen, show empathy, assert one's point of view, debate in a reasoned manner
3. 2 - Situate one's original discourse with explicit references
3.3 - Communicate non-verbally: posture and gestures
CT5 - ACT RESPONSIBLY IN A COMPLEX WORLD
5.1 - Understand the complex issues (in the company and in society) facing the engineer: grasp their social, societal, political, economic, environmental, ethical and philosophical dimensions.
5.2 - Integrate a responsible dimension (deontology, ethics) into their actions; identify, evaluate and anticipate the consequences of their actions and decisions at different levels of scale.

CONTENT

1) Reflection on the functioning, place and role of science and technology in our societies
> This course favors a cross-disciplinary approach, at the crossroads of different disciplines in the humanities and engineering sciences:
- Theme "Man and technology" / Cross-disciplinary sessions
2) Written and oral communication exercises

BIBLIOGRAPHY

List of books recommended by the teacher at the beginning of the year, according to the subjects covered.

PRE-REQUISITES

Methodologies acquired in 1st year.

IDENTIFICATION

CODE : FIMI-2-S2-EC-PH-SH1
ECTS : 4

HOURS

Cours :	10h
TD :	37h
TP :	8h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	59h
Travail personnel :	50h
Total :	109h

ASSESMENT METHOD

Continuous assessment all along the school semester to check acquired knowledge and skills by tests.
A final exam will be held at the end of the school semester to evaluate the ability to analyze and solve a problem using the knowledge and skills acquired during the whole year.

TEACHING AIDS

Textbooks with lecture notes, exercises and problems for tutorials and practicals wordings.
Multiple-choice questionnaire for autonomous training and self-assessment are available (French only).

TEACHING LANGUAGE

French

CONTACT

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AIMS

Targeted learning outcomes (TLA) :

AAv.1 Produce a circuit diagram from a schematic and vice versa, and model a 1st or 2nd order transient or sinusoidal electrical circuit.
AAv.2 Determine currents, voltages and energy quantities in a 1st or 2nd order transient (including the different regimes) or sinusoidal circuit (including transfer functions and filtering).
AAv.3 Construct and use graphical representations of electrical quantities.
AAv.4 Apply the concepts seen in electricity in an experimental context: propose and then implement an experimental protocol, present the results, compare the experiment and the model, carry out a critical analysis, write up a report.
AAv.5 Determine the action of electromagnetic forces in an electromagnetic or electromechanical system.
AAv.6 Evaluate quantitatively the phenomenon of static or motional induction in a simple electromagnetic or electromechanical system.

CONTENT

- Electromagnetism: electromagnetic forces, electric and magnetic moments, static and motional induction;
- AC electricity: complex impedances, electrical power, transfer function, introduction to filtering.

BIBLIOGRAPHY

All physics books written for first undergraduate cycle.

PRE-REQUISITES

Notions learnt during secondary education: calculus, plane geometry, and trigonometric functions, calculation skills (derivatives, anti-derivatives, complex numbers, quadratic equations, systems of linear equations, trigonometry, vectors¿), statistics (average and standard deviation), data and functions plots.
This teaching will also use the mathematical tools and skills that will be learnt all along the school year.
All the physics concepts covered in S1, S2 and S3 will be considered as acquired.

IDENTIFICATION

CODE : FIMI-2-S2-EC-TH-SH1
ECTS : 2

HOURS

Cours :	4h
TD :	9h
TP :	5h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	19.5h
Travail personnel :	15h
Total :	34.5h

ASSESMENT METHOD

Continuous assessment

TEACHING AIDS

- Lesson and exercise handouts
- Moodle Internet interface (course supplements and examination papers with answer keys)

TEACHING LANGUAGE

French

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AIMS

Apply the general methods of thermodynamics in simple situations
- By using the appropriate vocabulary (system, transformation, isotherm, etc.)
- By applying the first and second principles to typical transformations of closed systems, using the concepts of reversibility, heat, work and state function (internal energy, enthalpy, entropy, free enthalpy, etc.)

Establish the properties of a pure substance using :
- the temperature and pressure of a gas, and the perfect gas model for a single gas or a mixture of gases;
- the boiling temperature of a pure substance, its saturation vapour pressure and its heat capacity according to its physical state;
- Clapeyron's relation with the quantities associated with changes of state and making the relevant simplification assumptions
- the particularities of the (P,V) and (P,T) diagrams for typical transformations.

Describe and analyse a simple thermal machine:
- By using (definitions of) motor or receiver cycles,
- By using a cycle of transformations represented on a (P,V) diagram
- By calculating the coefficient of performance in the case of ideal and real operation

Analyse a chemical reaction:
- Identify the parameters of the standard state of reaction, the product formation reactions and the heat of reaction
- Use Hess's law to calculate the standard reaction quantities (internal energy, enthalpy and entropy)
- Use the principle of adiabatic calorimetry to determine a heat of reaction, a heat capacity and a flame temperature (put in all the expected values), by applying a material balance and a heat balance.

CONTENT

The engineering student will work and will be evaluated on the following knowledge:
- Thermodynamic potentials: Gibbs free energy
- Thermodynamics applied to phase transitions: Clapeyron's law
- Application to heat engines.
- Calorimetry
- Practical work on Power, efficiency and heat capacity
- Practical work on Liquid-vapour equilibrium

BIBLIOGRAPHY

P. ARNAUD, Cours de Chimie Physique, Eds Dunod
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique PC, Eds Bréal
J.L.QUEYREL, J. MESPLEDE, Précis de Physique, Thermodynamique Prépas MP SI PC SI, Eds Bréal
P. GRECIAS, Exercices et problèmes de Thermodynamique Physique, 2ème édition, Collection de sciences physiques, Eds Lavoisier Tec et Doc
H Prépa, Thermodynamique 2ème année MP-MP* PT-PT*, Eds Hachette Supérieur (Chapitre 1 pour le corps pur)
P. BONNET, Cours de Thermodynamique ; Eds Ellipses
J. P. PEREZ, Thermodynamique. Fondements et Applications. Eds
M. HULIN, N. HULIN, M. VEYSSIE. Thermodynamique. Eds Dunod

PRE-REQUISITES

-Several variable functions, differentials, partial derivatives (Math-Physics interdisciplinary teaching)
-Mastery of units
-General high school chemistry, physics and mechanics knowledge.

IDENTIFICATION

CODE : FIMI-2-S2-EC-MA-SH1
ECTS : 2

HOURS

Cours :	6h
TD :	11.5h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	19h
Travail personnel :	30h
Total :	49h

ASSESMENT METHOD

The evaluation consists 2 written tests 1:30 coefficient 1/2

TEACHING AIDS

TEACHING LANGUAGE

French

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AIMS

The course offered during the semester extends concepts covered in the first year (convergence, limits, continuity, differentiability) to new classes of mathematical objects (numerical series, sequences of functions).
The study of improper integrals will prepare the student for the later study of Fourier and Laplace transforms and of probability theory.

This course is part of the "Pure Science" Unit.
It contributes to developping the following skills :
C1 : To analyse a (real or virtual) system or problem
C2 : To exploit a model for a real of virtual model
C5 : To process data
C6 : To communicate an analysis and a scientific approach in an argued and logical way

In this framework, the student will work and be assessed on the following points:
C11 - To split up a problem or a system into its component parts in interaction
C15 - To identify problematics or objectives
C16 - To build a proof
C25 - To use techniques of algebraic and numeric computation
C54 - To interprate data in the context of a model
C55 - To summarise and link together several intermediate results in order to answer a general question
C62 - To be able to speak with a satisfying level of langage aiming at a good balance between a usual and symbolic langage

CONTENT

Improper integrals
Numerical Series
Sequences of functions

BIBLIOGRAPHY

S. Balac et L. Chupin, Analyse et algèbre : cours de mathématiques de deuxième année avec exercices corrigés et illustrations avec Maple, Presses polytechniques et universitaires romandes.
F. Butin, M. Picq, J. Pousin, Mathématiques - Cours, exercices corrigés - 2e année de classes préparatoires intégrées, Collection "Références sciences", Ellipses

PRE-REQUISITES

First-year mathematics course

Informatics and numerical society 4

IDENTIFICATION

CODE : FIMI-2-S2-EC-ISN-SH1
ECTS : *

HOURS

Cours :	3h
TD :	19h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	24h
Travail personnel :	15h
Total :	39h

ASSESMENT METHOD

continuous assessment

TEACHING AIDS

- Course slides
- Online exercises and correction
- Compilation of pointers to additional resources.

TEACHING LANGUAGE

French

CONTACT

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AIMS

Targeted learning outcomes :

AAv3.1 : At the end of semester, students will be able to write a program manipulating data stored in a list, dictionary or graph, which can be retrieved from a file containing open data.

AAv3.2 : At the end of semester students are able to design an algorithm solving a problem from data stored in a graph, using and adapting subgraph calculation algorithms.

AAv3.3 : At the end of semester, students are able to integrate the notion of algorithmic complexity into the development of efficient code.

CONTENT

- Graph theory, path algorithms and computation of covering structures
- Open data

BIBLIOGRAPHY

PRE-REQUISITES

FIMI-2-S1-EC-ISN-SH1

System Mechanics 2

IDENTIFICATION

CODE : FIMI-2-S2-EC-MS-TF-SH1
ECTS : 2.00

HOURS

Cours :	7h
TD :	21h
TP :	0h
Projet :	0h
Evaluation :	1.5h
Face à face pédagogique :	29.5h
Travail personnel :	30h
Total :	59.5h

ASSESMENT METHOD

- 1 Written Test (WT2) of 1.5 hour
- 1 Final Test (FT2) of 2.5 hours.
Average : (WT2*1.5+FT2*2.5)/4

TEACHING AIDS

- lecture notes and presentations
- exercices book (the same for all the 2nd year students)
Documents available on Moodle

TEACHING LANGUAGE

French
English

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AIMS

Target Learning Outcomes (AvA):

Aav.1 - Model a real mechanical system of bounded complexity including the specific dynamic behavior laws (ex: shock absorber, motor, intersolid contact...)

Aav.2 - Perform the complete energy balance of the mechanical system, then establish the mechanical equations associated with this balance and verify the dimensional homogeneity of the results obtained

Aav.3 - Perform a complete mechanical balance of the mechanical system, then optimize this balance for the establishment of equations of motion of this system

Aav.4 - Establish the characteristics of the operation of a mechanical system based on the equations established and verify the dimensional homogeneity of the results obtained

CONTENT

MASS GEOMETRY : Notion of mass, center of mass and center of inertia of a solid, operator of inertia, moments and products of inertia, Huygens theorem, principal and central frames of inertia, balancing.

KINETICS: Kinetic, dynamic screws and kinetic energy for one isolated solid, for a set of solids.

DYNAMICS: Fundamental principle of Dynamics and General Theorems (vectorial form), classification of Galilean (Newtonian or Inertial) frames depending on the studied phenomena. Force wrench transferred by joints taking into account friction, Coulombs friction (sum and moment), viscous dissipation, rheology of some usual mechanical components, and mechanical actions by actuators. Selection of the sub-system(s) to be isolated depending on the simulation objective(s): equations of motion and/or mechanical actions. Position of equilibrium, stationary positions and, for systems with a single degree-of mobility, linearized equation of motion and stability. First order equations, power, work, kinetic energy theorem, force and potential, first order equations derived from kinetic energy

BIBLIOGRAPHY

AGATI Mécanique Industrielle Dunod
BEGHIN Cours de mécanique théorique Gauthier-Villar
BELLET Problème de mécanique Cepadues editions
BERKELEY Cours de Physique 1 Armand Colin
BONCOMPAIN Méca. des Syst. Indus. (T2) Dunod
BROSSARD Mécanique Générale Tech. de l'Ingénieur AF4
BROUSSE Cours de mécanique Collection U
BONE Mécanique Générale (crs et ap.) Dunod U
CAZIN Cours de mécanique générale Gauthier-Villar
ROY Mécanique du solide rigide Dunod
LASSIA Cinématique Ellipse
LASSIA-BARD Dynamique Ellipse

PRE-REQUISITES

- System mechanics 1
- Vectors and Linear algebra
- Ordinary Differential Equations
- Mechanical design.

IDENTIFICATION

CODE : FIMI-2-S2-EC-ETRE-SH1
ECTS : 2

HOURS

Cours :	0h
TD :	19h
TP :	0h
Projet :	8h
Evaluation :	1h
Face à face pédagogique :	20h
Travail personnel :	25h
Total :	53h

ASSESMENT METHOD

Continuous assessment. Three assessments are organized:
- the survey of IPCC work are assessed during the session group presentation (formative or summative, to be specified)
- the introductory project on Life Cycle Life Cycle Assessment project a graded group presentation (summative), including non-quantifiable impacts (Human Sciences)
- activities around anthropocene, living issues and and climate-energy issues give rise to an individual summative.

TEACHING AIDS

Course materials and exercises.
1st Cycle Moodle platform: all course and planning and organization, links to resources.

TEACHING LANGUAGE

French

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AIMS

This teaching sequence, in S2, is the first part of a program that will continue throughout the studies, with the aim of training engineers who are aware of the challenges of the ecological transition.

In its February 26, 2020 letter of intent, INSA Lyon stated that "the courses in Sustainable Development and Social Responsibility (SDRS) courses combine the following training objectives :
* in terms of cross-disciplinary skills
* in terms of themes to be addressed: climate change, energy, raw materials resources, and damage to living organisms and human health.

Two cross-cutting themes are addressed: links between science, technology and society, and the dynamics of change.

The targeted learning outcomes are thus :
1) Use a multi-disciplinary body of knowledge to provide reasoned, qualitative and quantitative answers to advanced questions on the challenges of ecological transition in relation to resources and living organisms.
2) Associate human actions with their consequences on the planet's habitability, based on planetary limits and the finitude of resources.
3) Illustrate (explain) the systemic nature of socio-ecological issues; integrate the central role of living organisms and the human-nature relationship into the reasoning.
4) Using scientific data and a decentralized approach, imagine, design and present a forward-looking narrative on a given theme of socio-ecological transition.

CONTENT

The student-engineer will work on and be assessed on the following knowledge:
- Understanding of the main principles of the Anthropocene.
- Introduction to energy and living issues.
- Role of the engineer in the ecological transition.

The sequence will be structured as follows:
- 2h introduction ("Why talk about ecological transition in engineering schools?")
- 8h of lectures and transdisciplinary exercises on planetary limits and the Anthropocene
- 3h on biodiversity with the introduction to the One Health concept
- 5h on climate-energy issues related to IPCC works

The sequence ends with 9h on project on Life Cycle Assessment (LCA) and impact of the products

IMPORTANT: 8 hours of the 28-hour course will be taught by a pair of teachers (Engineering Sciences / Sciences and Humanities), in a "Sciences-Humas" format.

BIBLIOGRAPHY

Atlas of the Anthropocene. F. Gemenne, A. Rankovic, Sciences Po Cartography Workshop
IPCC reports.
IPBES reports.

PRE-REQUISITES

Associated secondary school curricula (2nde, 1ère et Terminale) on sustainable development and social responsibility.
sustainable development and social responsibility.
Climate mural created during 1st year induction week.
The various 1st semester courses (Engineering Sciences and Human Sciences are called upon more in terms of methods (e.g.: drawing up a balance sheet, analysis, restitution...) rather than knowledge.