INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Mechanical Engineering

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

ANNEE : 3ème année GM / 3rd year GM - 60 ECTS

SEMESTRE : 1er semestre 3GM / 1st semester 3GM - 30 ECTS

PARCOURS : Parcours standard 3GM-S1 / standard track 3GM-S1 - 30 ECTS

UE : Modélisation en mécanique - 6 ECTS

EC : Sens Physique et Ordres de Grandeurs - 5 ECTS

EC : Mécanique Lagrangienne et dynamique des systèmes - 5 ECTS

UE : Projet - 6 ECTS

EC : Projet Scientifique et Technique - 6 ECTS

EC : Objet technique : Imaginaire et société - 2 ECTS

UE : Sciences Humaines et Sociales / Humanities and social sicences - 6 ECTS

EC : Connaissance de l'entreprise et du monde professionnel - 1 ECTS

EC : Education Physique et Sportive / Physical Education - ECTS

UE : Conception mécanique 1 - 6 ECTS

EC : Ingénierie éco-systémique - 5 ECTS

EC : Conception et analyse des systèmes mécaniques - 5 ECTS

UE : Mathématiques, données et méthodes numériques 1 - 6 ECTS

EC : Mathématiques - 5 ECTS

EC : Données : Analyse, Traitement, Apprentissage - 5 ECTS

SEMESTRE : 2ème semestre / 2nd semester 3GM - 30 ECTS

PARCOURS : Parcours standard 3GM-S2 / standard track 3GM-S2 - 30 ECTS

UE : Conception mécanique 2 - 5 ECTS

EC : Conception et dimensionnement - 5 ECTS

EC : Innovation et société - 2 ECTS

UE : Mécanique des milieux continus - 6 ECTS

EC : Mécanique des fluides - 5 ECTS

EC : Mécanique des solides déformables - 5 ECTS

UE : Vibrations et contrôle - 6 ECTS

EC : Mécanique des vibrations - 5 ECTS

EC : Commande de systèmes linéaires - 5 ECTS

UE : Mathématiques, données et méthodes numériques 2 - 6 ECTS

EC : Méthodes numériques - 5 ECTS

EC : Projet Instrumentation, Acquisition, Exploitation - 5 ECTS

UE : Sciences Humaines et Sociales - 5 ECTS

EC : Education Physique et Sportive / Physical Education - ECTS

ANNEE : 4ème année / 4th year GM - 60 ECTS

SEMESTRE : 1er semestre / 1st semester 4GM - 30 ECTS

PARCOURS : Parcours standard / standard track 4GM-S1 - 30 ECTS

UE : Modélisation multiphysique / Multiphysics modeling - 4 ECTS

EC : Analyse numérique des opérateurs différentiels / Numerical analysis of differential operators - ECTS

EC : Transferts thermiques / Heat transfer - ECTS

UE : Projets transversaux 1 / Transversal projects 1 - 9 ECTS

EC : Conception Mécanique Assistée par Ordinateur +/ Computer Aided Design - ECTS

EC : Projet Transversal : du besoin au prototype / Design project from needs to prototype - ECTS

EC : Projet transversal : tutorat management - undefined ECTS

EC : Responsabilité sociétale de l'ingénieur / Societal responsability of the engineer - 2 ECTS

OPTION : Option pédagogique Mécatronique et Systèmes / special track mechatronics and systems 4GM-S1 - 12 ECTS

UE : Automatique, Contrôle des systèmes mécatroniques 1 / Automation and control of mechatronic systems 1 - 5 ECTS

EC : Représentation d'état et outils de synthèse optimale et robuste / State/space analysis and tools for optimal and robust control - ECTS

EC : Analyse et commande des systèmes automatisés / Analysis and control of automated systems - ECTS

UE : Architecture et Modélisation des systèmes mécatroniques 1 / Architecture and modeling of mechatronic systems 1 - 7 ECTS

EC : Analyse vibratoire des structures / Structural vibrations - ECTS

EC : Modélisation des Systèmes Multi/Physiques / Modeling of multi/physics systems - ECTS

OPTION : Option pédagogique Conception et Etudes / special track design and studies 4GM-S1 - 12 ECTS

UE : Conception de systèmes et transmission mécanique / System Design and Mechanical Transmission - 6 ECTS

EC : Conception appliquée de systèmes mécanique / Design of mechanical systems - ECTS

EC : Transmissions Mécaniques / Mechanical transmissions - ECTS

UE : Modélisation des structures et contacts / Structural and Contact Modelling - 6 ECTS

EC : Modélisation poutres et plaques et éléments finis / Beams, plates and their finite element analysis - ECTS

EC : Mécanique des Contacts / Contact mechanics - ECTS

OPTION : Option pédagogique Industrialisation et procédés / special track Industrialisation and processes 4GM-S1 - 12 ECTS

UE : Machines - 6 ECTS

EC : Conception des Moyens de Productions : sécurité et éco/ conception / Design of production systems: safety and eco/design - ECTS

EC : Mécanismes et Systèmes de Transmission / Mechanicsms and transmission systems - ECTS

UE : Procédés et Contrôles / Porocesses and testing - 6 ECTS

EC : Procédés de mise en forme primaire et contrôle non destructifs / Primary forming processes and non/destructive testing - ECTS

EC : Procédés de fabrication par usinage et métrologie / Machining processes and metrology - ECTS

OPTION : Option pédagogique Modélisation et Expérimentations / special track Modeling and Experiments 4GM-S1 - 12 ECTS

UE : Interaction des approches numériques et expérimentales 1 / Interaction of numerical and experimental approaches 1 - 6 ECTS

EC : Modélisation numérique et expérimentale 1 / Computational and experimental modeling 2 - ECTS

EC : Optimisation et Statistiques / Optimisation and statistics - ECTS

UE : Structures et systèmes / Structures and systems - 6 ECTS

EC : Mécanique linéaire et non/linéaire des structures / Linear and non/linear structural mechanics - ECTS

EC : Analyse de Mécanismes / Mechanisms analysis - ECTS

OPTION : Option pédagogique Polymères et Composites / special track Polymers and Composites 4GM-S1 - 12 ECTS

UE : Rhéologie, matériaux et procédés pour les polymères et les composites 1 / Rehology, materials and processes for polymers and composites 1 - 7 ECTS

EC : Matériaux polymères: renforts et matériaux d'âme / Polymer materials: reinforcement and core materials - ECTS

EC : Procédés de mise en forme des polymères et des composites / Polymer and composites processing - ECTS

UE : Conception et simulation procédés polymères et composites 1 / design and numerical simulation polymer and composite processes 1 - 5 ECTS

EC : Gestion de la production / Production management - ECTS

EC : Conception et fabrication de pièces plastiques et composites 1 / Design of plastic and composite parts 1 - ECTS

UE : Communication - 5 ECTS

EC : Education Physique et Sportive / Physical Education - ECTS

SEMESTRE : 2ème semestre / 2nd semester 4GM - 30 ECTS

PARCOURS : Parcours standard / standard track 4GM-S2 - 30 ECTS

UE : Projet Transversal : du cahier des charges au produit / Transversal project: from specifications to product - 12 ECTS

EC : Projet Transversal : du cahier des charges au produit / Design project - ECTS

EC : Management et gestion pour ingénieurs en entreprise et en équipe / Professional and team management for engineers - undefined ECTS

EC : Calculs de Structure par EF / Finite Element Analysis for structural mechanics - ECTS

UE : Sciences Humaines et Sociales / Humanities and social sicences - 3 ECTS

EC : Education Physique et Sportive / Physical Education - ECTS

EC : Options Sciences Humaines et Sociales, S2 Série 1 / Social and Human Sciences Options, S2 Series 1 - undefined ECTS

OPTION : Option pédagogique Conception et Etudes / special track design and studies 4GM-S2 - 15 ECTS

UE : Conception intégrée et transmission hydraulique / Integrated design and hydraulic transmissions - 6 ECTS

EC : Transmission hydraulique / Fluid power - ECTS

EC : CAO et CAE / CAD and CAE - ECTS

UE : Modélisation multiphysique / Multiphysics modeling - 9 ECTS

EC : Synthèse de mécanismes polyarticulés / Multibody systems - ECTS

EC : Mécanique des fluides et thermique pour la conception / Fluid and heat transfer - ECTS

EC : Analyse Vibratoire des Structures / Structural vibrations - ECTS

OPTION : GM-4-S2-OP-PC - 15 ECTS

UE : Rhéologie, matériaux et procédés pour les polymères et les composites 2 / Rehology, materials and processes for polymers and composites 2 - 7 ECTS

EC : Thermomécanique des procédés de mise en forme des polymères et des composites / Thermomechanics of polymer and composite processing - ECTS

EC : Mécanique des surfaces et interfaces / Surfaces and interfaces mechanics - ECTS

UE : Conception et simulation procédés polymères et composites 2 / design and numerical simulation polymer and composite processes 2 - 8 ECTS

EC : Conception et fabrication de pièces plastiques et composites 2 / / Design of plastic and composite parts 2 - ECTS

EC : Modélisation et simulation des procédés de mise en forme des polymères et composites / Numerical modeling of polymer and composite processing - ECTS

EC : Propriétés mécaniques des pièces polymères et composites : calcul de structures / Mechanical proprties of polymer and composite parts - ECTS

OPTION : Option pédagogique Industrialisation et procédés / special track Industrialisation and processes 4GM-S2 - 15 ECTS

UE : Chaine numérique produit-procédés / Digital product-process chain - 9 ECTS

EC : Modélisation non/linéaire en mécanique des solides pour la mise en forme / Forming process modeling and simulation - ECTS

EC : Conception et Définition des Machines Spéciales / Special purpose machine design - ECTS

EC : Tolérancement 3D ISO GPS et métrologie géométrique / Geometrical metrology - ECTS

UE : Management des Processus et Qualité / Process and quality management - 6 ECTS

EC : Outils pour la qualité / Tools for quality - ECTS

EC : Mathématiques et statistiques pour la maitrise statistique des procédés / Statistical process control - ECTS

OPTION : Option pédagogique Modélisation et Expérimentations / special track Modeling and Experiments 4GM-S2 - 15 ECTS

UE : Interaction des approches numériques et expérimentales 2 / Interaction of numerical and experimental approaches 2 - 6 ECTS

EC : Modélisation numérique et expérimentale 2 / Computational and experimental modeling 2 - ECTS

EC : CAO et CAE / CAD and CAE - ECTS

UE : Modélisation et technologie / Modeling and technology - 9 ECTS

EC : Analyse des Vibrations de Structures / Structural vibrations - ECTS

EC : Frottement et Lubrification / Friction and lubrication - 3 ECTS

EC : Conversions d'énergie / Energy conversions - ECTS

OPTION : Option pédagogique Mécatronique et Systèmes / special track mechatronics and systems 4GM-S2 - 15 ECTS

UE : Automatique, Contrôle des systèmes mécatroniques 2 / Automation and control of mechatronic systems 2 - 6 ECTS

EC : Dynamique et contrôle des systèmes aérospatiaux / Dynamics and control of aerospace systems - ECTS

EC : Identification et Contrôle actif des structures / Identification and active control of structures - ECTS

UE : Architecture et Modélisation des systèmes mécatroniques 2 / Architecture and modeling of mechatronic systems 2 - 9 ECTS

EC : Architecture des Actionneurs électriques / Electric actuators - ECTS

EC : Architecture des Actionneur hydrauliques / Fluid power - ECTS

EC : Transmissions mécaniques / Mechanical transmissions - ECTS

ANNEE : 5ème année / 5th year GM - 60 ECTS

SEMESTRE : 1er semestre / 1st semestre 5GM - 30 ECTS

PARCOURS : Parcours standard / standard track 5GM-S1 - 30 ECTS

OPTION : Option pédagogique Polymères et Composites / special track Polymers and Composites 5GM-S1 - 30 ECTS

UE : Projet Recherche et Ingénierie / Research and engineering project master thesis - 16 ECTS

EC : Projet Recherche et Ingénierie / Final project master thesis - 16 ECTS

UE : Spécialisation PC / Polymer and composites specialisation - 9 ECTS

EC : Mécanique avancée pour la prévision des propriétés d'usage / Advanced mechanics for the prediction of material properties - 5 ECTS

EC : Ingénierie numérique de la mise en forme / Numerical engineering of forming processes - 5 ECTS

EC : Introduction aux procédés hybrides et innovants / Introduction to innovative forming processes - 5 ECTS

UE : Sciences Humaines et Sociales / Humanities and social sicences - 5 ECTS

EC : Education Physique et Sportive / Physical Education - ECTS

EC : Projet Personnel en Humanités / Personal Project in Humanities - undefined ECTS

EC : Projet Personnel et Professionnel / Personnal and professional project - 1 ECTS

EC : Options Sciences Humaines et Sociales, S1 Série 3 / Social and Human Sciences Options, S1 Series 3 - undefined ECTS

OPTION : Option pédagogique Modélisation et Experimentations / special track Modeling and Experiments 5GM-S1 - 30 ECTS

UE : Stage en entreprise / Internship - 30 ECTS

EC : Stage en entreprise / Internship - 30 ECTS

OPTION : Option pédagogique Industrialisation et Procédés / special track Industrialisation and processes 5GM-S1 - 30 ECTS

UE : Sciences Humaines et Sociales / Humanities and social sicences - 5 ECTS

EC : Education Physique et Sportive / Physical Education - ECTS

EC : Projet Personnel en Humanités / Personal Project in Humanities - undefined ECTS

EC : Projet Personnel et Professionnel / Personnal and professional project - 1 ECTS

EC : Options Sciences Humaines et Sociales, S1 Série 3 / Social and Human Sciences Options, S1 Series 3 - undefined ECTS

UE : Spécialisation IP / Industrial engineering and process specialisation - 9 ECTS

EC : Ingénierie des Systèmes de Production / Production systems engineering - 5 ECTS

EC : Modélisation des procédés : fabrication additive, soudage, usinage / Modeling of manufacturing processes: additive amnufacturing, welding, machining - 5 ECTS

EC : Maintenance Industrielle / Industrial maintenance - 5 ECTS

EC : Intégrité des structures sous sollicitations extremes / Structural integrity under extreme loadings - 5 ECTS

EC : Mise en forme des renforts de Composites / Composite manufacturing - 5 ECTS

UE : Projet Recherche et Ingénierie / Research and engineering project master thesis - 16 ECTS

EC : Projet Recherche et Ingénierie / Final project master thesis - 16 ECTS

OPTION : Option pédagogique Conception et Etudes / special track design and studies 5GM-S1 - 30 ECTS

UE : Stage en entreprise / Internship - 30 ECTS

EC : Stage en entreprise / Internship - 30 ECTS

OPTION : Option pédagogique Mécatronique et Systèmes / special track Mechatronic and Systems 5GM-S1 - 30 ECTS

UE : Projet Recherche et Ingénierie / Research and engineering project master thesis - 16 ECTS

EC : Projet Recherche et Ingénierie / Final project master thesis - 16 ECTS

UE : Sciences Humaines et Sociales / Humanities and social sicences - 5 ECTS

EC : Education Physique et Sportive / Physical Education - ECTS

EC : Projet Personnel en Humanités / Personal Project in Humanities - undefined ECTS

EC : Projet Personnel et Professionnel / Personnal and professional project - 1 ECTS

EC : Options Sciences Humaines et Sociales, S1 Série 3 / Social and Human Sciences Options, S1 Series 3 - undefined ECTS

UE : Spécialisation MS / Mechatronics and systems specialisation - 9 ECTS

EC : Conversions d'énergie / Energy conversions - 5 ECTS

EC : Eco/Conception / Ecodesign - 5 ECTS

EC : Smart structures - 5 ECTS

EC : Dynamique des véhicules / Vehicule dynamics - 5 ECTS

EC : Optimisation pour la conception / Optimisation for systems design - 5 ECTS

EC : Robotique / Robotics - 5 ECTS

SEMESTRE : 2ème semestre / 2nd semester 5GM - 30 ECTS

PARCOURS : Parcours standard / standard track 5GM-S2 - 30 ECTS

OPTION : Option pédagogique Conception et Etudes / special track design and studies 5GM-S2 - 30 ECTS

UE : Sciences Humaines et Sociales / Humanities and social sicences - 5 ECTS

EC : Education Physique et Sportive / Physical Education - ECTS

EC : Projet Personnel en Humanités / Personal Project in Humanities - undefined ECTS

EC : Projet Personnel et Professionnel / Personnal and professional project - ECTS

EC : Options Sciences Humaines et Sociales, S2 Série 2 / Social and Human Sciences Options, S2 Series 2 - undefined ECTS

UE : Projet Recherche et Ingénierie / Research and engineering project master thesis - 16 ECTS

EC : Projet Recherche et Ingénierie / Final project master thesis - 16 ECTS

UE : Spécialisation CE / Design and technology specialisation - 9 ECTS

EC : Géométrie et Imagerie 3D : contrôle géométrique /surfacique et tomographie / Geometry and 3D imaging - 5 ECTS

EC : Architecture des systèmes mécaniques / Multi/physics systems modeling - 5 ECTS

EC : Bio/inspiration. Écoconception et Design / Bio/inspiration and ecodesign - 5 ECTS

EC : Outils Innovants d'Aide à la Conception / Innovative tools for design - 5 ECTS

EC : Tolérancement, Simulation Géométrique, Fabrication Assistée par Ordinateur / Manufacturing and innovative processes - 5 ECTS

EC : Conversions d'énergie / Energy conversions - 5 ECTS

EC : Conception surfacique. rétroconception et optimisation / Mechanical design and optimisation - 5 ECTS

EC : Biomécanique, Arts, Luxe, Architecture / Biomechanics, art, luxury, architecture - 5 ECTS

EC : Transmissions de puissance / Power transmission - 5 ECTS

OPTION : Option pédagogique Mécatronique et Systèmes / special track Mechatronic and Systems 5GM-S2 - 30 ECTS

UE : Stage en entreprise / Internship - 30 ECTS

EC : Stage en entreprise / Internship - 30 ECTS

OPTION : Option pédagogique Industrialisation et Procédés / special track Industrialisation and processes 5GM-S2 - 30 ECTS

UE : Stage en entreprise / Internship - 30 ECTS

EC : Stage en entreprise / Internship - 30 ECTS

OPTION : Option pédagogique Modélisation et Experimentations / special track Modeling and Experiments 5GM-S2 - 30 ECTS

UE : Spécialisation ME / Modeling and expriments specialisation - 9 ECTS

EC : Dynamique des Machines Tournantes / Rotor dynamics - 5 ECTS

EC : Modélisation numérique des écoulements / Computational fluid dynamics - 5 ECTS

EC : Solutions acoustiques et vibratoires dans l'industrie / Nois and vibration control in industry - 5 ECTS

EC : Rayonnement acoustique des structures / Structural acoustics - 5 ECTS

EC : Transferts thermiques avancés / Advanced heat transfer - 5 ECTS

EC : Tribologie / Tribology - 5 ECTS

EC : Analyse des groupes Moto Propulseurs / Engin and power train analysis - 5 ECTS

EC : Mécanique des Fluides Expérimentale / Experimental fluid mechanics - 5 ECTS

EC : Méthodes Numériques pour la Modélisation en Mécanique / Numerical methods for modeling in mechanics - 5 ECTS

UE : Projet Recherche et Ingénierie / Research and engineering project master thesis - 16 ECTS

EC : Projet Recherche et Ingénierie / Final project master thesis - 16 ECTS

UE : Sciences Humaines et Sociales / Humanities and social sicences - 5 ECTS

EC : Education Physique et Sportive / Physical Education - ECTS

EC : Projet Personnel en Humanités / Personal Project in Humanities - undefined ECTS

EC : Projet Personnel et Professionnel / Personnal and professional project - ECTS

EC : Options Sciences Humaines et Sociales, S2 Série 2 / Social and Human Sciences Options, S2 Series 2 - undefined ECTS

OPTION : Polymères et Composites / special track Polymers and Composites 5GM-S2 - 30 ECTS

UE : Stage en entreprise / Internship - 30 ECTS

EC : Stage en entreprise / Internship - 30 ECTS

Order of magnitude and physical sense

IDENTIFICATION

CODE : GM-3-S1-EC-SPOG
ECTS : 5

HOURS

Cours :	10h
TD :	24h
TP :	8h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	45h
Travail personnel :	33h
Total :	78h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

The general objective of this course can be summarized as follows: Carry out the entire process of modeling, solving and critically analyzing results on a simple case of the mechanical engineer's pre-dimensioning type.
In more detail, on completion of this course, students will be able to:
1. Manipulate and convert the units of physical quantities used by mechanical engineers (primary and derived units).
2. Conduct a dimensional analysis of a physical problem, extracting the relevant dimensionless quantities and discussing possible simplifications of the underlying model.
3. Manipulate and master the notions of power and energy, calculate these in a given model, and compare numerical values with the mechanical engineer's orders of magnitude.
4. Identify energy transformation mechanisms/energy flows in a mechanical engineer's pre-sizing model.
5. List and analyze the assumptions made in modeling a real problem, and qualify their impact on the degree of confidence/expected accuracy of the model in relation to the real problem.
6. Analyze and quantify the degree of confidence / accuracy of a pre-sizing model.
7. Carry out the numerical application of a model using the correct numerical precision of quantities and in calculations according to the degree of confidence / accuracy of the model in relation to the real problem.
8. Include uncertainty calculations where necessary in the numerical application of a model.
9. Understand and analyze a provided (pre-dimensioning type) modeling of a real problem, including the asymptotic behavior of the model or its application in particular cases.
10. Reason by analogy between different physics or between different models based on their partial differential equations.
11. Transform a model supplied in the form of partial differential equations into a dimensionless form.
All these skills will be applied to physics relevant to the mechanical engineer, such as (non-exhaustive list): beam theory, fluid statics, heat conduction, performance indices, etc.

CONTENT

1. Units, concepts of forces, energy and power and orders of magnitude in mechanics.
2. Dimensionless quantities and equations.
3. Modeling assumptions - model and calculation accuracy.
4. Critical modeling approach

BIBLIOGRAPHY

PRE-REQUISITES

1st cycle mathematical tools: torsors, integration, derivation, real analysis, solving simple differential equations, linear algebra.
Point mechanics / rigid solids: kinematics, kinetics, dynamics, general theorems, PFS, PFD, notion of mechanical equilibrium.
Schematization and reading of simple technical drawings.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Lagrangian mechanics and system dynamics

IDENTIFICATION

CODE : GM-3-S1-EC-MLAG
ECTS : 5

HOURS

Cours :	10h
TD :	24h
TP :	8h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	46h
Travail personnel :	33h
Total :	79h

ASSESMENT METHOD

Intermediate exam (2 hours, 30%), Final exam (2 hours, 50%), assessment in practical work session (20%).

TEACHING AIDS

Course handouts with examples and exercises. Tutorials with corrections. Past exam papers with detailed corrections.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

The aim of this course is to teach students to model a mechanical system using the Lagrangian approach to mechanics. Thanks to the targeted learning outcomes (AAV in French), students will be able to :
- AAV1: determine the velocities, energies and powers involved in the movement of a mechanical system.
- AAV2: apply the conservation laws of classical mechanics to a simple dynamics problem.
- AAV3: set up a calculation strategy based on the principle of virtual powers for compatible or incompatible virtual transformations in order to obtain the equations of motion of the system and possibly the mechanical actions.
- AAV4: determine the constraint equations linking generalised coordinates, implement a strategy taking into account these constraint equations either by incompatible virtual transformations or by introducing Lagrange multipliers.
- AAV5: write the equations of small motions of a system and determine its equilibrium positions (by 'a priori' or 'a posteriori' methods) and study the stability of the response.
- AAV6: analyse a system based on system dynamics with a CSR (Corporate Social Responsibility) objective and identify the quantities that play a role in the system's performance.
- AAV7: set up and run an experiment to observe and quantify dynamic phenomena.

CONTENT

1. Parameterisation of a mechanical system, calculation of kinetic and potential energies, calculation of power, conservation laws.
2. Principle of virtual powers on a system described by independent generalized coordinates for compatible or incompatible virtual transformations in order to obtain the equations of motion of the system and possibly of the mechanical actions.
3. Introduction of holonomic and non-holonomic constraint equations, obtaining the equations of motion by virtual transformation incompatible with the constraint equations or by introducing Lagrange multipliers.
4. Obtaining the equations of small motions and equilibrium positions either by 'a priori' or 'a posteriori' linearisation, studying the stability of the system response for small motions.

BIBLIOGRAPHY

Classical mechanics : an undergraduate text, R. Douglas Gregory, ISBN : 0-521-82678-0, 2006.
A treatise on analytical dynamics, L.A. Pars, ISBN : 0-918024-07-2, 1979.

PRE-REQUISITES

General theorems of dynamics. Calculation of velocities of rigid solids.

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Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Scientific and technical project

IDENTIFICATION

CODE : GM-3-S1-EC-PST
ECTS : 6

HOURS

Cours :	10h
TD :	10h
TP :	4h
Projet :	30h
Evaluation :	0h
Face à face pédagogique :	24h
Travail personnel :	35h
Total :	89h

ASSESMENT METHOD

Final Report (1/3) - Oral presentation and poster (1/3) - Work and involvment (1/3)

TEACHING AIDS

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

One trans-disciplinary subject (theoretical / digital) + simple experimental validation (measurement, design-fabrication, prototyping). MOD-EX / SIM-EX. Tools for bibliographic research, technical report writing, oral presentation of work, data formatting, interaction with others. Allowing students to work and be assessed on the following skills: - Posing and solving a problem - Choosing a methodology adapted to the problem at hand - Manipulating a set of data to extract relevant information - Managing a semester's work - Summarizing scientific and technical work in writing and orally.

CONTENT

"Technical project in pairs. The technical level required will be compatible with (first cycle, or equivalent).
Learning how to format technical documents.
During supervised time, consolidation of learning, analysis, reflection, the ability to properly pose and solve a scientific and technical problem, and the ability to manage a semester's work.
Consolidation and validation of written and oral reporting skills. "

BIBLIOGRAPHY

PRE-REQUISITES

Bachelor's degree or equivalent (bac + 2)

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

technical objects: imagination and observation

IDENTIFICATION

CODE : HU-3-S1-EC-S-GM-OTIO
ECTS : 2

HOURS

Cours :	4h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	26h
Travail personnel :	22h
Total :	48h

ASSESMENT METHOD

1. Oral and visual presentation (group mark)
2. Production of a prospective narrative (group mark)

TEACHING AIDS

Documents and digital resources on Moodle platform

TEACHING LANGUAGE

French

CONTACT

Mme CHOUTEAU Marianne : marianne.chouteau@insa-lyon.fr
Mme NGUYEN Céline : celine.nguyen@insa-lyon.fr

AIMS

OBJECTIVE OF THIS COURSE
By the end of the OTIO module, 3GM students will be able to construct the trajectory and the sociotechnical profile of a technical object.
LEARNING OBJECTIVES
Creating a Graphic Representation/Model Depicting Key Aspects of a Technical Object's History, Imaginary, Sensory Interactions, and Uses by:

Collecting academic and journalistic documents (both primary and secondary sources) on the history and imaginary surrounding a technical object.
Analyzing historical documents.
Analyzing representations of a technical object.
Conducting a sociological observation of the uses and users of a technical object.
Describing sensory interactions with a technical object.
Selecting the most significant elements to incorporate into the representation.
Constructing an oral presentation that supports and complements the graphic representation.
Imagining a Prospective Narrative of a Happy World Including the Studied Technical Object by:

Identifying the values of a happy world.
Translating these values into a fictional narrative.
Developing a coherent story.

CONTENT

Composing a graphic representation [sessions 1 to 7] and presenting it [Session 8]
- Foresight for a happy world [session 9]
- Write a coherent story [sessions 10 to 12], read it in session and make the link with technical culture [session 13]

BIBLIOGRAPHY

Jacques Billard (2018), « Une technogénèse », Médium, n°54, p.47-55
Deforge Y., (1993), De l'éducation technologique à la culture technique, Paris, ESF
Deforge Y., (1985), Technologie et génétique de l'objet industriel, Paris, Maloine
Rebekka Endler (2022), Le patriarcat des objets, Paris, Dalva, n°54
Garçon A-F., (2017), « Une brève histoire de la culture technique européenne et de sa relation à l'innovation », Technologie et innovation, p.17-2, http://www.openscience.fr/Une-breve-histoire-de-la-culture-technique-europeenne-et-de-sa-relation-a-l
Jeanne Guien (2021), Le consumérisme à travers ses objets, Paris, Divergences
Marie-Pierre Julien, Céline Rosselin (2005), La culture matérielle, Paris, La Découverte
Jacomy B., (1993), « Culture technique de l'ingénieur », Techniques de l'ingénieur, n°10
Noblet (de) Jocelyn (1981), Manifeste pour le développement de la culture technique, Paris
Perriault J. (1998), « « Culture technique ». Éléments pour l'histoire d'une décennie singulière 1975-1985 », Les cahiers de médiologie, 2 (N° 6), p. 197-214. DOI : 10.3917/cdm.006.0197. URL : https://www.cairn.info/revue-les-cahiers-de-mediologie-1998-2-page-197.htm
Roqueplo P (1983), Penser la technique : pour une démocratie concrète, Paris, Seuil

PRE-REQUISITES

Written and spoken French

Conferences and Seminars

IDENTIFICATION

CODE : GM-3-S1-EC-CEMP
ECTS : 1

HOURS

Cours :	10h
TD :	1h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	12h
Travail personnel :	15h
Total :	27h

ASSESMENT METHOD

- initial reflection sheet: 10% of the overall mark;
- MCQs on conferences: 4 times 10% of the overall mark;
- Final exam: 50% of the overall mark.

TEACHING AIDS

A methodology sheet will be provided and should be followed by the student throughout the semester.
Brief company presentations will be made available on INSA LMS platform.

TEACHING LANGUAGE

French

CONTACT

M. BIDEAUX Eric :
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M. VILLE Fabrice :
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Mme Vidal-Sallé Emmanuelle :
emmanuelle.vidal-salle@insa-lyon.fr

AIMS

The aim of this course is to give students the elements they need to start building their professional project.
At the end of this course students must be able to:
- describe at least 4 typical engineering days in the field of Mechanical Engineering using examples;
- produce a document that lays the foundations of their personal and professional project explaining the sectors of activity in which they will be looking for their first internship;
- describe the similarities and differences between the various engineering careers presented to them during the semester.

CONTENT

The programme is divided into two parts:
- an introduction to personal and professional projects, with the presentation of methodological tools for personal reflection
- four conferences with engineers from various companies talking about their job and experiences.

BIBLIOGRAPHY

PRE-REQUISITES

none

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

CENTRE DES SPORTS
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Sports

IDENTIFICATION

CODE : CDS-3-S1-EC-EPS
ECTS :

HOURS

Cours :	0h
TD :	21.5h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	21.5h
Travail personnel :	0h
Total :	21.5h

ASSESMENT METHOD

Assessment in Physical Education concerns the teaching of Sports and Artistic Physical Activities (APSA), and will take the form of continuous assessment with half-yearly marking.

The mark depends on the degree of acquisition of the skills expected in each of the activities, and the progress made over all the sessions in the cycle. The mark takes into account :

Individual and/or team performance
mastery of execution
Progress in the sports project
Responsibility and autonomy

TEACHING AIDS

All physical, sporting, artistic and competitive activities

TEACHING LANGUAGE

French

CONTACT

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AIMS

This EC is part of the Teaching Unit: SHS and contributes to the development of the School's transversal competences

1*Auto-evaluating one's own performance
Knowledges :
- Fundamentals, principles of action and terminology of sports activities
- Criteria for observation, achievement and success.
Abilities :
- Assess your level of practice
- Build up a warm-up
- Set goals for progress
- Manage physical and mental potential

2* Work, learn and develop independently
Knowledge :
- PSAA rules
- Observation criteria
- Principles of warm-up and cool-down
Abilities :
- Mobilise resources
- Analyse, observe, question
- Take on different roles (referee, choreographer)

3* Interact with others, work as part of a team
Knowledges :
- Roles and functions in each sports activity
Abilities :
- Communicate appropriately: verbal, non-verbal and postural communication.
- Integrate into a group
- Take part in and develop a group project
- Take the initiative
- Be a good listener

4* Be creative, innovative and enterprising
Knowledge :
- Artistic disciplines
Abilities :
- Draw on knowledge and resources from different artistic fields to produce an original work.
- Mobilise the imagination and sensibility and make them visible through dance movement
- Access the symbolism of the body

5* Act responsibly in a complex world
Knowledge :
- Safety and operating rules
Abilities :
- Identify uncertainties and risks and act to reduce them
- Integrate a responsible dimension into their actions
- Show respect and fair play in a power struggle

6* Working in an international context
Knowledge :
- Socio-cultural differences
Abilities :
- Integrate cultural diversity into group work
- Act with respect for self and others

CONTENT

Physical Education and Sport lessons are organised around traditional Physical Education lessons, or advanced lessons, or appropriate practices (EPSA), or competitive practices within the framework of the Section Sportive Haut Niveau.

1. Physcical Education lessons :
Students choose one or two physical and sporting activities per year from among the activities offered by the sports centre (individual, group, dual).
2. Appropriate Physical Education lessons: For all students who are exempt from physical activity for at least 2 months:
Swimming, Body-building, Nordic Walking, Somatic Exercise, Sophrology, Wheelchair Basketball, Pilates, Table Tennis, etc.
3. Advanced Physical Education courses :
Specialisation in a sporting activity, University training and competitions
4. SSHN (High-Level Athlete section)

University training and competitions

EPS 3GEN and GENEPI :
1st course in Hauteville in October: 2 days: outdoor activities Objective: Create team cohesion
1st term: PE lessons on Wednesdays from 8.00 to 9.30am: 9 team sports sessions

BIBLIOGRAPHY

PRE-REQUISITES

- EPS: none
- Appropriate Physical Education: subject to medical advice
- Advanced courses and competitive practice: previous practice required subject to specific selection according to each activity
- SHN: ministerial list

Levels 1 and 2: Physical Education, Appropriate physical education
Level 3: Advanced courses and competitive practice, SHN

Ecological and systemic engineering

IDENTIFICATION

CODE : GM-3-S1-EC-IES
ECTS : 5

HOURS

Cours :	2h
TD :	30h
TP :	4h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	38h
Travail personnel :	33h
Total :	71h

ASSESMENT METHOD

Oral restitution and written evaluation

TEACHING AIDS

Scientific documentation

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

At the end of this course, students should be able to analyze engineering-related environmental and societal issues in a systemic way:
- reformulate an engineering problem in a more global, multi-criteria vision, taking into account all socio-technical and environmental interactions
- Develop scenarios of continuity or rupture, then arbitrate between efficiency, robustness and goals, in a systemic approach.
- Produce a response that goes beyond the conventional (primacy of ethics over norms)
- Know how to denounce, resist, choose, demand, but also propose, create, participate in and commit to transformation projects: be both critical and a force for proposal.

CONTENT

Integrate multi-disciplinary issues right from the design stage, in particular by taking into account the end-of-life of products, the rebound effects of use and the growing need for energy and materials.
Understanding of the interdependencies between matter and energy in the light of planetary limits.
Take a critical look at technological innovations in terms of their environmental and societal impacts, and their functional needs, in order to design responsibly and with an awareness of their impact.
Mastery of the following concepts: Energy, extractivism, ecological impacts, rebound effect, social justice, living issues, optimality, performance VS robustness, social acceptability, regulatory constraints, end-of-life (multiple obsolescence), possible alternatives.
Ability to calculate an order of magnitude for/estimate the energy and material requirements of a technical system.
Vision of the engineer's role in supporting the transition.¿¿Example of a sequence applied to road traffic:
- Links between a technical object and our lifestyles, in the case of the hypermarket car.
- Using a life cycle assessment to propose strategies for reducing impact, case of mobility
- Assessing the impact of a technical object on biodiversity, case of road networks
- Integrate EROI and material intensity in the choice of an energy source, case of oil
- Integrating the possibilities and limits of end-of-life recovery in the choice of a material, in the case of end-of-life vehicles
- Integrate socio-technical and economic effects such as the rebound effect, network or fleet, in the case of electric cars
- Using the results of life-cycle analyses, in the case of electric cars
-Use a low-tech socio-technical approach, in the case of cargo bikes
- Identify the political, organizational and social issues involved in technical change, case of the car at the turn of the century
- Propose alternatives that are socially acceptable, as in the case of bicycles
- Ethically discern one's role as mediator of technology, as in the case of road safety.
- Integrate the need for emancipation, equity and social justice.

BIBLIOGRAPHY

Documents to be translated

PRE-REQUISITES

Be able to calculate an order of magnitude for/estimate the energy and material requirements of a technical system

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Design and analysis of mechanical systems

IDENTIFICATION

CODE : GM-3-S1-EC-CONAN
ECTS : 5

HOURS

Cours :	10h
TD :	24h
TP :	8h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	46h
Travail personnel :	33h
Total :	79h

ASSESMENT METHOD

Practical work
Intermediate exam
Final exam

TEACHING AIDS

Course handout
Exercise handout
Digital resources (moodle)

TEACHING LANGUAGE

French
English

CONTACT

M. Girardin François :
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AIMS

At the end of this course, each student should be able to :
- read a definition drawing of a mechanical part or system and transcribe it into a hand-drawn sketch

- identify the components used to perform the technological functions of positioning, holding, mechanical transmission and sealing

- explain how the mechanism works from an overall drawing, a CAD or a real system:
* Identify the motion and force transmission components.
* Identify the kinematic equivalence classes

- Draw and analyse the 3D kinematic diagram corresponding to a mechanism

- calculate an input-output law in terms of forces and speeds

- check mechanical components to meet imposed design requirements (direct contact and plain bearings)

- translate a functional specification into a kinematic diagram and mechanical pre-design sketch

- create, open and manipulate a 3D CAD model of a part or assembly

CONTENT

* Power chain, calculating forces and speeds at joints
* Kinematics, hyperstatism, tolerancing
* Positioning, holding in position
* Static and dynamic sealing
* Fits, calculations of clearances / tightenings
* Calculation of plain bearings
* Bearing layout
* Design and technical drawing
* CAD

BIBLIOGRAPHY

Simmons, C. H., & Maguire, D. E. (2012). Manual of engineering drawing: Technical product specification and documentation to British and International Standards. Butterworth-Heinemann.

PRE-REQUISITES

* Knowledge of CAD software: opening and manipulating a digital model
* Reading technical drawings (layout)
* Force calculations (Torsors, Fundamental Principle of Dynamics)

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Mathematics

IDENTIFICATION

CODE : GM-3-S1-EC-MATH
ECTS : 5

HOURS

Cours :	10h
TD :	24h
TP :	8h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	46h
Travail personnel :	33h
Total :	79h

ASSESMENT METHOD

Intermediate exam (1H30) without documents (33%), Final exam (2H) with personal A4 handwritten sheet and Laplace sheet (45%), Lab session reports (22%)

TEACHING AIDS

Course handouts with examples and exercises. Course overheads. Tutorial sheets with corrections. Examination papers.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

The main aim of mathematics teaching is to develop engineering students' skills in understanding and manipulating mathematical tools that are essential to their training and form an integral part of the mathematical culture of a mechanical engineer: analysis and solution of differential equations and differential systems, Laplace and Fourier transforms and their applications, projection, orthogonal bases (especially Fourier series and orthogonal polynomials), and least-squares methods.

At the end of this course, the engineering student will be able to (intended learning outcomes):

- identify the nature and solve by hand sufficiently simple differential equations and systems of differential equations.

- linearize and study the stability of a system of differential equations.

- determine the existence and calculate the Laplace and Fourier transforms of functions and distributions.

- understand what is a solution of a differential equation in the sense of distributions.

- calculate the orthogonal projection on a vector subspace.

- orthogonalize a finite- and infinite-dimensional basis.

- calculate the least-squares approximation of a function using Fourier series and orthogonal polynomials.

CONTENT

1. Reminder of differential equations, systems of differential equations, linearization, stability, Newton's method.

2. Fourier transform and applications (definition, properties, convolution, application to solving differential equations, distributions, transform of a distribution, discrete transform).

3. Laplace transform and applications (definition, properties, application to solving problems with initial values).

4. Projection, least squares, Hilbert spaces, bases, Fourier series, orthogonal polynomials, approximate integration.

BIBLIOGRAPHY

- C. Gasquet, P. Witomski, Fourier analysis and applications, Springer 1998
- J.-P. Demailly, Analyse numérique et équations differentielles, EDP Sciences, 2006.
- J.-M. Gilsinger, M. Jaï, Éléments d'analyse fonctionnelle, fondements et applications aux sciences de l'ingénieur. PPUR 2010.
- Laplace Transform, Schaum Outlines, McGraw-Hill 1991.

PRE-REQUISITES

FIMI mathematics program: analysis (continuity, derivability, limit calculations, limited developments), integrals of continuous functions, improper integrals, matrix linear algebra, eigenvalues and eigenvectors, function sequences and series.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Data processing

IDENTIFICATION

CODE : GM-3-S1-EC-DATA
ECTS : 5

HOURS

Cours :	10h
TD :	24h
TP :	8h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	46h
Travail personnel :	33h
Total :	79h

ASSESMENT METHOD

- Intermediate Exam on computer (30%)
- Final Exam on computer (30%)
- Lab class (20%)
- Project report (20%)

TEACHING AIDS

- Detailled slides of lectures + Associated notebooks illustrating the lectures
- Corrected notebooks of tutorials (progressively available during the semester)
- Self-training documents related to pre-requisites of the semester (Python language and NumPy and Matplotlib librairies)
- Autonomous quizzs on the progressive aquisition of skills (self-training, does not count in final grade)
- Corrected past exams

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

"The main aim of EC DATA is to introduce students to the handling of scientific and technical data. The data concerned may be of various kinds (quantitative or categorical, localized or not, one-dimensional or multidimensional, images, signals, etc.), of various types (experimental, digital, from the field) and of various origins (other CEs in the curriculum, research labs, industrial partners). The aim is to put the student in the position of an engineer who is confronted with a data set and has to extract useful information and knowledge from it. The aim is to provide students with the theoretical (probability and statistics, signal processing methods, learning methods) and practical (text editor, spreadsheet, programming language) tools they need to deal with a wide variety of such situations, with increasing levels of autonomy. On completion of this course, students will be able to:

1. Store and organize data for retrieval, retention, easy access and management on a computer.
2. Read any type of file containing binary or ASCII data (.txt, .data, .csv, .h5, .toto, etc.).
3. Identify the type of data (quantitative/categorical, localized or not, mono/multi-dimensional), their quality (abundant/limited) from the description of their origin and means of obtaining them (experimental/numerical/field).
4. Visualize and graph a series of data by selecting the right representation and visualization tool.
5. Process one-dimensional data to analyze a problem, applying theoretical tools in probability, statistics and signal processing.
6. Perform basic operations on higher-dimensional data, such as segmentation and filtering.
7. Fit a model on data by linear regression using the least-squares method, using different tools (spreadsheet, code).
8. Apply supervised or unsupervised learning methods (Principal Component Analysis, classification) in guided cases on high-dimensional data to extract information."

CONTENT

1. General information on data. (Why and how to process data? Data types, loading and saving data, graphical representations, common tools). 2. Basics of probability and statistics (random variables, CDF and PDF, descriptive statistics, common laws, statistical moments). 3. One-dimensional data (time, space or other: basic operations, interpolation, regression, differential operations, signal processing, spectral analysis, Fourier series and Discrete Fourier Transform). ¿4. Higher-dimensional data (2D, 3D, 1D+time, 2D+time, etc.). basic operations, segmentation, filtering, etc.). 5. Basics of supervised and unsupervised machine learning techniques.

BIBLIOGRAPHY

PRE-REQUISITES

Programming basics, Scientific undergraduate mathematics.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Mechanical design and sizing

IDENTIFICATION

CODE : GM-3-S2-EC-CODI
ECTS : 5

HOURS

Cours :	10h
TD :	22h
TP :	8h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	43h
Travail personnel :	35h
Total :	78h

ASSESMENT METHOD

Intermediate exam
Final exam
Case studies

TEACHING AIDS

Course handout
Exercise handouts
Digital resources (moodle)

TEACHING LANGUAGE

French
English

CONTACT

M. BOULANGER Thomas :
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AIMS

The aim of this course is to set up an approach for dimensioning the parts and links of a mechanical system, based on preliminary design data.

At the end of this course, students should be able to :
- Validate the dimensions of a beam-like part based on an elastic limit criterion applied to the equivalent Von Mises stress.
- Determine the service life of a part such as a drive shaft subjected cyclically to combined torsion/bending loading.
- Select standard guiding components such as angular contact bearings for a given service life.
- Define the stiffness and dimensional characteristics of components making up an elastic connection, such as coil springs or spring washers, to achieve a given technical function, such as a pressing force on friction surfaces.
- Determine the number and dimensions of threaded elements needed to transmit torque or create a seal in a removable flush-mounted connection.
- Propose and validate technical solutions based on data from a top-down functional analysis and a functional expression of need.
- Represent technical solutions in a collaborative mock-up based on a skeleton structure.

CONTENT

- Static sizing: cohesive torsor, equivalent stress, sizing criterion and safety coefficient.
- Fatigue sizing: fatigue limit, endurance diagram and cumulative damage applied to drive shafts subjected to combined torsion and bending.
- Pivot connections using angular-contact bearings: hyperstatism, induced loads, service life and notion of preload.
- Elastic connections: coil springs and spring washers.
- Complete threaded connections: screw and assembly characteristics, tightening torque, dimensioning using simple and optimized methods.

A case study carried out in pairs enables the design and sizing approach to be implemented, based on data from a top-down functional analysis and a functional expression of need. A 3D model and drawings of the technical solution are produced using a collaborative method.

BIBLIOGRAPHY

Simmons, C. H., & Maguire, D. E. (2012). Manual of engineering drawing: Technical product specification and documentation to British and International Standards. Butterworth-Heinemann.

PRE-REQUISITES

Modeling mechanical actions
Determining the mechanical actions of an isostatic model
Strength of straight beams
Reading technical drawings
Basic knowledge of CAD software

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

IDENTIFICATION

CODE : HU-3-S2-EC-S-GM-INNO
ECTS : 2

HOURS

Cours :	0h
TD :	28h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	28h
Travail personnel :	30h
Total :	58h

ASSESMENT METHOD

Presentation in “Exhibition” Mode (group grade)
Collective Progress Grade, based on various assignments completed throughout the semester

TEACHING AIDS

Documents and digital resources on Moodle

TEACHING LANGUAGE

French

CONTACT

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Mme NGUYEN Céline :
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AIMS

By the end of the INNO module, 3GM students will be able to propose an innovative concept that makes sense in response to a problem.
To be an innovative concept that makes sense, the concept must meet the following criteria:
- The concept is innovative
- The concept creates meaning for the user
- The concept creates meaning for society
The learning objectives are :
1. To develop an innovative concept [create].
- Students are able to identify a problem
- Pupils are able to define the scope of the problem on the basis of monitoring work [recognise].
- Students are able to use creative methods to generate alternative concepts [apply]
- Students are able to choose a concept [evaluate]
- Students are able to design a proto-card to clarify their concept.

2. Test the meaning of the innovative concept for users and society [evaluate]
- The students are able to use the semi-structured interview method to validate that the concept they have devised makes sense.
- Students are able to compare the value potential of the concept they have devised with that of its competitors
- Students are able to estimate the attitude of stakeholders towards the meaning of the concept they have devised.

CONTENT

The first part of the course aims to define a problem that makes sense for society (3 sessions)
The second part aims to bring out innovative concepts (2 sessions)
The third part selects a concept based on its ability to make sense for users and society (3 sessions)
The fourth part aims to test the chosen concept (4 sessions)
Finally, the last part is dedicated to communicating the concept.

BIBLIOGRAPHY

PRE-REQUISITES

Spoken and written French

Fluid Mechanics

IDENTIFICATION

CODE : GM-3-S2-EC-FLUID
ECTS : 5

HOURS

Cours :	10h
TD :	22h
TP :	8h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	44h
Travail personnel :	22h
Total :	66h

ASSESMENT METHOD

Intermediate exam (20min) as a multiple choice (20%), 2 lab reports (20%), Final exam (3H).

TEACHING AIDS

Slides of the main course, exercice list with corrections

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

"School skills in engineering :
A1- Analyze a system (real or virtual) or a problem (level 2)
A2- Use a model of a real or virtual system (level 2)
A3- Implement an experimental approach (level 2)
A4- Design a system to meet specifications (level 2)
School skills in humanity, documentation and physical and sports education :
B2- Work, learn and develop independently (level 1)
B3- Interact with others, work as part of a team (level 1)
School skills specific to the specialty :
C2- Analyze expressed or presumed needs and define the design requirements for a mechanical system to meet these needs (level 1)
C3- Design and predimension a mechanical system (level 2)
C8- Model the behavior of a system or multiphysical phenomenon (level 2)
C10- Establish a problem-solving approach (level 2)
By mobilizing the following skills :
A5- Process data
By enabling the student to work on and be assessed on the following knowledge :
- Fluid statics, wall forces, Bernoulli's theorem, momentum
- Kinematics, turbulence, continuity, fluid dynamics, pressure drop, pump.
By enabling the student to work and be assessed on the following skills:
- Apply the fundamental equation of fluid statics
- Apply the QDM theorem
- Define the kinematic properties of a flow
- Predict aerodynamic forces on an object in a flow
- Select a pump and determine the operating point of a hydraulic system"

CONTENT

1. Static and dynamic force and momentum balance.
2. Bernoulli's Bernoulli's theorem (perfect fluid).
3. Local balance equations (continuity and Navier-Stokes) and associated boundary conditions.
4. Fluid kinematics, Eulerian and Lagrangian descriptions, steady and unsteady flows, 1D, 2D, 3D.
5. Head losses, pump characteristics, functioning point, association of pumps is series or parallel

BIBLIOGRAPHY

PRE-REQUISITES

Bachelor Mathematics level

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Mechanics of deformable solids

IDENTIFICATION

CODE : GM-3-S2-EC-MDEF
ECTS : 5

HOURS

Cours :	10h
TD :	22h
TP :	8h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	43h
Travail personnel :	35h
Total :	78h

ASSESMENT METHOD

final exam (2h) + 2 practical work assessments (4hx2)

TEACHING AIDS

textbook (lecture notes + exercises)

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

"1-Master the notions of stresses, strains and displacements, their representations (tensors) and the links between them.
2-Translate a static mechanics problem using the formalism of continuum mechanics.
3-Associate a system of equations, hypotheses and boundary conditions with a static mechanics problem in order to determine stresses, strains and displacements.
4-Physically interpret results obtained by solving a mechanical problem.
5-Relate local quantities (stresses, strains, etc.) to macroscopic quantities (forces, displacements, equilibrium, etc.).
6-Predict whether the elastic limit has been reached for a mechanical part undergoing a given loading.
7-Solve a simple static mechanics problem by solving elementary problems.
8-Formulate an elasto-static problem in energy terms, developments towards a numerical solving (FEM)."

CONTENT

"Tensor algebra
Kinematics; linearized deformations; strain measures;
Stress vector; stress tensor; yield criteria (Tresca, vM)
Equilibrium (Cauchy, D'Alembert, energy form)
Elastic and thermo-elastic behavior
Plane and axisymmetric elasticity"

BIBLIOGRAPHY

Mécanique des milieux continus, Jean Salençon, Tome I concepts généraux, Tome II Thermoélasticité

PRE-REQUISITES

integral calculus, differential operators, matrix algebra, tensile test

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Vibration of Mechanical Systems

IDENTIFICATION

CODE : GM-3-S2-EC-MVIB
ECTS : 5

HOURS

Cours :	10h
TD :	22h
TP :	8h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	42h
Travail personnel :	35h
Total :	77h

ASSESMENT METHOD

final exam (2h) all documents authorized (66%), 2 self assessments in practical work (33%)

TEACHING AIDS

Course
TD Materials
Numerical programs
Moodle site

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

The objective of this teaching is the study of mechanical vibrations encountered in any structure. This teaching in a theoretical and practical approach allows to acquire the basic notions essential to the understanding and analysis of the dynamic behavior of structures. At the end of this EC (targeted learning outcomes) the student is able to:
- model a mechanical system,
- put the system into an equation,
- extract the dynamic characteristics,
- implement an analytical or numerical approach to calculate the real responses of the system under loading.
- He also knows how to implement a vibration test with different excitation and measurement techniques.
- The student is thus able to have a critical view, to interpret the dynamic responses and to modify the structure with a view to controlled behavior.

CONTENT

1 - Equations for 1, N degrees of freedom.
2 - Transfert and impulsional function, modal schema.
3 - Determination of eigenvalues and eigenvectors
4 - Evaluation of Damping
5 -Free and forced (sinusoidal) response,
Use of the eigenmode base for the calculation of a structural response under modal or proportional viscous damping.
6 - Introduction to continuous system.
Phenomenology in longitudinal motion, torsion and bending of beam and plate systems 7 - Implementation of a measurement chain to characterize the dynamics of structures

BIBLIOGRAPHY

Biblio
• M. Lalanne, P. Berthier, J. Der Hagopian
Mechanical Vibrations for Engineers, J. Wiley, 1983
• G. Venizelos
Vibrations des structures, Analyse modale, Modélisation, Ellipses 2012
• M. Thomas, F. Laville,
Simulation des vibrations mécaniques par Matlab, Simulink et Ansys, PU du Québec 2007
• B. Combes
Vibrations des structures pour l'ingénieur et le technicien, Théorie et applications, Ellipses 2009
• J-L Guyader
Vibration des milieux continus, Hermès –Lavoisier, 2002

PRE-REQUISITES

Matrix calculation , Solid 's mechanism, elasticity, linear algebra, Numerical calculation, Data science, acquisition and post processing

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Control of linear systems

IDENTIFICATION

CODE : GM-3-S2-EC-CSL
ECTS : 5

HOURS

Cours :	10h
TD :	22h
TP :	8h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	44h
Travail personnel :	35h
Total :	79h

ASSESMENT METHOD

Final exam: 2h
Mid-term examination: 2h

TEACHING AIDS

Lecture notes
Exam session documents
Lecture slides
Summary cards

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

Control engineering concerns the representation, analysis and manipulation of the dynamical response of systems. This discipline has become central to the design of any guided system and, in particular, of mechanical systems. Its purpose is to improve the performances of a system with respect to several criteria, such as stability, speed or accuracy, and ensure repeatability in the behaviour of industrial processes even in the presence of uncontrolled disturbances in the work environment. The goal of this course is to introduce, within a linear framework, the basic tools required to represent and analyse these systems then design suitable control laws.

At the end of this course
The student masters the different approaches to modeling linear systems.
The student masters representations using transfer functions, state-space representations, and block diagrams.
The student is able to analyze and interpret the time response and frequency response of linear systems.
The student is able to identify and model elementary linear systems.
The student is able to evaluate the controllability and observability of a system.
The student is able to determine and analyze the stability of linear systems.
The student is able to assess the performance of closed-loop systems.
The student is able to design robust controllers.
The student masters the frequency-domain synthesis of linear controllers.
The student understands the practical aspects of linear system control, including sampling, instrumentation, and software-based sensors.

CONTENT

To achieve the aforementioned objectives, the course aims to cover the following topics:
1) Representations and characterization of linear systems:
- Input/output approach, transfer functions, state approach, state representation, block diagrams
- Time-domainresponse and analysis: harmonic, step, and impulse responses
- Frequency-domain response and analysis: Bode plots
- Elementary linear models (gain, integrator, 1st order, 2nd order, pure delay, differentiator)
- Controllability and observability

2) Performance analysis
- Stability: input/output stability (analysis of transfer function poles), internal stability, Nyquist criterion, stability margins
- Performance criteria of closed-loop systems: settling time, overshoot, accuracy, bandwidth

3)Controller synthesis:
- Robustness
- Frequency synthesis of linear controllers (P, PI, PD, PID, lead-lag controllers)
- State feedback control and pole placement
- Practical aspects of linear system control: sampling, instrumentation, software sensors

The course also includes two practical lab sessions (8h) introducing the problem of closed-loop control (feedback) on a real system.

BIBLIOGRAPHY

[1] Automatique appliquée Tome 1, E. Dieulesaint, D. Royer, Masson 1987.
[2] Théorie et calcul des asservissements linéaires, J.Ch. Gille, P. Decaulne, M. Pelegrin, Dunod 1992.
[3] Commande des systèmes linéaires, Ph. De Larminat, Hermès 1993.
[4] Asservissement, régulation, commande analogique, Tome 2, M. Rivoire, J-L. Ferrier, Eyrolles 1990.
[5] Automatique : systèmes linéaires et continus, S. Le Ballois, P. Codron. Eyrolles, 2006.
[6] Systèmes Automatiques : Commande des processus, J.P. Hautier, J.P. Caron. Ellipses, 1997.
[7] Feedback control of dynamics systems. G. F. Franklin, D. Powell, A. Emami-Naeini. Addison-Wesley, Reading, MA 1994.
[8] Modern control systems. R. C. Dorf, R. H. Bishop, 1998.

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Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Numerical methods

IDENTIFICATION

CODE : GM-3-S2-EC-NUM
ECTS : 5

HOURS

Cours :	10h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	36h
Travail personnel :	0h
Total :	36h

ASSESMENT METHOD

Intermediate exam (2H) without documents (30%), Final exam (2H) without documents (35%), report and digital code of the mini-project carried out in pairs (35%).

TEACHING AIDS

Course overheads. Tutorial topics with correction and numerical code. Catalog of mini-projects. Assessment books.

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

This course is an introduction to numerical methods for the approximate resolution of problems commonly encountered in Mechanics, whether stationary or unsteady, boundary and/or initial value problems. This course, based on a multiphysics and numerical modeling approach in the field of Mechanics, enables students to acquire a fundamental knowledge of Numerical Analysis and a global understanding of how to obtain, implement and exploit a numerical model.

At the end of this course (intended learning outcomes):

- Depending on the nature of the problem to be solved, students will be able to choose a numerical method based on quality and/or numerical cost criteria, while justifying their choices.
- Using analytical modeling of a stationary or unsteady problem, students will be able to implement a reasoned approach to numerical modeling and validation of numerical results obtained in the Python environment.
- Students will be able to conduct a critical analysis of the numerical results obtained, validating them with a reasoned approach in relation to numerical convergence and the accuracy obtained.
- Students will be able to develop a numerical method based on simple modeling to take into account non-linear phenomena or phenomena described by data.
- Students will be able to carry out a convergence analysis of an iterative numerical scheme in the linear case, in order to dimension a numerical model.
- The student acquires autonomy in learning the numerical approach, through independent confrontation of a complex problem.

CONTENT

The program of the course is :

1. Introduction to numerical modeling and simulation.
2. Solving systems of algebraic equations: generalities, direct methods, iterative methods, successive approximation methods, implementation.
3. Finite-difference method for partial differential equations: General, principles and obtaining 1D schemes, implementation, elements of analysis (consistency, stability, convergence), 2D extensions of the method.
4. Numerical schemes for initial-value problems: Principles, analysis and implementation, single-step methods, multi-step methods, prediction-correction methods, semi-discretization and space-time discretization.

BIBLIOGRAPHY

J.-P. Demailly, Numerical analysis and differential equations, EDP Sciences, 2016
F. Filbet, Numerical analysis: algorithm and mathematical study, Dunod, 2013
G. Allaire, Numerical analysis and optimization: an introduction to mathematical modeling and numerical simulation, Ed. de l'Ecole Polytechnique, 2005

PRE-REQUISITES

Mathematics (GM-3-S1-EC-MATH), basic elements on analysis and linear algebra (1st cycle)
Basics on Data processing (GM-3-S1-EC-DATA)
Algorithm basics.

Instrumentation, Data Acquisition and Exploitation project

IDENTIFICATION

CODE : GM-3-S2-EC-PIAE
ECTS : 5

HOURS

Cours :	0h
TD :	4h
TP :	8h
Projet :	20h
Evaluation :	1h
Face à face pédagogique :	13h
Travail personnel :	30h
Total :	63h

ASSESMENT METHOD

Collective assessment of the technical reports of the project groups (50%), individual oral assessment during the project (20%), collective assessment of an experimental set-up (10%), individual oral assessment during the practical work session (20%).

TEACHING AIDS

Course materials, practical work materials, technical documentation (acquisition system, sensors)

TEACHING LANGUAGE

French
English

CONTACT

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AIMS

The main objective of this course is to train students to set up experimental protocols in order to achieve a specific objective, such as comparing experimental data with a model or with results from the scientific literature. By the end of this course, thanks to the following targeted learning outcomes (AAV in French), students will be able to:
- AAV1: analyse a system and determine the physical quantities used to characterise the system.
- AAV2: set up an experimental approach with a specific objective.
- AAV3: select suitable sensors and set up an acquisition chain.
- AAV4: post-process and exploit the signals measured for a defined objective.
- AAV5: make relevant comparisons between measured data and models and/or other measurements.

CONTENT

Introduction (2 x 2h sessions) to physical quantities and units, different sensor technologies and general principles of acquisition chains. Introduction to measurement uncertainties and errors.
Project (10 sessions of 2 hrs) in triads on the instrumentation of a mechanical system and the use of data for comparison with a model or other measurement data.
Practical work (2 sessions of 4 hours) on measuring the mechanical characteristics of a beam in tension using different methods and sensors.

BIBLIOGRAPHY

Data acquisition for sensor systems, H. Rosemary Taylor, ISBN: 0-412-78560-9, 1997.
The makerspace librarian's sourcebook, Ellyssa Kroski, ISBN: 978-1-78330-229-1, 2017.
Arduino in Science, Collecting, Displaying, and Manipulating Sensor Data, Richard J. Smythe, ISBN: 978-1-4842-6777-6, 2021.

PRE-REQUISITES

Know how to handle and convert the units of physical quantities used by mechanical engineers.
Know the basics of probability and statistics and be able to calculate measurement uncertainties.
Know the basics of signal processing.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

CENTRE DES SPORTS
Domaine Scientifique de la DOUA
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Sports

IDENTIFICATION

CODE : CDS-3-S2-EC-EPS
ECTS :

HOURS

Cours :	0h
TD :	21.5h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	21.5h
Travail personnel :	0h
Total :	21.5h

ASSESMENT METHOD

Assessment in Physical Education concerns the teaching of Sports and Artistic Physical Activities (APSA), and will take the form of continuous assessment with half-yearly marking.

The mark depends on the degree of acquisition of the skills expected in each of the activities, and the progress made over all the sessions in the cycle. The mark takes into account :

Individual and/or team performance
mastery of execution
Progress in the sports project
Responsibility and autonomy

TEACHING AIDS

All physical, sporting, artistic and competitive activities

TEACHING LANGUAGE

French

CONTACT

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AIMS

This EC is part of the Teaching Unit: SHS and contributes to the development of the School's transversal competences

1*Auto-evaluating one's own performance
Knowledges :
- Fundamentals, principles of action and terminology of sports activities
- Criteria for observation, achievement and success.
Abilities :
- Assess your level of practice
- Build up a warm-up
- Set goals for progress
- Manage physical and mental potential

2* Work, learn and develop independently
Knowledge :
- PSAA rules
- Observation criteria
- Principles of warm-up and cool-down
Abilities :
- Mobilise resources
- Analyse, observe, question
- Take on different roles (referee, choreographer)

3* Interact with others, work as part of a team
Knowledges :
- Roles and functions in each sports activity
Abilities :
- Communicate appropriately: verbal, non-verbal and postural communication.
- Integrate into a group
- Take part in and develop a group project
- Take the initiative
- Be a good listener

4* Be creative, innovative and enterprising
Knowledge :
- Artistic disciplines
Abilities :
- Draw on knowledge and resources from different artistic fields to produce an original work.
- Mobilise the imagination and sensibility and make them visible through dance movement
- Access the symbolism of the body

5* Act responsibly in a complex world
Knowledge :
- Safety and operating rules
Abilities :
- Identify uncertainties and risks and act to reduce them
- Integrate a responsible dimension into their actions
- Show respect and fair play in a power struggle

6* Working in an international context
Knowledge :
- Socio-cultural differences
Abilities :
- Integrate cultural diversity into group work
- Act with respect for self and others

CONTENT

Physical Education and Sport lessons are organised around traditional Physical Education lessons, or advanced lessons, or appropriate practices (EPSA), or competitive practices within the framework of the Section Sportive Haut Niveau.

1. Physcical Education lessons :
Students choose one or two physical and sporting activities per year from among the activities offered by the sports centre (individual, group, dual).
2. Appropriate Physical Education lessons: For all students who are exempt from physical activity for at least 2 months:
Swimming, Body-building, Nordic Walking, Somatic Exercise, Sophrology, Wheelchair Basketball, Pilates, Table Tennis, etc.
3. Advanced Physical Education courses :
Specialisation in a sporting activity, University training and competitions
4. SSHN (High-Level Athlete section)

University training and competitions

EPS 3 GEN - GENEPI :
PE lessons on Wednesday from 8.00 to 9.30: 2 x 5 sessions: outdoor activities and 2nd 2-day course in Hauteville

BIBLIOGRAPHY

PRE-REQUISITES

- EPS: none
- Appropriate Physical Education: subject to medical advice
- Advanced courses and competitive practice: previous practice required subject to specific selection according to each activity
- SHN: ministerial list

Levels 1 and 2: Physical Education, Appropriate physical education
Level 3: Advanced courses and competitive practice, SHN

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Ingénieur, spécialité génie mécanique

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Numerical analysis

IDENTIFICATION

CODE : GM-4-S1-EC-COANO
ECTS :

HOURS

Cours :	10h
TD :	24h
TP :	0h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	38h
Travail personnel :	24h
Total :	62h

ASSESMENT METHOD

Test (4h)

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

*

*Knowledge:
Culture in numerical analysis, partial differential equations, Finite difference scheme, Differential equations and systems, Free step scheme / linked step scheme, consistency, stability, convergence.

*Capacity:
To be able to select a numerical scheme and evaluate its advantages and drawbacks.
To be able to evaluate the quality and the cost of a numerical scheme.
To be able to read the technical documents regarding softwares, and use these sofware at their best.
To be able to implement a numerical model, by programming or using black box type functions. The privileged tool is Matlab.
To be able to interpret and lead a critical analysis on a numerical solution.

CONTENT

1. Finite difference method for partial differential equations
1.1 Introduction to stationary partial differential equations
1.2 Basic principles of the finite difference method in 1D. Illustrations et implementations.
1.3 Analysis of the method : consistency, stability and convergence
1.4 Extensions to 2D
2. Numerical schemes for initial value problems
2.1 Single-step methods : principle, analysis and implementation
2.2 Multi-steps methods (prediction-correction)
2.3 Newmark method for second order problems
2.4 Numerical solvers
2.5 Semi-discretization in space and space-time discretization

BIBLIOGRAPHY

Demailly J.P., Analyse numérique et équations différentielles, EDP Sciences, Grenoble Sciences, Saint-Martin d'Hères, 2006
Butcher J.C., Numerical methods for ordinary differential equations, Wiley, New York, 2008
Shampine L.F., Numerical solution of ordinary differential equations, Chapman Hall, New York, 1994
Allaire G., Analyse numérique et optimisation, Editions de l'Ecole Polytechnique, Palaiseau, 2005
Filbet F., Analyse numérique, algorithmes et étude mathématique, Dunod, Paris 2009.
Rappaz J., Picasso M., Introduction à l'analyse numérique, PPUR, Lausanne 1999.

PRE-REQUISITES

EC Informatique et méthodes numériques (3-GM, S1)
EC Mathématiques et éléments finis (3-GM, S2)
EC Mathématiques (3-GM, S1)
Basics in Real analysis, linear and bilinear algebra
Basics in algorithmics

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Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Fluid and Thermal Mechanics

IDENTIFICATION

CODE : GM-4-S1-EC-COTTH
ECTS :

HOURS

Cours :	14h
TD :	24h
TP :	8h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	50h
Travail personnel :	16h
Total :	66h

ASSESMENT METHOD

Final examination.

TEACHING AIDS

Lecture notes will be provided.

TEACHING LANGUAGE

French

CONTACT

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AIMS

*

* Knowledge:
mechanismes of heat transfer, heat conduction, analytical solution, thermal resistances, forced convection, natural convection, heat transfer correlations, radiation, thermophysical properties.

* Abilities:
- Analyze a heat transfer problem and identify the main physical processes involved
- Decompose and solve a thermal conduction problem
- Understand and estimate the heat transfer rate by forced or natural convection
- Understand and estimate the radiatif heat transfer rate in simple cases
- Solve a coupled heat transfer problem

This course will allow students to understand the basic phenomena of heat transfer, analyze practical problems involving heat transfer and develop simple models in basic geometries and flow configurations.

CONTENT

Basic concepts of heat transfer. Conduction: description of physical phenomena, Fourier law, heat conduction equation, initial and boundary conditions. Steady state conduction: 1D analytical solutions, analogy and thermal resistance, heat fins. Unsteady conduction: lumped capacity model, analytical solutions in semi-finite and finite solids, multi-directional conduction by product of solutions. Thermal convection in single-phase fluids: physical phenomena, Newtons heat law, classification of convection problems, external forced convection, boundary layer, internal forced convection in ducts, natural convection. Thermal radiation: physical phenomena and fundamental laws, black body radiation, emission and reception of real bodies, opaque diffuse-gray surfaces, practical example of radiative heat transfer between two surfaces.

BIBLIOGRAPHY

[1] J.-F. Sacadura, Transferts thermiques. Initiation et approfondissement, Tec & Doc Lavoisier, Paris, 2015.
[2] A. Bejan, Heat Transfer, Wiley, N.Y., 1985.
[3] M. N. Ozisik, Basic Heat Transfer, Mc Graw Hill, N.Y., 1985.
[4] F. P. Incropera, D. P. DeWitt, Fundamentals of Heat and Mass Transfer , Wiley, N.Y., 2002.

PRE-REQUISITES

Computer Aided Design

IDENTIFICATION

CODE : GM-4-S1-EC-COCAO
ECTS :

HOURS

Cours :	0h
TD :	16h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	18h
Travail personnel :	12h
Total :	30h

ASSESMENT METHOD

Test 1h30 during the tutorials

TEACHING AIDS

Online documents and tutorials

TEACHING LANGUAGE

French

CONTACT

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AIMS

Practice of a CAD software :3D Representation ,part design, assembly design, basic of Kinematics. Fundamentals for CAD of mechanical systems.

CONTENT

3D representation of parts, Assembly design, Kinematic simulation, interference analysis, parameterization

BIBLIOGRAPHY

PRE-REQUISITES

technical drafting, mechanical system analysis

Projects

IDENTIFICATION

CODE : GM-4-S1-EC-COPR
ECTS :

HOURS

Cours :	0h
TD :	36h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	37h
Travail personnel :	84h
Total :	121h

ASSESMENT METHOD

Several items :
- Validation of a MOOC
- management planning
- Project review
- Final defense
- Continuous evaluation by the teacher
- Collective score related to the quality of the work of the project team + an amount of points to be distributed

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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AIMS

This is a team work project. The objective is to give a solution to a need expressed by a customer (a company, an artist, an association ...), providing a scientific and technical answer.
At the end of the project, the functional specifications must be drafted and a first iteration of solution must be carried out. This solution can take the form of a digital solution. The project must lead to a "go/no go" decision.

CONTENT

Each project topic is carried on by 3 competing teams
Functional analysis
Organization of the team
Project planning
Creativity / solution search
Choice of solution
Technical Development
Proof of feasibility or not
Preparation of final deliverables
Identify the difficulties, the locking points.
Debriefing / feedback on project and deliverables.

BIBLIOGRAPHY

PRE-REQUISITES

basic skills on mechanical desing, HU-3-GM-CREA-S1 et HU-3-GM-INNO-S2

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

IDENTIFICATION

CODE : HU-4-S1-EC-S-GM-COPR
ECTS : undefined

HOURS

Cours :	0h
TD :	18h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	19h
Travail personnel :	6h
Total :	25h

ASSESMENT METHOD

Project Management Plan: 1/3

MCQ on the MOOC Project Management: 1/3

Note from the project and team management tutor: 1/3

TEACHING AIDS

On Moodle: Online MOOC for Project Management

TEACHING LANGUAGE

French

CONTACT

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AIMS

Competencies developed:
2. Work, learn, evolve autonomously
2.2 Develop, implement, regulate a relevant strategy of action in a defined goal

3. Interact with others, work in teams
3.4 Integrating into a group, positioning oneself, building a relationship dynamic to the group, integrate new members
3.5 Managing conflicts, the balance between individual and collective interests
3.6 Engage in a collective project: building and running a project, the to evolve; become aware of their role and responsibility

4. Be creative, innovate, undertake
4.3 Innovate / create value in the business based on issues industrial, professional ...

6. Situate, work, evolve in a company, a socioproductive organization
6.4 Design and conduct an industrial or service project

7. Work in an international and intercultural context
7.4 Integrating cultural diversity into group work

CONTENT

On Moodle: Online MOOC for Project Management

BIBLIOGRAPHY

PMBOK: Guide Du Corpus Des Connaissances En Management De Projet, 5ème édition

PRE-REQUISITES

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Domaine Scientifique de la DOUA
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Social responsibilities of engineer

IDENTIFICATION

CODE : HU-4-S1-EC-S-GM-RSI
ECTS : 2

HOURS

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

ASSESMENT METHOD

Press Review Presentation (oral group grade)
Personal Essay, based on the reading of a book from the course's extended bibliography (individual written grade)

TEACHING AIDS

Moodle: course materials; bibliography
Teaching activities: case studies; serious game

TEACHING LANGUAGE

French

CONTACT

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AIMS

Explain the types (ethical, moral or legal), natures (political, social, economic and environmental) and scales (micro, meso, macro) of the engineer's responsibilities, taking examples from current events on the scale of a professional engineering situation and societal debates.
Identify the causes and issues of an ethical problem in an engineering context and determine the responsibilities of the various stakeholders.
Justify a position (point of view and/or decision) using ethical reasoning according to its role in the target context.
Propose a personal vision of engineering responsibility based on critical reading.

CONTENT

introduction: RSI: definitions and contexts
Micro analysis of RSI
- Socio-history of the engineering profession
- Fundamentals of ethics
- Ethics of technology
Meso analysis of CSR
- CSR - Origins and legal framework
- CSR - Psychodynamics of work
- CSR - Case studies Harassment and sexism
Macro analysis of CSR
- Risks and vulnerabilities
- Environmental ethics
- Technical democracy
Conclusion

BIBLIOGRAPHY

DIDIER Christelle, Penser l'éthique des ingénieurs, Paris, PUF, 2008
GILLIGAN Carole, Une voix humaine. L'éthique du care revisitée, Paris, Climats, 2024
HESS Gérald, Éthiques de la nature, Paris, PUF, 2013
JONAS Hans, Le principe responsabilité. Une éthique pour la civilisation technologique, Paris, Champs-Flammarion, 1979
RENOUARD Cécile, Éthique et entreprise, Ivry, L'Atelier, 2013
SANDEL Michael, Justice, Paris, Albin Michel, 2016
VINCK Dominique & SAINSAULIEU Ivan, Ingénieur aujourd'hui, Lausanne, PPUR, 2015

PRE-REQUISITES

Written and spoken French

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique
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Mechatronics and System Control

IDENTIFICATION

CODE : GM-4-S1-EC-MSSC
ECTS :

HOURS

Cours :	14h
TD :	22h
TP :	8h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	47h
Travail personnel :	25h
Total :	72h

ASSESMENT METHOD

TEACHING AIDS

course document, slides of oral presentation, exercices document

TEACHING LANGUAGE

French

CONTACT

M. DI LORETO :
michael.di-loreto@insa-lyon.fr

AIMS

- knowledge:
modeling of dynamical systems, state-space representation, modal analysis, stability, controllability, observability, state feedback, pole placement, output feedback with observer, internal regulator, numerical simulation

Capacities :
- Modeling of multi-physics systems into sub-systems and state variables description
- Analysis of model properties : equilibrium, stability, controllability and observability
- Synthesis of state feedback and output feedback with observer for trajectory tracking and disturbance decoupling
- Linear quadratic optimization pour control design
- Realization of numerical simulation of a control system

CONTENT

- State-space realization : Definitions, systems, equilibrium analysis, linearization
- Analysis of linear systems : time-domain, modal analysis, frequency approach, stability
- Properties of linear systems : Controllability, observability, canonical forms, minimal realization, grammians
- State-feedback and output feedback
- Linear Quadratic Regulator and robustness analysis
- Model reduction

BIBLIOGRAPHY

P. Borne, G. Dauphin-Tanguy, J.P. Richard, F. Rotella, & I. Zambettakis. Automatique: Analyse et régula- tion des processus industriels, Tome 1 Régulation continue. Méthodes et pratiques de l¿ingénieur. Editions Technip, 1993.
E.-K. Boukas. Systèmes asservis. Editions de l¿Ecole Polytechnique de Montréal, 1995.
R. Dorf & R. Bishop. Modern control systems (7th Edition). Addison-Wesley, 1995.
G. C. Goodwin, S. T. Graebe, & M. E. Salgado. Control System Design. Lavoisier, 2000. URL http://csd.newcastle.edu.au/.
L. Jaulin. Représentation d'état pour la modélisation et la commande des systèmes. Lavoisier, 2005.
T. Kailath. Linear systems. Prentice-Hall, Englewood Cliffs, N. J., 1980.
P. De Larminat. Commande des systèmes linéaires. Hermès, 2002.
D. G. Luenberger. Introduction to dynamic systems: Theory, models, and applications. John Wiley & Sons, 1979.

PRE-REQUISITES

3GM-CSL

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Mechatronics and System Control

IDENTIFICATION

CODE : GM-4-S1-EC-MSSA
ECTS :

HOURS

Cours :	8h
TD :	12h
TP :	8h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	30h
Travail personnel :	18h
Total :	48h

ASSESMENT METHOD

1 Exam (2h)

TEACHING AIDS

Lecture + Tutorials / Logiciel : Simio, Matlab/Simulink

TEACHING LANGUAGE

French

CONTACT

M. BIDEAUX Eric :
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M. SMAOUI Mohamed :
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AIMS

- Knowing architecture of automated systems : from physical layer (sensors and intelligent actuators, industrial network, ...) to industrial IT command-control systems,
- Using Petri Nets for performance evaluation of industrial automated processes : modelling, simulation, analysis, and sizing,
- Implementing synchronization and communication using fieldbus technology.

CONTENT

- Architecture of automated systems,
- Modelling with Petri Nets,
- System analysis of systems modelled with Petri Nets,
- Performance analysis of industrial processes,
- Introduction to production management (sizing and optimization),
- Introduction to field bus
- Some example of industrial or embended field bus: Ethernet, IEEE, ASI, CAN

BIBLIOGRAPHY

PETERSON J.L, "Petri nets theory and modeling of systems", Prentice Hall, 1981
JENSEN K., "Colored Petri nets. Basic concepts, analysis methods and practical use", 2 volumes, Springer-Verlag, 1991, 1995

PRE-REQUISITES

No

IDENTIFICATION

CODE : GM-4-S1-EC-MSAV
ECTS :

HOURS

Cours :	12h
TD :	20h
TP :	12h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	46h
Travail personnel :	30h
Total :	76h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

MME FAVERJON Beatrice :
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AIMS

"Vibration Analysis of Structures
- NDDL reduced dissipative systems: (state matrices / complex modes) Vibac 3-GM EC complement.
- Local approach (General theorems of dynamics) for the study of Vibration of Strings, beams (torsion, longitudinal, flexion) and rectangular and circular plates in flexion.
- Equations of motion. Method of resolution and analytical solution
- Fundamental notions: eigenmodes, eigen frequencies, modal property, free and forced answers
- Approaches by expansion of Rayleigh-Ritz, by modal decomposition and Finite elements. Notion of truncation, fineness of meshing, convergence of methods.

- Modeling EF as a user (implementation of the model from a geometry, boundary conditions and loading, iterative calculation of the modal base, calculation of a forced response, etc ...)
- Phenomenology and assumptions
- Sub-structuring method, condensation method
- Expérimentations

CONTENT

1. Free vibrations of beams inr compression traction (boundary conditions, initial conditions, modal scheme, modal decomposition, property of orthogonality of modes, ...)
2. Bending vibrations (boundary conditions, hyperbolic solutions)
3. Approaches methids (Rayleigh- Rayleigh ritz)
4. Forced vibrations of beams in torsion
5. Finite element modeling 1
6.Finite element modeling 2
7. Finite Element Modeling: assemblies (rigid connections, spring connections, soldering points), Sub-structuring 1 (ANSYS)
8. Sub-structuring 2 (ANSYS aircraft)

BIBLIOGRAPHY

PRE-REQUISITES

Mechatronics and System Control

IDENTIFICATION

CODE : GM-4-S1-EC-MSMS
ECTS :

HOURS

Cours :	14h
TD :	46h
TP :	0h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	64h
Travail personnel :	50h
Total :	114h

ASSESMENT METHOD

4h:
- 1h: mid-term exam,
- 3h: final-term exam.

TEACHING AIDS

Course and exercice handouts, synthesis slides, Moodle course

TEACHING LANGUAGE

French

CONTACT

M. MARQUIS-FAVRE Wilfrid :
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AIMS

To be able to :
- address multi-physics system modelling;
- choose an adapted tool for modelling;
- formulate the objectives, the hypotheses and the validity limits of modelling;
- analyse and critisize the obtained model;
- use the model in order to answer the given engineering study objectives (the analysis of behavior and performances, and the design/control of multi-technological and multi-physics systems).

CONTENT

1. Introduction of the multi-physics modelling context: modelling objectives, multi-technology and multi-physics approach, notions of circuits and networks, system functions and hypotheses.
2. Elements of multi-physics modelling: energy and coupling approach, physical laws and behavioral laws, analogy and bond graph elements, construction of the bond graph representation.
3. Analysis of multi-physics models: bond graph causality, systems of equations, model properties.
4. Advanced multi-physics modelling: multiport bond graph, thermofluid systems, electrofluid systems, multibody systems, vibratory systems, models governed by partial derivative equations, lagrangian ant hamiltonian approaches, port-hamiltonian systems, inverse models and bond graph bicausality.

BIBLIOGRAPHY

- Dauphin-G. Les bond graphs. IC2 : Série Systèmes automatisés. Hermès Science C21 B28- Borutzky, W. Bond graph modelling of engineering systems. Springer, 2011.
- Karnopp, D. C., Margolis, D. L., Rosenberg, R. C. System dynamics: Modeling, Simulation, and Control of Mechatronic Systems. 5th Ed., John Wiley & Sons, 2012.

PRE-REQUISITES

Physics of preparatory classes and of the common core courses of GM department.
Mathematics of preparatory classes and of the common core courses of GM department (differential equations, partial derivative equations, integration numerical methods,...).

Computer Aided Design

IDENTIFICATION

CODE : GM-4-S1-EC-CECSM
ECTS :

HOURS

Cours :	4h
TD :	36h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	40h
Travail personnel :	40h
Total :	80h

ASSESMENT METHOD

2 technical report

TEACHING AIDS

Moodle e-learning

TEACHING LANGUAGE

French

CONTACT

M. COLON DE :
romain.colon@insa-lyon.fr

AIMS

At the end of this course the student will have:
- Established, in collaboration with other students, a product-oriented design methodology inspired by the NF X 50-151 standard and following
- Consolidated its technical culture by studying cases in different fields of mechanics.
- Strengthened its capacity to deal with complex problems related to Function / Processes / Geometry / Material optimization
- Produced the numerical documents relating to his study: collaborative digital model (skeleton methodology), drawing on a layout according to the norm, bill of materials
- Managed the numerical data associated with its study

CONTENT

¿ Standards for functional analysis, value analysis and eco-design
¿ Method of research and evaluation of the physical principles of the solutions (TRIZ theory)
¿ Search for associated technical solutions (kinematic diagrams, diagrams, prechoices, multi-criteria matrix)
¿ Validation of technical functions from a geometrical point of view, kinematics, static and dynamic
¿ Choice of standard connection elements and positioning of the actuators (technological diagram, assembly diagram)
¿ ISO functional rating and GPS specifications of surfaces.
¿ Choice of production processes, material and shape optimization in terms of strength according to a known performance objective (notion of material performance index).
¿ Analysis of the mountability, lubrication, sealing, reliability.
¿ Validation of the technical functions with regard to the requirements of the specifications.
¿ A project of design applied in a CAD environment allows to put into practice the knowledge obtained on a concrete case.

BIBLIOGRAPHY

SPINNER, G., Conception des machines. Principes et applications Tomes 1 à 3, 1997, Presses polytechniques et universitaires romandes
BASSET, DEPEYRE, LONG, MICHAUD, Polycopié de construction mécanique; 270 p.
LONGEOIT, JOURDAN, Construction Industrielle et Technologie Industrielle DUNOD
Géraldine Benoit-Cervantes - Boîte à outils de l'innovation DUNOD

PRE-REQUISITES

-Study of the mechnanical joint components (developed in 3GM CONAN and CONDIM)
-Study of mechanical transmission components (3GM CONAN and CONDIM)
- Study of energy conversion and control components
- Mechanical behavior of technical systems (kinematic, static, dynamic, energetic)
- Strength of materials, elasticity

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Analytical Mechanics

IDENTIFICATION

CODE : GM-4-S1-EC-CETRM
ECTS :

HOURS

Cours :	14h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	43h
Travail personnel :	20h
Total :	63h

ASSESMENT METHOD

1 test (2 hours) + 1 test (1hours)

TEACHING AIDS

1 handout and slides - Softwares : Kisssoft, Matlab

TEACHING LANGUAGE

French

CONTACT

M. BRUYERE Jérôme :
jerome.bruyere@insa-lyon.fr

AIMS

*

*Knowledge:
Geometry, Technology, Power Transmission, Gear, belt, Design, Power Transmissions, Transmittable power, System behaviour, power loss.

*Abilities:
To be able to define and modify the design parameters of a power transmission system with gear or belt.
To be able to design a gear or belt system
To know how to optimize a gear or belt system
To simulate, with an industrial software, the behaviour of a transmission system.

CONTENT

I-Introduction
- The power transmission systems / advantage - disadvantage
II-Transmission by gear
- Principle of generation of the involute cylindrical gears
- Parameters of the teeth geometry
- Meshing
- Loaded capacity, following the recommendations of the ISO6336 standard method
- Main power losses
- Design of planetary gear trains
- Design approach of a gear transmission
III- Transmissions by belt and chain
- Main families of belts and chains
- Elements of calculation to design a supple link power transmission
- Evaluation of the life duration

BIBLIOGRAPHY

PRE-REQUISITES

GM-3-CONAN-S1 et GM-3-CDIM-S2

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Solid Mechanics

IDENTIFICATION

CODE : GM-4-S1-EC-CESOL
ECTS :

HOURS

Cours :	20h
TD :	22h
TP :	8h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	54h
Travail personnel :	20h
Total :	74h

ASSESMENT METHOD

1 IE de 1h
1 DS de 2h
2 rapports de TP

TEACHING AIDS

1 - INSA and UCBL libraries
2 - Textbook comprising lecture notes (to be completed) and a list of exercises + formulae
3 - Numerical documents: extended solutions of problems , elements about the history of Mechanics

TEACHING LANGUAGE

French

CONTACT

M. MORESTIN Fabrice :
fabrice.morestin@insa-lyon.fr

AIMS

To know the hypotheses used in the models of beams and plates, know how to carry out analytical calculations on slender structures
and be able to modelize beam and plate structures using the finite element method. Be able to program finite beam elements on MatLab to understand the functioning of slender structure elements (degrees of freedom in translation and rotation). Know how to use an industrial calculation code (Abaqus) to carry out simulations of complex systems in static and dynamic using plate elements.

CONTENT

Curved beams, planes and straight. Frenet axes, curvature, main tensor of quadratic moments / Beam hypotheses : definitions, hypotheses on materials, St-Venant hyp / Kinematics: mean line, displacements, rotations Cohesion, link with stress tensor / Energy methods: calculation of deformation energy, problem solving.
Plates: Thin and thick plates, Kirchhoff hypotheses, Mindlin, axi-symmetric systems.
Objective: to be able to solve analytically problems of reference.
Finite elements of beams and plates: reminders on finite elements: degree of freedom, interpolation functions / resolution of a linear system in structural mechanics: weak formulation, stiffness matrix, external forces, assembly / specificity of beams and plates: Degrees of freedom in rotation

BIBLIOGRAPHY

Timoshenko et Goodier, 'Theory of Elasticity', Mc Graw-Hill
Saada, 'Elasticity. Theory and Applications', Krieger
Serge Laroze, 'POUTRES', I.S.B.N. : 2854287126, 2015, Cépadues Edition
Serge Laroze, 'SOLIDES ELASTIQUES / PLAQUES ET COQUES', I.S.B.N. : 9782854287103, 2015, Cépadues Edition.

PRE-REQUISITES

GM-3-MSOL2

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
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Tribology

IDENTIFICATION

CODE : GM-4-S1-EC-CEMCO
ECTS :

HOURS

Cours :	18h
TD :	22h
TP :	8h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	50h
Travail personnel :	24h
Total :	74h

ASSESMENT METHOD

2 short written tests (2h00), 1 summary report

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. BIBOULET Nans :
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AIMS

*

*Knowledge:
Contact Mechanics, mechanical systems, contact stresses, fatigue life, friction, lubrication

*Capacities:
¿To analyze contacts in conventional mechanical systems (gears, bearings, cams ...).
¿To control the stresses in the mechanical links.
¿To know how to dimension and optimize the lubrication of the connections.
¿To numerically simulate the mechanical behavior of a link

CONTENT

. Contact mechanics - générality
. Semi-infinite domain, stress-strain relations
. Normal contact - Hertz theory
. Tangential loading, fretting, rolling and sliding contacts
. Non Hertzien contacts (edge effect, conformity, dissimilar materials, coatings, adhesion, viscoelasticity, plasticity)
. Lubricated contacts
. Numérical methods
. Surface roughness effects

BIBLIOGRAPHY

Contact Mechanics (K.L. Johnson)
Mechanics of Elastic Contacts (Hills, Nowell, Sackfield)

PRE-REQUISITES

Solid Mechanics

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Computer Aided Design

IDENTIFICATION

CODE : GM-4-S1-EC-IPEMS
ECTS :

HOURS

Cours :	12h
TD :	18h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	31h
Travail personnel :	30h
Total :	61h

ASSESMENT METHOD

1 test of 1 hour, 1 technical report

TEACHING AIDS

Moodle e-learning

TEACHING LANGUAGE

French

CONTACT

M. COLON DE :
romain.colon@insa-lyon.fr

AIMS

This course gives you the necessary knowledge for an application of the regulatory texts structuring your design:
- Machinery Directive
- Social Directive
- Ecodesign guidelines: EuP, ErP, RoHS and WEEE

The application to the special machines of the standard NF E 01-005 of ecodesign of mechanical products will allow you to approach the design of special machines and means of production in the broad sense more efficiently, less impacting for the environment and especially in a legal way! CAD course case studies complete this course to implement a design approach incorporating risk assessment and ecodesign guidelines. This design approach will be documented, in relation to the essential health and safety requirements on the one hand and the eco-design requirements on the other hand. The aim will be to create a CE certification technical file integrating the documents derived from the digital model (plan, nomenclature, manual ...).

CONTENT

COURSE:
- Definition of a special machine, the standards that apply to it, the European directives on safety and ecodesign

TD:
- In a CAD environment, creation of an EC technical file with plans and risk assessment, put in place appropriate safety measures, conclusions. Analysis of the environmental impact, taking into account the environmental profile according to standard NF 01-005

BIBLIOGRAPHY

guide de la normalisation AFNOR
guide de la maintence industrielle DELAGRAVE

PRE-REQUISITES

CAD Practical works (4 GM basic core curriculum), Mechanical Design (3GM CONAN & CONDIM)
Static, kinematic and dynamic of rigid bodies.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Analytical Mechanics

IDENTIFICATION

CODE : GM-4-S1-EC-IPMST
ECTS :

HOURS

Cours :	16h
TD :	44h
TP :	0h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	64h
Travail personnel :	24h
Total :	88h

ASSESMENT METHOD

2 test of 1 hour, 1 exam of 2 hours

TEACHING AIDS

Moodle e-learning

TEACHING LANGUAGE

French

CONTACT

MME GUILBERT Bérengère :
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AIMS

At the end of this course the student will be able to:
- To modelize, design and integrate a mechanically complex system from a kinematic point of view
- Determine the combination of actuators at a lower cost allowing the realization of a target kinematic function
- Analyze the power chain and choose the mechanical transmission components (brakes, clutches, belts, chains, gears)
- Analyze the power chain and choose hydraulic transmission components (pumps and motors, accumulators, cylinders, pressure and flow components, load sensing and coupler)

CONTENT

COURSE:
- Modeling of poly-articulated systems, position and trajectory generators as well as plane kinematics (base-rolling, developed, developing, envelope)

TD:
- Determination of mechanical transmission elements such as chain, belt, clutch, brakes and gears. For the gears, a deepening will allow to determine the possible corrections in order to optimize their implantation in simple and epicycloidal trains.
- Determination of fluid transmission elements such as pumps, motors, accumulators, cylinders, pressure and flow components, load sensing and coupling
- Kinematics applications oriented special machines types press, packaging machine, opening and access, handling ...

BIBLIOGRAPHY

Lecture notes
Bone J.C., Morel J., Boucher M., Mecanique generale : cours et applications, Ed. Dunod Université, 1994, 507 p.
Lassia R., Mécanique générale des solides indéformables - Cinématique : Cours et exercices corrigés, Ed. Ellipse, 2000

PRE-REQUISITES

CAD Practical works (4 GM basic core curriculum), Mechanical Design (3GM CONAN & CDIM)
Static, kinematic and dynamic of rigid bodies.

Manufacturing

IDENTIFICATION

CODE : GM-4-S1-EC-IPPP
ECTS :

HOURS

Cours :	0h
TD :	16h
TP :	12h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	30h
Travail personnel :	10h
Total :	40h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. GIRARDIN Francois :
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AIMS

A-Manufacturing Process
* Know how to create a manufacturing line
* Know the technological elements related to the implementation of primary processes (forging, molding, injection)
B- Control en testing
* Master the physical and technical basis of non-destructive testing
* Know how to use the most appropriate technique for a NDT problem

CONTENT

A- Methods and process
* Elements of implementation of primary processes, including forging, molding, injection

B- NDT
* Study of the propagation of an acoustic wave in matter; Application to the detection of plane defects and thickness measurement.
* Study of the attenuation of X-rays, in 2D (X-ray) and 3D (tomography) imaging; Identification of typical aluminum casting defects.
* Use of experimental bench and simulation tools.

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE : GM-4-S1-EC-IPPU
ECTS :

HOURS

Cours :	0h
TD :	38h
TP :	20h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	61h
Travail personnel :	20h
Total :	81h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. GIRARDIN Francois :
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AIMS

A-Manufacturing Process
* Know how to create a manufacturing line
* Master the process of machining complex parts on CNC machines using CAM
B- Control en testing
* Know how to use conventional metrology techniques
* Master the results of measurements and uncertainties

CONTENT

A1- Methods and process
* Chronology of machining operations: elementary operations and associations, machining constraints, sequence of operations, manufacturing project.
* Machining Assembly: position of worpiece, isostatism, clamping
* Simulation of machining, verification of compliance with tolerances

A2- CAM & Numerical Command Machine Tool
* The digital chain, from CAD to the actual part
* Functional bases of a Digital Drive/NC and CAD/CAM software.
* Preparation of a file to manufacture a part with complex surfaces: CAM model with tool path and milling conditions for 3 and / or 5 axes operations, optimization of the machining time and quality of the machined surface, Production of a prototype part on 3 or 5 axis machining center.

B1-Metrology
* Realization of dimensional and geometrical controls with conventional means
* Introduction to Measurement Uncertainties and Connection of Means of Measurement

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Experimental approaches

IDENTIFICATION

CODE : GM-4-S1-EC-MEMNE
ECTS :

HOURS

Cours :	0h
TD :	6h
TP :	48h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	55h
Travail personnel :	20h
Total :	75h

ASSESMENT METHOD

1 oral defense (1 hours, synthesizing the work of the 4 sessions of a theme) / 1 detailed report (synthesizing the work of the 4 sessions of a theme) / 4 fiches (for sessions not subject to a Defense or report)

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. EL HAJEM :
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AIMS

This course is delivered in the form of computational and experimental workshops. 12 sessions of practical works are thus divided into 3 themes from 6. The objectives here are to deal with scientific problems at the level of the piece and the mechanical system from the point of view of the numerical or analytical modeling as well as from an experimental point of view. The complementarity and interactions between the two approaches will be at the heart of this work. The assumptions and the choice of the models will be at the center of the reflections. An important objective of this EC is to learn how to synthesize a scientific work in oral and written form.

CONTENT

Measurements of physical phenomena / Analyzes and understanding of observed phenomena / Definitions of hypotheses and choice of numerical and / or analytical models / comparison of results of numerical modeling with experimental measurements

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE : GM-4-S1-EC-MEOPS
ECTS :

HOURS

Cours :	24h
TD :	24h
TP :	0h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	52h
Travail personnel :	30h
Total :	82h

ASSESMENT METHOD

Optimization : examination 2h

TEACHING AIDS

Optimization : lecture handout

TEACHING LANGUAGE

French

CONTACT

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M. BOISSE Philippe :
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M. MAHFOUD Jarir :
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AIMS

*

*Knowledge:
Optimal solution, gradient, evolution, random variables, theoretical / empirical distributions, Weibull

*Capabilities:
Perform an optimization by the Simplexe
Use Gradient Method, Cauchy, Newton, BFGS.
Use Trust method
Use Genetic Algorithm
Analyze an experimental dataset
Perform a linear regression and determine its significance
use stochastic modeling by Monte Carlo method

CONTENT

Optimization :
Introduction to optimization.
Zero order optimization method: Simplex,
Gradient method, Cauchy, Newton, BFGS.
Local minimum, Trust method,
Genetic algorithms, method of Particular swarms.
Calculation of variations (concepts).
Statistics :
- Random variables, theoretical / empirical distributions
- Sampling laws, estimation, confidence intervals
- Linear regression
- Introduction to Monte Carlo methods

BIBLIOGRAPHY

Ravindran, K.M. Ragsdell, G.V. Reklaitis, Engineering optimization, Methods and application, Wiley.
P. Bérest, Calcul des variations, Applications à la mécanique et à la physique, Ellipse
D. Goldberg, Algorithmes génétiques, Addison,Wesley
J. Bass, Eléments de calcul des probabilités, Masson.
Rosengard, cours de statistiques appliquées, Presse Universitaire de France.

PRE-REQUISITES

Solid mechanics, linear operators, probability.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Solid Mechanics

IDENTIFICATION

CODE : GM-4-S1-EC-MEMDS
ECTS :

HOURS

Cours :	16h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	44h
Travail personnel :	10h
Total :	54h

ASSESMENT METHOD

Final exam (2h)

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. GRAVOUIL Anthony :
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AIMS

*

*Knowledge:
Structural non-linear mechanics, solid mechanics, advanced finite element method, finite element analysis of structures, software implementation

*Capacity:
- to be able to have a unified vision of continuum mechanics and thermodynamics (thermal, solid, fluid)
- to be able to use and master an industrial finite element code for non-linear problems
- to be able to develop resolution algorithms for structural mechanics.

CONTENT

1) Thermodynamics for continuous materials
- Kinematics of large strains
- Local and global conservation equations, non-linear behaviors for solid materials
2) Computational structure mechanics
- Non-linear finite elements analysis : Matlab and Abaqus

BIBLIOGRAPHY

PRE-REQUISITES

Deformable solids mechanics (small transformations)
Numerical methods (differential equations and numerical solvers)

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Analytical Mechanics

IDENTIFICATION

CODE : GM-4-S1-EC-MEAME
ECTS :

HOURS

Cours :	16h
TD :	24h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	41h
Travail personnel :	35h
Total :	76h

ASSESMENT METHOD

1 exam (1hour)

TEACHING AIDS

handbook

TEACHING LANGUAGE

French

CONTACT

M. VILLE Fabrice :
fabrice.ville@insa-lyon.fr

AIMS

- Modelling and analysis, from a kinematic point of view, of complex mechanisms
- Design of linkage mechanisms
- Design and/or Analysis of Gear transmissions

CONTENT

KINEMATICS
- planar kinematics (moving/fixed centrode...)
- linkage mechanisms (2D et 3D)

TRANSMISSIONS
- tooth generation
- interference
- dimensionning
- gear ration
- efficiency

BIBLIOGRAPHY

Engrenages - Conception Fabrication Mise en uvre, Georges HENRIOT, Dunod

Etude géométrique des engrenages cylindriques de transmission de puissance, Jacques DUFAILLY, Ellipses

Calcul de la capacité de charge des engrenages cylindriques de transmission de puissance, Jacques DUFAILLY, Ellipses

Systèmes Mécaniques, AUBLIN, BONCOMPAIN, BOULATON, CARON, JEAY, LACAGE, REA, Dunod

PRE-REQUISITES

Point and solid kinematics
Matrix calculations

Materials science

IDENTIFICATION

CODE : GM-4-S1-EC-PCPRA
ECTS :

HOURS

Cours :	40h
TD :	32h
TP :	20h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	96h
Travail personnel :	30h
Total :	126h

ASSESMENT METHOD

Examination in 3 parts (6h)

TEACHING AIDS

Manuscripts of courses, exercice lessons and practical works

TEACHING LANGUAGE

French

CONTACT

M. CHARMEAU Jean-Yves :
jean-yves.charmeau@insa-lyon.fr
M. DUMONT Pierre :
pierre.dumont@insa-lyon.fr

AIMS

Part A (14h course / 8h exercise lesson / 12h practical work):
A1 (6h course / 4h exercise lesson / 4h practical work) - General knowledge for Mechanics Polymer and Composite engineers on the development and synthesis of polymer resins. Effect on the processing and properties of the polymer resins to produce polymer parts or binder in composites.
A2 (4h course / 2h exercise lesson / 4h practical work) - Study of the structure and morphology of polymer materials and their evolution during the forming process
A3 (4h course / 2h exercise lesson / 4h practical work) - Formulation of thermosetting and thermoplastic reactive matrices in the context of high performance structural composite processes. Study of structural transformations. TTT diagram for the control of the curing cycle.
Part B (6h course / 4h exercise lesson / 8h practical work)
Knowledge on fibrous reinforcements and core materials used to fabricate polymer matrix composite parts and sandwich structures. Knowledge on the processes used to obtain these materials, the descriptors of their microstructure, and their basic physical and mechanical properties.
Part C (6h course / 6 exercise lesson)
(i) Knowledge on tools for the microstructural characterization and choice of materials as well as related microstructure descriptors.
(ii) Learn how to use these tools to analyse the microstructure of materials and understand their possible defects.

CONTENT

A-1 Terminology. Reaction Mechanisms and kinetics. Chain polymerisation. Polymolecularity and mean molecular weights. A-2 Morphology of TP in the solid state. Characterisation of crystal lattices. Kinetics of static crystallization or during processing. A-3 Structural transformation of TDs. Rheokinetics / characterisation of networks. In situ control of composite processes. B-1 Reinforcing fibres for composites. Nature of fibres. Fabrication. Surface treatments. Applications. Morphological descriptors. Physical and mechanical properties. B-2 Bundles and reinforcements for composites. Multi-scale architectures. Fabrication. Microstructural descriptors of the microstructure. Links between microstructure and mechanical properties. B-3 Core materials. Introduction to cellular materials: nature and architectures. Fabrication. Microstructure descriptors. Links microstructure / mechanical properties. C-1 Tools for the characterization and analysis of microstructures. Characterisation techniques of microstructures. Definition of microstructural descriptors. Use of software dedicated to image analysis (ImageJ, Matlab). C-2 Inferential statistics. Basic concepts of probabilities. Theory of sampling / estimation. Tests of hypotheses. C-3 Selection of materials. Overall method of selection of materials. Multi-objective selection. Consideration of geometry. Performance indices. Eco conception. CES EDUPACK Software.

BIBLIOGRAPHY

[1] Fibrous Materials, 2nd edition, K. Chawla, Cambridge University Press, Cambridge, Royaume Uni, 2016.
[2] Cellular Solids, 2nd edition, L.J. Gibson, M.F. Ashby, Cambridge University Press, Cambridge, Royaume Uni, 1997.
[3] Polymer Foams Handbook - Engineering and Biomechanics Applications and Design Guide, 1st Edition, N. Mills, Butterworth-Heinemann, Oxford, Royaume Uni, 2007.
[4] M.F. Ashby, BH, Materials Selection in Mechanical Design
[5] J. Oher, F. Mücklich, Wiley, Statistical analysis of microstructures in materials science

PRE-REQUISITES

Materials science (SIMS 3GM), Rheology (RMP 3GM)

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Fluid and Thermal Mechanics

IDENTIFICATION

CODE : GM-4-S1-EC-PCPMF
ECTS :

HOURS

Cours :	12h
TD :	10h
TP :	16h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	40h
Travail personnel :	25h
Total :	65h

ASSESMENT METHOD

2-h examination and practical work reports or presentations

TEACHING AIDS

Manuscripts of lessons, exercice lessons and practical works

TEACHING LANGUAGE

French

CONTACT

MME BARRES Claire :
claire.barres@insa-lyon.fr

AIMS

Knowledge:
polymers, composites, processing, process parameters, processing tools, physical phenomena

To be able to :
- choose a process for a specific production
- explain the operation of polymer and composite processing techniques
- adjust the main operating parameters of a process in a well-argued manner
- implement thermal or flow computations in polymer processing situations
- do the dimensioning of a tool for a given production

CONTENT

A Extrusion - Course (6h) Overview of single-screw and two-screw technologies. Transport mechanisms, fusion/plasticization, flows. Analytical models in functional areas. Defects, dimensional problems. Elements of technology and design of dies. Exercise lessons (4h) Modelling of the melted flow zone, characteristic curves, coupling screw-dies. Modelling of plasticization in single-screw devices. Flows in twin-screw devices. Practical works (8h) 1-Single-screw extrusion: operating parameters, pressure-pressure relationship, and residence time. 2-Extrusion-blow moulding.
B Composite forming processes -Introduction to Liquid Composite Molding (LCM) processes and pre-impregnated composite forming processes: Course (4h): Principles. Applications. Forming steps and associated physical phenomena. Advantages and drawbacks (i) deformation phenomena of dry and impregnated reinforcements for long-fibre composite materials, (ii) impregnation phenomena, and (iii) flow-induced structure short-fibre reinforcements.
Exercise lessons (4h): theory on the flow of fluids in porous and fibrous media. Practical work (4h): development of a composite part by the compression of Sheet Molding Compound. Links between forming parameters and forming defects. Practical work (4h): fabrication of a composite part by RTM. Links between process parameters and forming defects.

BIBLIOGRAPHY

[1] Flow and Rheology in Polymer Composites Manufacturing, Volume 10, 1st Edition, Editors: S.G. Advani, Elsevier, Amsterdam, Pays-Bas, 1994.
[2] Manufacturing Techniques for Polymer Matrix Composites (PMCs), 1st Edition, Editors: Suresh Advani Kuang-Ting Hsiao, Woodhead Publishing, Cambridge, Royaume Uni, 2012.
Polymer Extrusion, 4ème ed. C. Rauwendaal ; Hanser Publishers (2001)
[3] Screw Extrusion, Science and Technology. J.L. White, H. Potente ; Hanser Publishers (2001)
[4] Extrusion Dies for Plastics and Rubber, Design and Engineering Computations, 3ème ed. W. Michaeli ; Hanser Publishers (2003)

PRE-REQUISITES

Materials science (SIMS 3GM) and rheology (RMP 3GM), basic concepts of fluid mechanics, basic concepts of design

Manufacturing

IDENTIFICATION

CODE : GM-4-S1-EC-PCGEP
ECTS :

HOURS

Cours :	10h
TD :	18h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	31h
Travail personnel :	20h
Total :	51h

ASSESMENT METHOD

1 examination (1h)+ 1 Exam (1h30)

TEACHING AIDS

Production management and quality:
- 1 handout (lecture notes + exercices)
- moodle platform with autocorrected online exercices for self-training
- serious game to experience a production situation

Design of experiments:
- 1 handout (lecture notes + exercices)

Databases:
- 1 handout (lecture notes + exercices)

TEACHING LANGUAGE

French

CONTACT

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M. CHEUTET Vincent :
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AIMS

Production management and quality:
- know the basic principles of production planning (S&OP, MPS, MRP)
- know the definition of a quality management system
- know the main tools of problem solving and lean manufacturing

Design of experiments:
- how to establish factors influence
- Carry out an analysis of variance (ANOVA)
- use fractional factorial designs, ordering experiments and Taguchi method.

Databases:
- Processing informations with a database

CONTENT

Production management and quality:
- Introduction; technical data management; production planning (S&OP, MPS, MRP)
- Quality management system and ISO9001v2015; problem solving tools; lean manufacturing

Design of experiments:
- Full factorial experiment, linear regression model, comparing variance
- Other method for experiment design

Databases:
- Introducing and using an OpenSource database

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Computer Aided Design

IDENTIFICATION

CODE : GM-4-S1-EC-PCCOF
ECTS :

HOURS

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

ASSESMENT METHOD

Examination (2h)

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. TOLLENAERE Hervé :
herve.tollenaere@insa-lyon.fr

AIMS

1 - The objective is to know the basics of moulding analysis. We will endeavour to define the concepts of parting planes and parting lines. These concepts allow us to imagine and design the blocks of a mould to obtain a part.
2- To analyse the moulding tools for plastic and composite parts.

CONTENT

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

CENTRE DES SPORTS
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Sports

IDENTIFICATION

CODE : CDS-4-S1-EC-EPS
ECTS :

HOURS

Cours :	0h
TD :	21.5h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	21.5h
Travail personnel :	0h
Total :	21.5h

ASSESMENT METHOD

Assessment in Physical Education concerns the teaching of Sports and Artistic Physical Activities (APSA), and will take the form of continuous assessment with half-yearly marking.

The mark depends on the degree of acquisition of the skills expected in each of the activities, and the progress made over all the sessions in the cycle. The mark takes into account :

Individual and/or team performance
mastery of execution
Progress in the sports project
Responsibility and autonomy

TEACHING AIDS

All physical, sporting, artistic and competitive activities

TEACHING LANGUAGE

French

CONTACT

Mme JAUSSAUD Marie :
marie.jaussaud@insa-lyon.fr

AIMS

This EC is part of the Teaching Unit: SHS and contributes to the development of the School's transversal competences

1*Auto-evaluating one's own performance
Knowledges :
- Fundamentals, principles of action and terminology of sports activities
- Criteria for observation, achievement and success.
Abilities :
- Assess your level of practice
- Build up a warm-up
- Set goals for progress
- Manage physical and mental potential

2* Work, learn and develop independently
Knowledge :
- PSAA rules
- Observation criteria
- Principles of warm-up and cool-down
Abilities :
- Mobilise resources
- Analyse, observe, question
- Take on different roles (referee, choreographer)

3* Interact with others, work as part of a team
Knowledges :
- Roles and functions in each sports activity
Abilities :
- Communicate appropriately: verbal, non-verbal and postural communication.
- Integrate into a group
- Take part in and develop a group project
- Take the initiative
- Be a good listener

4* Be creative, innovative and enterprising
Knowledge :
- Artistic disciplines
Abilities :
- Draw on knowledge and resources from different artistic fields to produce an original work.
- Mobilise the imagination and sensibility and make them visible through dance movement
- Access the symbolism of the body

5* Act responsibly in a complex world
Knowledge :
- Safety and operating rules
Abilities :
- Identify uncertainties and risks and act to reduce them
- Integrate a responsible dimension into their actions
- Show respect and fair play in a power struggle

6* Working in an international context
Knowledge :
- Socio-cultural differences
Abilities :
- Integrate cultural diversity into group work
- Act with respect for self and others

CONTENT

Physical Education and Sport lessons are organised around traditional Physical Education lessons, or advanced lessons, or appropriate practices (EPSA), or competitive practices within the framework of the Section Sportive Haut Niveau.

1. Physcical Education lessons :
Students choose one or two physical and sporting activities per year from among the activities offered by the sports centre (individual, group, dual).
2. Appropriate Physical Education lessons: For all students who are exempt from physical activity for at least 2 months:
Swimming, Body-building, Nordic Walking, Somatic Exercise, Sophrology, Wheelchair Basketball, Pilates, Table Tennis, etc.
3. Advanced Physical Education courses :
Specialisation in a sporting activity, University training and competitions
4. SSHN (High-Level Athlete section)

University training and competitions

BIBLIOGRAPHY

PRE-REQUISITES

- EPS: none
- Appropriate Physical Education: subject to medical advice
- Advanced courses and competitive practice: previous practice required subject to specific selection according to each activity
- SHN: ministerial list

Levels 1 and 2: Physical Education, Appropriate physical education
Level 3: Advanced courses and competitive practice, SHN

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IDENTIFICATION

CODE : GM-4-S2-EC-COPR
ECTS :

HOURS

Cours :	0h
TD :	96h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	97h
Travail personnel :	150h
Total :	247h

ASSESMENT METHOD

- Management planning
- Final defense
- Continuous evaluation of the project work
- Quality of the business expertise
- Collective self-assessment note linked to the quality of the work of the project team

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. TOLLENAERE Hervé :
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M. EL HAJEM :
mahmoud.el-hajem@insa-lyon.fr

AIMS

This is a project team work.
Each team of students starts from a technical specification formalized in GM-4-COPR-S1 projects or posed by an "external customer".
The work required consists of developing and validating a precise and pre-industrializable technical solution: each part of the system will be designed taking into account the various industrial constraints.

CONTENT

Analysis of the specifications and project planning
Identification of business needs
Creativity / solution search
Choice of solution(s)
Technical Development
Debriefing / feedback on project and deliverables

BIBLIOGRAPHY

PRE-REQUISITES

basic skills on mechanical desing, HU-3-GM-CREA-S1 et HU-3-GM-INNO-S2

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

IDENTIFICATION

CODE : HU-4-S2-EC-S-GM-MAGIEE

ECTS : undefined

HOURS

Cours :	0h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	20h
Travail personnel :	20h
Total :	40h

ASSESMENT METHOD

-Individual assessment 40%
-Collective assessment 60%

TEACHING AIDS

Slides and digital resources on Moodle

TEACHING LANGUAGE

French

CONTACT

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M. LE GUENNIC Thomas :
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Mme SALINI Fabienne :
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AIMS

This course contributes to the development of the competency CT6: CT6: POSITION ONESELF WITHIN A COMPANY OR AN ORGANIZATION

- Place the company in its socio-economic and competitive environment.
- Understand the organization and management of the company.
- To enable students to understand an organization as a complex system made up of interrelated individuals.
- To enable students to get to know themselves better in order to position themselves as employees, managers and/or company directors.

CONTENT

Session 1: Introduction
Session 2: Knowing your motivations and values, leadership & management styles
Session 3: Sociology of Organizations
Session 4: Project
Session 5: The company in its context
Session 6: Corporate Strategy
Session 7: Group Psychodynamics
Session 8: Individual test evaluation
Session 9: Project
Session 10: Project
Session 11: Conclusion

BIBLIOGRAPHY

-Michel Capron, Françoise Quairel-Lanoizelée, L'entreprise dans la société, Paris, La Découverte, 2015.
-Christelle Didier, Penser l'éthique des ingénieurs, Paris, PUF, 2008.
-Frédéric Fréry, Gerry Johnson & al., Stratégique, Paris, Pearson, 2017.
-Christophe Midler, Bernard Jullien, Innover à l'envers. Repenser la stratégie et la conception dans un monde frugal, Paris, Dunod, 2017.
-Ivan Sainsaulieu et Dominique Vinck, Ingénieur aujourd'hui, Lausanne, Presses polytechniques et universitaires romandes, 2015.
- William Schutz, L'élément Humain, Interéditions, 2006.

PRE-REQUISITES

Very good skills in French (TCF)
OTIO 3GM S1 ; INNO 3GM S1 ; COPRO 4GM S1 ; RSI 4GM S1

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

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Finite Element Modeling

IDENTIFICATION

CODE : GM-4-S2-EC-COCAS
ECTS :

HOURS

Cours :	0h
TD :	16h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	17h
Travail personnel :	12h
Total :	29h

ASSESMENT METHOD

Test at the end of the training cycle (1 hours)

TEACHING AIDS

Online documents and tutorials

TEACHING LANGUAGE

French

CONTACT

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MME SALLE Emmanuelle :
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AIMS

This EC is part of the EU GM-4-COPRO-S2, Transversal Projects and contributes to:
Engineering Science Skills for Engineers:
A1- Analyze a system (real or virtual) or a problem (level 2)
A2- Exploit a model of a real or virtual system (level 3)

Specialty schools specific to the specialty:
C7- Use digital simulation tools (level 2)
C8- Model the behavior of a multiphysical system or phenomenon (level 2)
C10- Establish a problem-solving approach (level 2)

By mobilizing the following skills:
A5- Edit data
C3- Design and pre-dimension a mechanical system

By allowing the student to work and be evaluated on the following knowledge:
- information necessary for the realization of a finite element calculation
- different types of algorithms that are used by ABAQUS and ANSYS Workbench
- parameters to improve the relevance of a calculation

By allowing the student to work and be evaluated on the following abilities:
- To put in data a simple problem of mechanics of the structures using the software ABAQUS
- To put in data a simple problem of structural mechanics using the software ANSYS Workbench
- Exploit calculation results
- Interpret calculation results

CONTENT

Discovery of the graphical interfaces of ABAQUS and ANSYS Workbench software.
Use of both software to carry out finite element modeling for structural components.
Depending on students' previous knowledge, applications can focus on different types of modeling, the aim is deepen their knowledge and experience in the field of finite element calculation.

BIBLIOGRAPHY

PRE-REQUISITES

Numerical Analysis and Mathematical Modeling Course (GM-3-INUM-S1, GM-3-MMEF-S, GM-4-COANO-S1)
Solid Mechanics Course (GM-3-MSOL-S2)

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

CENTRE DES SPORTS
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Sports

IDENTIFICATION

CODE : CDS-4-S2-EC-EPS
ECTS :

HOURS

Cours :	0h
TD :	21.5h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	21.5h
Travail personnel :	0h
Total :	21.5h

ASSESMENT METHOD

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The mark depends on the degree of acquisition of the skills expected in each of the activities, and the progress made over all the sessions in the cycle. The mark takes into account :

Individual and/or team performance
mastery of execution
Progress in the sports project
Responsibility and autonomy

TEACHING AIDS

All physical, sporting, artistic and competitive activities

TEACHING LANGUAGE

French

CONTACT

Mme JAUSSAUD Marie :
marie.jaussaud@insa-lyon.fr

AIMS

This EC is part of the Teaching Unit: SHS and contributes to the development of the School's transversal competences

1*Auto-evaluating one's own performance
Knowledges :
- Fundamentals, principles of action and terminology of sports activities
- Criteria for observation, achievement and success.
Abilities :
- Assess your level of practice
- Build up a warm-up
- Set goals for progress
- Manage physical and mental potential

2* Work, learn and develop independently
Knowledge :
- PSAA rules
- Observation criteria
- Principles of warm-up and cool-down
Abilities :
- Mobilise resources
- Analyse, observe, question
- Take on different roles (referee, choreographer)

3* Interact with others, work as part of a team
Knowledges :
- Roles and functions in each sports activity
Abilities :
- Communicate appropriately: verbal, non-verbal and postural communication.
- Integrate into a group
- Take part in and develop a group project
- Take the initiative
- Be a good listener

4* Be creative, innovative and enterprising
Knowledge :
- Artistic disciplines
Abilities :
- Draw on knowledge and resources from different artistic fields to produce an original work.
- Mobilise the imagination and sensibility and make them visible through dance movement
- Access the symbolism of the body

5* Act responsibly in a complex world
Knowledge :
- Safety and operating rules
Abilities :
- Identify uncertainties and risks and act to reduce them
- Integrate a responsible dimension into their actions
- Show respect and fair play in a power struggle

6* Working in an international context
Knowledge :
- Socio-cultural differences
Abilities :
- Integrate cultural diversity into group work
- Act with respect for self and others

CONTENT

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4. SSHN (High-Level Athlete section)

University training and competitions

BIBLIOGRAPHY

PRE-REQUISITES

- EPS: none
- Appropriate Physical Education: subject to medical advice
- Advanced courses and competitive practice: previous practice required subject to specific selection according to each activity
- SHN: ministerial list

Levels 1 and 2: Physical Education, Appropriate physical education
Level 3: Advanced courses and competitive practice, SHN

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INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

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Domaine Scientifique de la DOUA
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Humanities and social sciences

IDENTIFICATION

CODE : HU-0-S2-EC-S-SERIE1
ECTS : undefined

HOURS

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

ASSESMENT METHOD

Assessment will be conducted through continuous evaluation. The assessment methods will be presented at the beginning of the semester by the teaching team

TEACHING AIDS

Materials are chosen by the instructor based on the module:
• Didactic documents related to the module
• Audiovisual materials
• Recommended readings

TEACHING LANGUAGE

French

CONTACT

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Mme GOUTALAND Carine : carine.goutaland@insa-lyon.fr

AIMS

A series of elective courses in Humanities and Social Sciences (HSS) offers several options for students to choose from, allowing them to develop and deepen specific skills. This course aims to develop one or more transversal skills among the following:
• CT1: Self-awareness and self-management
• CT2: Working, learning, and evolving independently
• CT3: Interacting with others, working in a team
• CT4: Demonstrating creativity
• CT5: Acting responsibly in a complex world
• CT6: Navigating and evolving within an organization
• CT7: Working in an international and intercultural context
The list of options available in Series 1 and the specific competencies for each option are detailed in the catalog on the IntranetHumas: https://intranethumas.insa-lyon.fr/sciences-humaines-sociales/offre-de-formation/cours-la-carte-0

CONTENT

Each module is designed to encourage interaction and active student participation. The content is structured around the following key aspects:
• Theoretical deepening related to the theme
• Reflection on the topic
• Practical exercises and activities
• Assessments and presentation of work

BIBLIOGRAPHY

The bibliography is selected by the instructor based on the module.

PRE-REQUISITES

French

Computer Aided Design

IDENTIFICATION

CODE : GM-4-S2-EC-CETHY
ECTS :

HOURS

Cours :	8h
TD :	22h
TP :	8h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	41h
Travail personnel :	25h
Total :	66h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. DUREISSEIX David :
david.dureisseix@insa-lyon.fr

AIMS

Knowledge:
-reading hydraulic diagram,performance of components

-performance of circuits,steady state,pre dimensioning

-design circuits

Abilities:
- be abble to read a hydraulic diagram of moderate complexity
- be abble to evaluate the performances of components and circuits in steady state
- be abble to determine a pre-dimensioning of the main components
-be abble to design a hydraulic circuit with requirements specifications

CONTENT

1. General information / reminders
2. Pumps / motors: technology and main characteristics
3. Distributors / valves: technology and main characteristics
4. Accumulators: technology and design elements
5. Pressure / flow control
6. cylinder

TD

1. TD compressibility of the oil

2. TD circuit sequencage

3. TD Pump / motor, illustration output, pump pulsation, pressure limiter

4. TD flow regulation

5. TD temperature of fluid

6. TD sizing accumulator

7. TD complex circuit

8. TD design circuit

2. TD Sizing / choice of cylinder

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Computer Aided Design

IDENTIFICATION

CODE : GM-4-S2-EC-CECAO
ECTS :

HOURS

Cours :	0h
TD :	36h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	38h
Travail personnel :	10h
Total :	48h

ASSESMENT METHOD

ongoing evaluation, three sessions of two hours of computer works

TEACHING AIDS

Moodle e-learning

TEACHING LANGUAGE

French

CONTACT

M. BARD Christophe :
christophe.bard@insa-lyon.fr

AIMS

Key words :
3D CAD, solid-shape-hybrid modeling, multi-CAD data exchange, knowledge, advanced CAD features, digital review, mechanical behaviour, kinematics, dynamic, finite element, strength, optimization.

Intents :
3D CAD design (Solid, Shape & Hybrid modeling) of simple and complex mechanical parts and products including multi-Cada data exchange.
-Capture of Design intents, expertise, product behaviour and corporate know-how and turns this knowledge into Digital Mock-Up (DMU) explicit rules.
-Implementation of advanced CAD-features (power-copy, features recognition and re-engineering) and 3D digital review (interference detection and analysis, dynamic sectionning, geometry comparison, assembly / disassembly simulation (Fitting simulation), kinematics traces and swept volumes.
- Perform CAD integrated stength, performance and optimization analysis based on kinematic, dynamic dans Finite element analysis (Linear).
-Collaborative design, product developpment and manufacturing, service and project data management

CONTENT

Nine classes (4 hours) of practical work on the following themes:
- Digital review, mechanical dysfunction research, fitting annalysis,
- Kinematic and dynamic analysis, dafting of summary documents
- Knowledge, implementation of design rules
- Shape design
- Static FEM Analysis - Basics and methodology
- Static FEM Analysis - Case study
- Modal Analysis of a mecanical system, various modelling strategy and associated impacts
- Role playing, re-engineering and product life cycle managment

BIBLIOGRAPHY

PRE-REQUISITES

CAD Practical works (4 GM basic core curriculum), Mechanical Design (4GM)
Static, kinematic and dynamic of rigid bodies, Continuum mechanics (static ans dynamic) and FEM analysis

Analytical Mechanics

IDENTIFICATION

CODE : GM-4-S2-EC-CECIN
ECTS :

HOURS

Cours :	16h
TD :	24h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	43h
Travail personnel :	46h
Total :	89h

ASSESMENT METHOD

* 1 evaluation of 45 min. during lecture in the middle of semester
* 1 evaluation of 2 hours at the end of semester

TEACHING AIDS

Lecture notes and slides.
Exercises notes.
Softwares : Adams, Maple/ Maplesim, Matlab, Amesim.

TEACHING LANGUAGE

French

CONTACT

M. SANDEL Arnaud :
arnaud.sandel@insa-lyon.fr

AIMS

Be able to analyse and define multibody in order to obtain given kinematics or mechanical feedback control.
Design the kinematics of particular mechanisms : trajectory, position or function generator.

CONTENT

1- 3D et 2D definitions : instantaneous rotation axes and centers, axoid surfaces, primitive curves in 2D-motion. Reminder : slip velocity, rolling and swiveling.
2- Conjugate curves.
3- Curvatures study with the Euler-Savary method.
4- Curvatures study with the Bobillier method.
5- Resolution of a trajectory synthesis method - quaternions.
6- Cam mechanisms.
Examples and exercises : geometry of pumps and compressors, special machines design, vehicle steering, suspensions, finger prosthesis, printing mechanisms, oil pumping mechanism, cam system...

BIBLIOGRAPHY

Lecture notes
Bone J.C., Morel J., Boucher M., Me¿canique ge¿ne¿rale : cours et applications, Ed. Dunod Universite¿, 1994, 507 p.
Lassia R., Mécanique générale des solides indéformables - Cinématique : Cours et exercices corrige¿s, Ed. Ellipse, 2000

PRE-REQUISITES

Screws, geometry and kinematics seen in the courses :
* Systems mechanics of 2nd INSA Year (or similar)Statics,
* EC Mechanical systems mechanics (3GM)

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Fluid and Thermal Mechanics

IDENTIFICATION

CODE : GM-4-S2-EC-CEFTE
ECTS :

HOURS

Cours :	24h
TD :	16h
TP :	8h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	51h
Travail personnel :	25h
Total :	76h

ASSESMENT METHOD

Two exams (1h30_1h15)
TPS (4h)

TEACHING AIDS

Digital pdf class notes; Exercice and laboratory paper folders

TEACHING LANGUAGE

French

CONTACT

M. RIVIERE Nicolas :
nicolas.riviere@insa-lyon.fr

AIMS

*Knowledge
Internal combustion engine, reciprocating engine, axial flow engine, engine technology, thermodynamics and cycles, external aerodynamics, aerodynamic forces boundary layer, meshing, computational fluid dynamics, heat exchangers, technology of heat exchangers

*Abilities:
* be able to integrate aerodynamics during a design process
* be able to integrate thermics during a design process
* how to integrate fluid/heat components with a new designed device
* use simultaneously CAD and CFD softwares

CONTENT

*** heat transfer (complements), heat exchangers, engines
*** aerodynamics : forces, viscous effects, compressibility effects, 3D effects, special devices
*** Computational fluid dyanamics and heat transfers (CFD) : equations, turbulence, meshes, wall treatment, boundary conditions, computational strategy, post processing
*** CFD for design, CAD /CFD interaction

BIBLIOGRAPHY

Versteeg & Malalasekera, an introduction to computational Fluid Dynamics, Pearson Prentice hall, 1995.
Cengel & Boles Thermodynamics, an engineering approach, McGraw-Hill, 1989.
Anderson, J.D. ""Fundamentals of Aerodynamics"". McGraw-Hill, 2ème Ed., 1991
Bejan, A. Heat Transfer, Wiley, 1982

PRE-REQUISITES

Basics in Fluid mechanics, thermodynamics & Heat transfer

IDENTIFICATION

CODE : GM-4-S2-EC-CEAVS
ECTS :

HOURS

Cours :	18h
TD :	14h
TP :	12h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	44h
Travail personnel :	34h
Total :	78h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. DUFOUR Regis :
regis.dufour@insa-lyon.fr

AIMS

Knowledge:
Linear dynamics. Continuous systems. Natural frequencies. Mode shapes. Damping. Dynamic deflection. Analytical method. Finite Element Method. Modal method.

Capacities:
Understanding of vibration phenomena. Calculation of natural frequencies and associated mode shape of a continuous mechanical system. Calculation of the dynamic response of a system subject to external sollicittaions.
Choice of the modelling methods the best adapted to the problem
Establishing a Finite Element model
Analyse of numerical and measured results in linear time and frequency domains

CONTENT

The program focus on the linear response prediction of structures subject to different types of excitations. In this end, the dynamic characteristics are calculated: natural frequencies and modes shapes, loss factor, modes orthogonality, modal mass and stiffness.
1- Vibration of beam in extension (axial and torsion)
2- Vibration of beam in bending
3- Approximation method: Rayleigh-Ritz
4- Finite Element method.
5- Extension to rectangular and circular plates
6- Rotordynamics in bending (in torsion).
Simple models: Campbell diagram, critical speed, unbalance mass, transmitted force, bearings.
Finite Element model. Standards. Industrial applications.

The tutorials and the laboratories utilize the FE software ANSYS and ROTORINSA.
The laboratories concern
- the forced response of an in-plan truss. Test and FE modelling
- the impulse and mass unbalance responses of a beam mounted on a suspension
- Plate in bending. Test and FE Modelling

BIBLIOGRAPHY

M. LALANNE, J. Der HAGOPIAN, Mechanical Vibrations for Engineers, J. Wiley & sons, 1983.

B. COMBES, Vibrations des structures pour l'ingénieur et le technicien : théorie et applications, Ellipses 2009

G. VENIZELOS, Vibrations des structures, Analyse modale, Modélisation, Ellipses 2012.

M. THOMAS, F. LAVILLE, Simulation des vibrations mécaniques par Matlab, Simulink et Ansys, 2007

M. LALANNE, G. FERRARIS, Rotordynamics Prediction in Engineering, J. Wiley & Sons, 2nd Ed. 1998

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Fluid and Thermal Mechanics

IDENTIFICATION

CODE : GM-4-S2-EC-PCPMF
ECTS :

HOURS

Cours :	26h
TD :	14h
TP :	32h
Projet :	0h
Evaluation :	6h
Face à face pédagogique :	78h
Travail personnel :	50h
Total :	128h

ASSESMENT METHOD

TEACHING AIDS

Lecture and exercise manuscripts

TEACHING LANGUAGE

French

CONTACT

M. BOUTAOUS M'hamed :
mhamed.boutaous@insa-lyon.fr

AIMS

Part A (L 8h, EL 4h, PW 8h) - Flow properties of polymer materials: to know the rheological properties of complex fluids.
Part B (L 10h, EL 6h) - Thermal properties of processes: to know the heat transfer phenomena in order to quantify the heat fluxes, the temperature fields and the kinetic-structure links. To know how to dimension and optimize tools by multiphysics modelling.
Par C (L 8h, EL 4h, PW 24h) - Injection of thermoplastics: to know the general principles of this process, the interactions between material / mold / press. To know how to dimension and choose an injection molding machine, to carry out a preliminary adjustment calculation and to optimize the parameters.

CONTENT

A Rheology of complex fluids (C 8h, TD 4h) - Nonlinear rheology of molten polymers - Identification of constitutive laws for the modeling of forming processes - Rheology of emulsions, suspensions and filled materials.
B Thermal transfer (L 10h, EL 6h) - Heat equation, transfers in composite materials, viscous dissipation, phase change, crystallization, and applications to processes ¿ Case studies: injection, rotomoulding, thermoforming, crystallinity rate, crystallisation in a fibrous medium.
C Injection (L 8h, EL 4h): General principle of the process, moulding cycle, functions of injection and closure units. Efforts and pressures involved. Predicted calculation of the setting of a press. Dimensioning and selection criteria for a press. TD: 1. Study and optimisation of the moulding parameters. Parallel with PVT curves and rheological studies. 2. Dimensioning and choice of a press for a given production.
8 4-h PW: Capillary rheometry - Dynamic rheometry - Characterisation of the rheological properties of short fiber composites - Polymer matrix flow within composite reinforcements - Injection 1. Filling and shrinkage -Injection 2. Acquisition of data - Thermoforming - Rotomoulding.

BIBLIOGRAPHY

[1] Flow and Rheology in Polymer Composites Manufacturing, Volume 10, 1st Edition, Editors: S.G. Advani, Elsevier, Amsterdam, Pays-Bas, 1994.
[2] Manufacturing Techniques for Polymer Matrix Composites (PMCs), 1st dition, Editors: Suresh Advani Kuang-Ting Hsiao, Woodhead Publishing, Cambridge, Royaume Uni, 2012.
[3] Collectif, Heat Transfer in Polymer Composite Materials, March Wiley-ISTE, 2016.

PRE-REQUISITES

Materials science courses (SIMS 3GM)
Process courses (GM-4PCPMF)
Heat transfer and fluid mechanics courses

Materials science

IDENTIFICATION

CODE : GM-4-S2-EC-PCSRF
ECTS :

HOURS

Cours :	12h
TD :	8h
TP :	8h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	30h
Travail personnel :	20h
Total :	50h

ASSESMENT METHOD

2-h examination + report and/or presentation on practical works

TEACHING AIDS

Manuscripts of courses, exercise lessons and practical works

TEACHING LANGUAGE

French

CONTACT

M. CHARMEAU Jean-Yves :
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AIMS

Knowledge of basic physicochemical mechanisms, physical mechanisms and parameters governing surface and interface phenomena (adhesion / adhesion, surface analysis, surface treatment)

Application to surfaces of polymers and inorganic materials

CONTENT

A) Physico-chemistry of surfaces and interfaces:
A-1) General Definitions: Surface, Interface - Surface layer, Interphase - Wettability, Adhesion and adhesion
A-2) Basic aspects of surface energies: Intuitive notions of surface tension for liquids - Thermodynamic modelling of interfaces - The different interactions and forces involved: Inter-atomic bonds - Intermolecular bonds
A-3) Static and dynamic surface tension measurement techniques: Liquid case - Solid case - Theories: Mechanical theory - Theories concerning specific adhesion; The most recent developments: the theory of acid / base interactions - Multiscale developments
B) Measurements and Mechanical Control of Adherence:
B-1) Non-destructive testing and testing
B-2) Mechanical destructive tests: failure localisation - Main experiments and loading conditions
C) Surface analysis: Optical and electronic microscopy - FTIR / ATR - ESCA - SIMS - AFM
D) Surface treatments: Mechanical treatments - Thermal treatments - Chemical treatments - Electromagnetic treatments - Vacuum treatments

BIBLIOGRAPHY

[1] Souheng Wu « Polymer interface and adhesion » Marcel DeKKer editions, New-York, 1982.
[2] J. Israelachvili « Intermolecular & Surface Forces », 2ème édition, Academic press, Londres, 1991

PRE-REQUISITES

GM-3-SIMS-S1 or equivalent

Computer Aided Design

IDENTIFICATION

CODE : GM-4-S2-EC-PCCOF
ECTS :

HOURS

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

ASSESMENT METHOD

2-h examination and quotation project report

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. TOLLENAERE Hervé :
herve.tollenaere@insa-lyon.fr

AIMS

1- Designing plastic and composite parts and tools
2- Dimensioning of a part or assembly

CONTENT

1- Design of plastic parts injected and composite parts
2- Dimensioning. Use of software dedicated to dimensioning

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Fluid and Thermal Mechanics

IDENTIFICATION

CODE : GM-4-S2-EC-PCSIM
ECTS :

HOURS

Cours :	20h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	52h
Travail personnel :	30h
Total :	82h

ASSESMENT METHOD

2h examination + reports or presentations on numerical exercice courses

TEACHING AIDS

Lecture and execice manuscripts

TEACHING LANGUAGE

French

CONTACT

M. MARTOIA Florian :
florian.martoia@insa-lyon.fr

AIMS

To model and design the flow problems associated to the forming processes. To know how to analytically calculate for simple geometry cases the velocity and pressure fields for generalised Newtonian fluids. To know the finite element (FE) formulation of flow problems of molten polymers and composites in a soft state. To know how to implement a flow problem using a FE software dedicated to the forming processes.

CONTENT

Part A. Modelling of flow problems for complex fluids
Flows induced by a depression or the displacement of walls of generalized Newtonian fluids. Nearly-developed and thin-layer flows. Flow networks in tools. Effects of flow conditions (adhesion, slip, stationary and unsteady flows). Free-surface flows
Part B. Finite element method for polymer and composite forming processes
Weak formulation for the mechanics of Newtonian and viscoelastic fluids. Pressure-velocity-stress finite elements. Simplification to the case of thin-layer flow problems.
Part C. Use of finite element codes dedicated to polymer and composite forming processes

BIBLIOGRAPHY

[1] Flow and Rheology in Polymer Composites Manufacturing, Volume 10, 1st Edition, Editors: S.G. Advani, Elsevier, 1994.
[2] La mise en forme des matières plastiques, 4e édition, J.-F. Agassant et coll., Tech et Doc Lavoisier, 2014.
[3] The Structure and Rheology of Complex Fluids (Topics in Chemical Engineering) 1st Edition, R.G. Larson, Oxford University Press, 1999.
[4] Constitutive Equations for Polymer Melts and Solutions: Butterworths Series in Chemical Engineering, R.G. Larson, Butterworth-Heinemann, 1998.
[5] The Finite Element Method in Heat Transfer and Fluid Dynamics, Third Edition, J. N. Reddy, D.K. Gartling, CRC Press, 2010.
[6]Transport Phenomena, 2nd Edition , R. B. Bird, W. E. Stewart, E. N Lightfoot, Wiley, 2002.
[7] Précis Matières Plastiques. J-P. Trotignon, J. Verdu, A. Dobraczynski, M. Piperaud, Nathan, 2005.

PRE-REQUISITES

SIMS 3GM, RMP 3GM, GM-4-PCRMP-S1, GM-4-ANOD-S1, GM-4-PCPMF-S1.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Solid Mechanics

IDENTIFICATION

CODE : GM-4-S2-EC-PCPRM
ECTS :

HOURS

Cours :	10h
TD :	34h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	47h
Travail personnel :	35h
Total :	82h

ASSESMENT METHOD

3-h examination + reports or presentation on numerical exercice courses

TEACHING AIDS

Lecture and exercice manuscripts

TEACHING LANGUAGE

French

CONTACT

M. DUMONT Pierre :
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AIMS

To know how to model the thermo-hygroelastic anisotropic properties of parts and structures made of polymers and composite materials. To know how to analytically calculate the displacement, strain and stress fields for parts with a simple geometry of for structures that are subjected to simple mechanical loading. To know how to write an adapted finite element (FE) formulation of the thermo-hygroelastic problems for parts or structures. To know how to formulate a mechanical problem in order to design polymer or composite parts or structures.

CONTENT

Basic concepts on the composites made of polymer matrices and fibre reinforcement (consituents, applications, architectures). Thermo-hygroelasitc mechanical behaviour of short-fibre composite materials (Cox, Cox-Krenchel, and Halpin-Tsai-Kardos theories). Mechanical behaviour of long-fibre composite materials: mechanical properties of layers. Theory of thin, thick and sandwich laminated plates. Failure criteria and damage of composite structure. Some examples of simple structures and various mechanical loading conditions. Finite element (FE) method: basic concepts and application to laminated, shell and sandwich plates. Structural design of polymer and composite parts using the FE method.

BIBLIOGRAPHY

[1] L. P. Kollár, G. S. Springer, Mechanics of Composite Structures, Cambridge University Press, Cambridge, Royaume-Uni, 2003.
[2] J.N. Reddy, Mechanics of Laminated Composite Plates and Shells: Theory and Analysis, Second Edition, CRC Press, Bocca Raton, USA, 2004.
[3] C. Decolon, Structures composites calcul des plaques et des poutres multicouches, Hermès, Paris, 2000.
[4] J.-M. Berthelot, Matériaux composites (5° Éd.), Comportement mécanique et analyse des structures Tec Doc Lavoisier, Paris, 2012.
[5] D. Gay, Matériaux composites (6° Éd.), Hermes Science Publications, Paris, 2015.

PRE-REQUISITES

Solid mechanics 3GM, Materials science SIM 3GM

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Solid Mechanics

IDENTIFICATION

CODE : GM-4-S2-EC-IPSP
ECTS :

HOURS

Cours :	6h
TD :	34h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	43h
Travail personnel :	10h
Total :	53h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. EL GUEDJ :
thomas.elguedj@insa-lyon.fr

AIMS

This course deals with the introduction of non-linearities of geometric type and those due to the behavior of materials.
At the end of this course, students must be able to identify the type of non-linearity encountered and to choose the tools to implement non-linear behavior. They will also have to master simulation codes dedicated to manufacturing processes, and using these notions of non-linearity.

CONTENT

Theory: geometrical non-linearities and behavior in solid mechanics.
* Kinematics of major transformations: polar decomposition, total and updated Lagrangian formulations, Eulerian, Lagrangian and mixed quantities.
* Constraints: stress tensors conjugate to deformation tensors. Concept of objectivity and elements of implementation in the calculation codes.
* Introduction to plasticity: criteria, load surface, flow laws, hardening. Application to the plasticity of Von Mises, explicit and implicit radial return.

Practice: software for the simulation of shaping processes in large transformations.
* Formalization of the problem for different families of process and master the bases of the implementation of each software (for example, forging, molding, injection, ...).
* Study and optimization of the process by simulation: solve a problem of optimization of a process among those studied previously by implementing the corresponding simulation software. For example: optimizing the process parameters, the shape of the tool, etc.

BIBLIOGRAPHY

[1] W. JOHNSON, P.B. MELLOR - Engineering Plasticity - John Wiley and sons - 1983.
[2] B.G. NEAL - Plastic Methods of Structural Analysis - Chapman and Hall Ltd and Science Paperbacks - 1970.
[3] P. BAQUE, E. FELDER, J. HYAFIL, Y.DESCATHA - Mise en forme des métaux : applications de la plasticité - Dunod - 1973.
[4] Y. BASAR and D. WEICHERT - Nonlinear Continuum Mechanics of Solids - Springer - 2000.

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Computer Aided Design

IDENTIFICATION

CODE : GM-4-S2-EC-IPCDM
ECTS :

HOURS

Cours :	0h
TD :	40h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	40h
Travail personnel :	24h
Total :	64h

ASSESMENT METHOD

2 technical report

TEACHING AIDS

Moodle e-learning

TEACHING LANGUAGE

French

CONTACT

M. COLON DE :
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AIMS

*

*

Capacities:
- Design a system that meets a set of specifications
- Design and pre-dimension a mechanical system
- Design for assembly and other conceptual methods adapted to machines
- Define the specifications and design the entirety of a complex special machine: integration of standard components, specific parts, transmissions

CONTENT

Valorized nomenclature : cost, impact, method of obtaining parts ...
Robust design at the assembly level: skeleton, assembly family, family of components ...
Modular design, configurable
Concept of life cycle analysis using NFE01-005 and ISO 14040
Transmission Components: Brake, Clutches, Couplers.

BIBLIOGRAPHY

guide de la normalisation AFNOR
guide de la maintence industrielle DELAGRAVE

PRE-REQUISITES

CAD Practical works (4 GM basic core curriculum), Mechanical Design (3GM CONAN & CONDIM)
Static, kinematic and dynamic of rigid bodies.

IDENTIFICATION

CODE : GM-4-S2-EC-IPGEO
ECTS :

HOURS

Cours :	0h
TD :	36h
TP :	12h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	48h
Travail personnel :	10h
Total :	58h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. RAYNAUD Stephane :
stephane.raynaud@insa-lyon.fr

AIMS

*Knowledge:
- GPS quotation, geometric metrology, uncertainties, functional quotation.

* Capacities:
- Being able to design a functional dimension
- Being able to simulate assemblies under tolerancing conditions
- Know how to implement geometric metrology techniques 3D modeling of dimensioning on mechanical assemblies
Taking into account geometric dimensions for the development of a control range and a 3D control program
Performing checks on 3D measuring machine, measuring arm or laser tracker

CONTENT

2D Manual Functional tolerancing
3D ISO GPS tolerancing with the CATIA FTA tool. Modeling solids positioning with 3DCS tools in CATIA. Geometric simulation for the optimization of dimensions IS GPS 3D taking into account the distributions of Manufacturing and the Capability of the processes. Drawing up ISO tolerancing
Reading and analysis of the specifications for the choice of the geometric measurement means
Capability of control means, Test R and R
Range and control program. Control of measurement uncertainties
Realization of a control report.
Report results to the client.

BIBLIOGRAPHY

PRE-REQUISITES

Geometry and GPS ISO (3GM-Conan) dimension reading - Dimensional metrology - Basic statistics

IDENTIFICATION

CODE : GM-4-S2-EC-IPOQ
ECTS :

HOURS

Cours :	8h
TD :	16h
TP :	20h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	44h
Travail personnel :	10h
Total :	54h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

MME VINOT Marina :
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AIMS

*

*Knowledge:
the main standards defining a quality management system,
the tools of lean manufacturing

*Capacities:
Apply a problem solving approach
Conduct risk analysis (FMECA) and opportunities analysis (SWOT)
Use the control tools of the design process: value analysis, QFD.

CONTENT

* What is quality?
* Quality management system; norms ISO 9000 to 9004
* Problem solving approaches: 5W, data collection and visualisation, brainstorming, 5 whys, Ishikawa, Pareto, choice matrix
* Opportunity and risk-driven planning: SWOT, FMECA
* Design process control: functional design, value-driven design, QFD, HCPP
* Production process control: lean manufacturing

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE : GM-4-S2-EC-IPMSP
ECTS :

HOURS

Cours :	14h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	43h
Travail personnel :	10h
Total :	53h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. LECLERE Quentin :
quentin.leclere@insa-lyon.fr

AIMS

*

*Knowledge:
probability laws,Estimation, confidence intervals,Hypothesis test, anova,statistical process control.

*Abilities:
to analyse an experimental dataset
to implement an hypotesis test
to conduct an analysis of variance test
to realise a linear regression
to apply statistical process control tools (control chart, capability, gauge R&R)

CONTENT

Maths
* Probability laws, central limit theorem
* Confidence interval estimation
* Hypothesis testing, analysis of variance
* Regression models

SPC: Statistical Process Control
* Setting up of control cards
* Process control,
* capability
* MSA, R & R test

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Experimental approaches

IDENTIFICATION

CODE : GM-4-S2-EC-MEMNE
ECTS :

HOURS

Cours :	0h
TD :	6h
TP :	48h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	55h
Travail personnel :	20h
Total :	75h

ASSESMENT METHOD

1 synthetic oral defense (synthesizing the work of the 4 sessions of a theme) / 1 synthesis report (synthesizing the work of the 4 sessions of a theme) / 4 fiches (for sessions not subject to a Defense or report)

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. LEFEVRE Stephane :
stephane.lefevre@insa-lyon.fr

AIMS

This course is delivered in the form of computational and experimental Workshops. 12 sessions of pratical works are distributed on 3 themes tackled in specialization of 5th year (dynamics of structures, fluids and conversion of energy, tribology and mechanical transmission). The objectives here are to deal with scientific problems from the point of view of numerical or analytical modeling and from an experimental point of view. Thus, the complementarity and interactions between the two approaches will be at the heart of this work. The assumptions and choices of the models will be at the center of the reflections. Basic phenomenological notions will be illustrated and advanced numerical and experimental tools will be used.

CONTENT

Measurements of physical phenomena / Analyzes and understanding of observed phenomena / Definitions of hypotheses and choice of numerical and / or analytical models / comparison of results of numerical modeling with experimental measurements

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Computer Aided Design

IDENTIFICATION

CODE : GM-4-S2-EC-MECAO
ECTS :

HOURS

Cours :	0h
TD :	36h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	38h
Travail personnel :	10h
Total :	48h

ASSESMENT METHOD

ongoing evaluation, three sessions of two hours of computer works

TEACHING AIDS

Moodle e-learning

TEACHING LANGUAGE

French

CONTACT

M. BARD Christophe :
christophe.bard@insa-lyon.fr

AIMS

Intents :
implementation of advanced features and mains analysis tools available in CAD environment
Skills :
Part and assembly design, multi-CAD Design, knowledge, advanced CAD features, re-engineering, complex shape design, hybrid design, static and dynamic analysis, loads cases, FEM analysis of complex linked mechanisms, analysis strategy, quality and cost, applicability, validity and critical analysis of simulation results

CONTENT

Nine classes (4 hours) of practical work on the following themes:
- Desing and re-engineering of mechanical parts, client request, standard components integration,standardized formats
- Kinematic and dynamic analysis, dafting of summary documents
- Knowledge, implementation of design rules
- Shape design
- Static FEM Analysis - Basics and methodology
- Static FEM Analysis - Case study
- Modal Analysis of a mecanical system, various modelling strategy and associated impacts
- optimization
- awareness of non linear behavior in FEM analysis of mechanical assemblies

BIBLIOGRAPHY

PRE-REQUISITES

CAD Practical works (4 GM basic core curriculum)
Static, kinematic and dynamic of rigid bodies, Continuum mechanics (static ans dynamic) and FEM analysis

IDENTIFICATION

CODE : GM-4-S2-EC-MEAVS
ECTS :

HOURS

Cours :	20h
TD :	24h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	46h
Travail personnel :	40h
Total :	86h

ASSESMENT METHOD

Exam 2h

TEACHING AIDS

Lecture handout

TEACHING LANGUAGE

French

CONTACT

M. TOTARO Nicolas :
nicolas.totaro@insa-lyon.fr

AIMS

*Analyzing a system (real or virtual) or a problem
Exploiting a model of a real or virtual system
Processing data
Implementing an experimental approach
Communicating an analysis, a scientific approach
Analyzing the expressed or assumed needs and define the design requirements of a mechanical system meeting these needs
Designing and pre-dimensioning a mechanical system
Using numerical simulation tools
Modeling the behavior of a multiphysics system or phenomenon
Setting an experimental approach
Setting a problem solving process

*Knowledge:
equation of motion,mode shape, natural frequency, free response, forced response, damping, experimental modal analysis, finite element mode.

* Capacities:
Being able to calculate the eigen-modes of a mechanical system in linear vibrations
Being able to calculate the vibratory response of a system knowing the external load applied to it
Being able to choose the method of discretization best adapted to the problem
Being able to set up the finite element model
Being able to interpret and analyze numerical results and vibratory measurements

CONTENT

1. Free vibrations of beams in torsion and / or compression traction (boundary conditions, initial conditions, modal scheme, modal decomposition, property of orthogonality of modes, ...)
2. Forced vibrations of beams in torsion and / or compression traction (force distribution, harmonic excitations, mass / spring equivalence)
3. Bending vibrations (boundary conditions, hyperbolic solutions) and vibrations of plates
4. Illustration of the modifications of structure by passive way to control the behavior (addition of mass, stiffness, etc ...) from the method of mobilities.
5. Programming of the response of a beam in flexion (MATLAB)
6. Finite Element Modeling (choice of elements, average surface area, convergence of the model) (ANSYS)

BIBLIOGRAPHY

M. LALANNE, J Der HAGOPIAN, Mechanical Vibrations for Engineers, John Wiley and sons, 1983ons, 1983. B. COMBES, Vibrations des structures pour l'ingénieur et le technicien: théorie et applications, Ellipses 2009
G. VENIZELOS, Vibrations des structures, Analyse modale, Modélisation, Ellipses 2012
M. THOMAS, F. LAVILLE, Simulation des vibrations mécaniques par Matlab, Simulink et Ansys, 2007
J.L GUYADER, Vibrations in continuous media, Hermès Science/Lavoisier, 2002

PRE-REQUISITES

GM-3-VIBAC-S2; GM-3-MEXP-S1; GM-3-MATH-S1; GM-4-MEMDS-S1

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Tribology

IDENTIFICATION

CODE : GM-4-S2-EC-MEFRL
ECTS : 3

HOURS

Cours :	20h
TD :	22h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	45h
Travail personnel :	30h
Total :	75h

ASSESMENT METHOD

written intermediate test (1 hrs) and written exam (2 hrs)

TEACHING AIDS

numerical work space (Moodle2), course notes and excercises

TEACHING LANGUAGE

French

CONTACT

M. MORESTIN Fabrice :
fabrice.morestin@insa-lyon.fr
M. DUREISSEIX David :
david.dureisseix@insa-lyon.fr

AIMS

KNOWLEDGE:
-friction phenomena,Hertz contact
-hydrodynamic lubrication
-elasto-hydrodynamic lubrication

Abilities:
ca1: able to solve pde's
ca2: performance analysis of a mechanical component
ca3: choice of appropriate solution method

CONTENT

An introduction to tribology from a mechanical viewpoint, example lubrication of internal combustion engines. Outline of "dry" friction and the influence of contact parameters. Extension to lubricated contacts, Stribeck curve, study of thin films and the Reynolds equation. Study of lubrication regimes: hydrostatic, hydrodynamic and analysis of applications like journal bearings and thrust bearings. Introduction to elastohydrodynamic lubrication, application to bearings and gears, link between Stribeck curve and film thicknes.

BIBLIOGRAPHY

1) Frêne J., Nicolas D., Degueurce B., Berthe D., Godet M., `Lubrification Hydrodynamique..., Paris Eyrolles 1990.
2) Johnson K.L., « Contact Mechanics », Cambridge University Press, 1985.
3) Dowson D., Higginson G.R., `Elastohydrodynamic Lubrication, the fundamentals of roller and gear lubrication..., Pergam. Press 1977

PRE-REQUISITES

contact mechanics, dimensional analysis, mathematics (pde)

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Fluid and Thermal Mechanics

IDENTIFICATION

CODE : GM-4-S2-EC-MECEN
ECTS :

HOURS

Cours :	24h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	46h
Travail personnel :	45h
Total :	91h

ASSESMENT METHOD

Final Exam (2h)

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. EL HAJEM :
mahmoud.el-hajem@insa-lyon.fr

AIMS

-Describe and analyze thermodynamically the operating principles of energy conversion systems in sectors such as transport, industry or energy production.
-Identify the diffrent components of a turbomachine and explain the role of each element.
-Modeling and analyzing, from the point of view of fluid mechanics, the performance of a turbomachine.

CONTENT

- Theory of machines, exergy, thermodynamics in finite time
- Thermal machines and steam power plants, Vapour power cycles, gas power cycles
- Thermodynamics of compressors
- Refrigerating plants and heat pumps
- Air treatment (air conditioning), humid air
- Reciprocating internal combustion engines with external heat input, energy balances
- Machinery classification: Centrifugal, axial machines. Hydraulic turbines, wind turbines, gas turbines, compressors, turbocharger, turbojet and pumps.
- Turbomachinery Components
- Insertion of the machines in the associated circuits, serial / parallel coupling
- Description of Turbomachinery operation, Energy transfer and velocity diagram in turbomachines.
- Mechanisms of loss and quantify the different yields: isentropic, polytropic
- Preliminary design for turbomachines elements
- Cavitation phenomenon in Hydraulic machines.
- Dimensional analysis and similarity in turbomachines

BIBLIOGRAPHY

- Turbomachinery : basic theory and applications - Logan , Earl - 1993
- Internal Combustion Engine Fundamentals, Heywood, 1988

PRE-REQUISITES

Thermodynamics, Fluid mechanics

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Analytical Mechanics

IDENTIFICATION

CODE : GM-4-S2-EC-MSSM
ECTS :

HOURS

Cours :	14h
TD :	20h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	36h
Travail personnel :	56h
Total :	92h

ASSESMENT METHOD

Final exam (2h)

TEACHING AIDS

"Slides and course notes"

TEACHING LANGUAGE

French

CONTACT

M. MASSIONI Paolo :
paolo.massioni@insa-lyon.fr

AIMS

Be able to analyse and define multibody in order to obtain given kinematics or mechanical feedback control.
Design the kinematics of particular mechanisms : trajectory, position or function generator.

CONTENT

CLASSES
Rigid body dynamics (rotation matrix, Euler angles, quaternions, Euler equation)
Principles of atmospheric flight (lift, drag, thrust, cruise, maneuvers, load factor, flight envelope)
Moment and force balance on the aircraft, longitudinal, lateral, directional static stability, linearized equations of the dynamics in cruise
Longitudinal dynamics and its modes, lateral-directional and its modes, turbulence, stability augmentation systems, autopilot
Spaceflight: gravity, 2-body problem, orbits, orbital elements, rocket equation, orbital maneuvers
Space rendezvous, 3-body problem, interplanetary transfers
Attitude dynamics, actuators, sensors, magnetic field, gravity gradient

TUTORIALS (matlab)
Dynamics of the rigid body: energy, angular momentum, stability of motion, quaternions
Attitude estimation: Kalman filtering (inertial platform)
Dynamics of drones/quadrocopters
Aircraft dynamics: Matlab example, linearization, static stability, eigenmodes
Aircraft dynamics: stability augmentation, SISO method, LQR
Simulation of orbits, space maneuvers in orbit around the earth
Space rendezvous and docking: planning and control
Satellite attitude control: equations of satellite motion with gravity gradient, detumbling with "b-dot" law

BIBLIOGRAPHY

"Wie, Bong. Space Vehicle Guidance, Control and Astrodynamics. American Institute of Aeronautics and Astronautics, Inc., 2015.
Cook, Michael V. Flight dynamics principles: a linear systems approach to aircraft stability and control. Butterworth-Heinemann, 2012."

PRE-REQUISITES

GM-4-MSSC-S1 (state space modeling, optimal and robust control) or equivalent

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Mechatronics and System Control

IDENTIFICATION

CODE : GM-4-S2-EC-MSICA
ECTS :

HOURS

Cours :	12h
TD :	20h
TP :	12h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	47h
Travail personnel :	20h
Total :	67h

ASSESMENT METHOD

2h exam: active control
1h exam: identification

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. CHESNE Simon :
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AIMS

The objective of this course is twofold. At the end of the course, the students need to have a good command in active control of complex structures. Thanks to adequate mechatronic components, they should know how to choose and implement different active control algorithms. The methodology suggested in this course is based on an analysis of mechanical system. In order to design the different control laws a parametric identification of the models is required. Different aspects of dynamic identification are presented from the basics to the practical implementation. Industrial applications are shown and investigated.

CONTENT

I - SPECIFICITIES OF ACTIVE CONTROL OF STRUCTURES in active control of structures: Analysis of kinematic chain, mechatronic components, performance objectives / specification, modelling, model reduction.
II - CONTROL TYPES AND CONFIGURATIONS : Choice and type of control laws, control strategies (collocated / decentralized / modal / high-low authority, ...), optimization of sensor and actuator location / shape, observer design and reconstruction algorithms .
III - ACTIVE CONTROL METHODS : Advantage of colocalized systems (Pole-zero flipping), active damping (Phase lead / lag compensators, IFF, DVF, PPF, pole placement), active isolation (Sky-hook, IFF, flexible modes). Control without model. Advantage of a mechanical model control-based, control based on a phenomenological model, modal control of discrete and flexible structures, spillover.
IV - IDENTIFICATION : Objectives, model structures (physical /non-physical models, linear / nonlinear models, continuous / discrete time models, deterministic / stochastic model), Identification methods: Graphical and parametric methods (least squares: recursive / extended / generalized /intrumental variable), optimization methods, implementation and validation (input signals, sampling, data pre-processing, validation, case studies).
V- INDUSTRIAL APPLICATIONS EXAMPLES : Rotating machines, robots, Geophone, telescope, helicopter, ... from the specifications to the tuning.

BIBLIOGRAPHY

Vibration control of active structures - An introduction, André Preumont, Springer, 2011
Active control of structures, André Preumont and Kazuto Seto, John Wiley and sons, 2008
Vibration with control measurement and stability - Daniel J. Inamann - Prentice-Hall
Industrial noise and vibration control, J.D. Irwin and E.R. Graf, Prentice -Hall
Sensors and actuators - Control system instrumentation, Clarence W. de Sylva, CRC Press, 2007.
Active sound and vibration control - Theory and applications, Osman Tokhi and Sandor Veres, IEE Control engineering series 62, 2002
System Identification - Theory For the User, Lennart Ljung Prentice Hall, 1999.
System Identification, T. Söderström, P. Stoica, Prentice Hall, 1989.
Identification of Parametric Models from Experimental Data. E. Walter, L. Pronzato. Springer, 1997.
Identification des systèmes. I. Landau. Hermès, Paris, 1998.

PRE-REQUISITES

GM-3-CSL-S2 : Linear System Control
GM-3-VIBS2 : Discrete Systems in vibration
GM-4-MCS5-S1 : State space and optimale and robust sythesis

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Mechatronics and System Control

IDENTIFICATION

CODE : GM-4-S2-EC-MSAE
ECTS :

HOURS

Cours :	8h
TD :	16h
TP :	20h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	47h
Travail personnel :	20h
Total :	67h

ASSESMENT METHOD

2h final interrogation
1h Test
4h reports

TEACHING AIDS

Lecture + Tutorials - Logiciel : Simio, Matlab/Simulink, AMESim

TEACHING LANGUAGE

French

CONTACT

M. BIDEAUX Eric :
eric.bideaux@insa-lyon.fr

AIMS

- To known the architecture of an electrical actuating chain, especially from a technical point of view
- Figure out who is who and pilote what
- Be aware of the basis modelling for the components of this chain, and their performances (efficiency...)
- Determine how to pick up the different components

This lessons includes teaching in electric and electronic engineering.

CONTENT

- Reminder on electromagnetism (Maxwell, field, energy, ...)
- Linear electroùagnetic actuator
- Electric motor
- Entire actuating chain: engine, power electronic, control unit, measurement

Micro-projet : Study and design of the actuating chain of a partciular engine

BIBLIOGRAPHY

PRE-REQUISITES

No

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Computer Aided Design

IDENTIFICATION

CODE : GM-4-S2-EC-MSAH
ECTS :

HOURS

Cours :	10h
TD :	24h
TP :	8h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	45h
Travail personnel :	10h
Total :	55h

ASSESMENT METHOD

2 h test at the end of the semester
1 h test

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

AIMS

- Know how to read a hydraulic diagram
- Know the basic physical principles in hydraulics
- Know and understand the main components of a circuit
- Know how to evaluate the performances of components and circuits in steady state
- Know how to determine a pre-dimensioning of the main components
- Be aware of certain behaviors appearing in transition
- Know the basic principles of regulation and safety of hydraulic circuits

CONTENT

1. General information / reminders
2. Pumps / motors: technology and main characteristics
3. Distributors / valves: technology and main characteristics
4. Accumulators: technology and design elements
5. Pressure / flow control
6. Electrical Analogy and Force / Displacement Control

BIBLIOGRAPHY

Fundamentals of Fluid Power Control, John Watton, Cambridge Press, November 2009
ntroduction to Fluid Power, James L Johnson, Cengage Learning, 1 edition, 2001

PRE-REQUISITES

Mechanical design courses

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Computer Aided Design

IDENTIFICATION

CODE : GM-4-S2-EC-MSTM
ECTS :

HOURS

Cours :	12h
TD :	26h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	41h
Travail personnel :	20h
Total :	61h

ASSESMENT METHOD

1 test of 1h and 2h final test

TEACHING AIDS

1 - INSA and UCBL libraries
2 - Textbook comprising lecture notes (to be completed) and a list of exercises + formulae

TEACHING LANGUAGE

French

CONTACT

M. BRUYERE Jérôme :
jerome.bruyere@insa-lyon.fr

AIMS

Knowledge:
Gears, belt pulleys, friction mechanisms, kinematic and technological analysis, power losses, design.

Abilities:
- Model the kinematics and dynamic behavior of mechanical power transmission systems and communicate them
- Simulate with industrial software the behavior of dynamic mechatronic systems, interpret and communicate the results
- Define the mechanical stresses applied in static or dynamic in a power transmission system

CONTENT

Geared transmissions:
1- Introduction: advantages and drawbacks of transmission systems
2- Perfect systems: geometry (manufacturing, profile shift, tooth thickness), transmission ratio and equivalent inertia in geared trains and planetary gear trains, meshing (contact ratio, undercutting, sliding ...)
3- Real systems: notion about gear dimensioning, power losses, perturbed kinematics

Transmission by friction and flexible links:
Belts, clutches, brakes and chains

BIBLIOGRAPHY

Dudley's Handbook of Practical Gear Design and Manufacture, Stephen P. Radzevich, CRC Press
Gears and Gear Drives, D. Jelaska, Wiley

PRE-REQUISITES

3-GM

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Final project master thesis

IDENTIFICATION

CODE : GM-5-S1-EC-COPRI
ECTS : 16

HOURS

Cours :	0h
TD :	1h
TP :	0h
Projet :	200h
Evaluation :	1h
Face à face pédagogique :	2h
Travail personnel :	200h
Total :	402h

ASSESMENT METHOD

Ongoing evaluation, final report and defense

TEACHING AIDS

Depending on the topic

TEACHING LANGUAGE

French
English

CONTACT

M. BUFFIERE Jean-Yves :
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AIMS

To train students in the performance of industrial analysis and design or research, possibly funded by industrial partners.

CONTENT

Practice of knowledges and knowhow studied during the whole cursus

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Advanced mechanics for the prediction of material properties

IDENTIFICATION

CODE : GM-5-S1-EC-PCMAV
ECTS : 5

HOURS

Cours :	0h
TD :	37h
TP :	4h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	41h
Travail personnel :	15h
Total :	56h

ASSESMENT METHOD

Reports on the studies that are done.

TEACHING AIDS

Manuscripts of lessons, exercice lessons and practical works

TEACHING LANGUAGE

French

CONTACT

M. RINALDI Renaud :
renaud.rinaldi@insa-lyon.fr

AIMS

To understand the links between the microstructural characteristics of polymer and composite parts and their physical and mechanical properties as well as their damage and fracture properties

CONTENT

Part A - From the microstructure to the effective propertie of parts
- Basis of upscaling (homogenisation) theories (micro-macro uspcaling techniques)
- Applications : use of Digimat code or Geodict or Abaqus or Ansys for the calculation of effective properties

Part B -Damage et fracture of polymer and composite parts
- Basis of the damage and fracture mechanics
- Application and extension to polymer materials
- Application and extension to composite materials (cases of laminates and short-fibre composites)

Part C - Finishing processes and assembly processes
- General introduction to the finishing and assmebly processes of polymer (thermoset and
thermoplastic) and composite parts
- Principle of decoration processes and painting: related physico-chemical, physical and mechanical properties

BIBLIOGRAPHY

[1] Damage Mechanics of Composite Materials, Volume 9, 1st Edition, Editor: R. Talreja, Elsevier, Amsterdam, Pays-Bas, 1994.
[2] Application of Fracture Mechanics to Composite Materials, Volume 6, 1st Edition, Editor: K. Friedrich, Elsevier, Amsterdam, Pays-Bas, 1989.

PRE-REQUISITES

GM-4-PCPRA-S1, GM-4-PCPMF-S1, GM-4-PCPMF-S2, GM-4-PCSIM-S2, GM-4-PRM-S2

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Numerical engineering of forming processes

IDENTIFICATION

CODE : GM-5-S1-EC-PCNUM
ECTS : 5

HOURS

Cours :	0h
TD :	32h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	32h
Travail personnel :	25h
Total :	57h

ASSESMENT METHOD

Practical work reports.

TEACHING AIDS

Manuscripts of lessons, exercice lessons

TEACHING LANGUAGE

French

CONTACT

M. DUMONT Pierre :
pierre.dumont@insa-lyon.fr

AIMS

Chaining the numerical tools for the desing of parts, starting from the choice of a forming process to the end-use properties of part.

CONTENT

Advanced simulation of forming processes for polymers and composites
- Advanced use of codes for polymer and composites processing (Polyflow, Moldflow...)
- Advanced use of structural mechanics codes (ex. Abaqus)

BIBLIOGRAPHY

[1] Flow and Rheology in Polymer Composites Manufacturing, Volume 10, 1st Edition, Editors: S.G. Advani, Elsevier, Amsterdam, Pays-Bas, 1994.
[2] Manufacturing Techniques for Polymer Matrix Composites (PMCs), 1st Edition, Editors: Suresh Advani Kuang-Ting Hsiao, Woodhead Publishing, Cambridge, Royaume Uni, 2012.
[3] Polymer Extrusion, 4ème ed. C. Rauwendaal ; Hanser Publishers (2001)

PRE-REQUISITES

GM-4-PCPRA-S1, GM-4-PCPMF-S1, GM-4-PCPMF-S2, GM-4-PCSIM-S2, GM-4-PRM-S2

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Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Introduction to innovative forming processes

IDENTIFICATION

CODE : GM-5-S1-EC-PCPHY
ECTS : 5

HOURS

Cours :	12h
TD :	24h
TP :	8h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	44h
Travail personnel :	25h
Total :	69h

ASSESMENT METHOD

Practical work reports.

TEACHING AIDS

Manuscripts of lessons, exercice lessons and practical works

TEACHING LANGUAGE

French

CONTACT

M. CHARMEAU Jean-Yves :
jean-yves.charmeau@insa-lyon.fr

AIMS

A. Additive manufacturing (AM) of polymer parts, Processes of shaping of innovative and functional multi-layer materials, Plastronics

B. Processing routes for long and discontinuous fibre composites

CONTENT

A. Additive manufacturing (AM) of polymer parts, Processes of shaping of innovative and functional multi-layer materials, Plastronics

B. Processing routes for long and discontinuous fibre composites

BIBLIOGRAPHY

[1] Manufacturing Techniques for Polymer Matrix Composites (PMCs), 1st Edition, Editors: Suresh Advani Kuang-Ting Hsiao, Woodhead Publishing, Cambridge, Royaume Uni, 2012.
Polymer Extrusion, 4¿me ed. C. Rauwendaal ; Hanser Publishers (2001)
[2] Screw Extrusion, Science and Technology. J.L. White, H. Potente ; Hanser Publishers (2001)
[3] Extrusion Dies for Plastics and Rubber, Design and Engineering Computations, 3¿me ed. W. Michaeli ; Hanser Publishers (2003)
[4] FRANKE, J¿rg (ed.). Three-Dimensional Molded Interconnect Devices (3D-MID): Materials, Manufacturing, Assembly and Applications for Injection Molded Circuit Carriers. Carl Hanser Verlag GmbH Co KG, 2014.

PRE-REQUISITES

GM-4-PCPRA-S1, GM-4-PCPMF-S1, GM-4-PCPMF-S2

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

CENTRE DES SPORTS
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Sports

IDENTIFICATION

CODE : CDS-5-S1-EC-EPS
ECTS :

HOURS

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

ASSESMENT METHOD

Assessment in Physical Education concerns the teaching of Sports and Artistic Physical Activities (APSA), and will take the form of continuous assessment with half-yearly marking.

The mark depends on the degree of acquisition of the skills expected in each of the activities, and the progress made over all the sessions in the cycle. The mark takes into account :

Individual and/or team performance
mastery of execution
Progress in the sports project
Responsibility and autonomy

TEACHING AIDS

All physical, sporting, artistic and competitive activities

TEACHING LANGUAGE

French

CONTACT

MME JAUSSAUD Marie :
marie.jaussaud@insa-lyon.fr

AIMS

This EC is part of the Teaching Unit: SHS and contributes to the development of the School's transversal competences

1*Auto-evaluating one's own performance
Knowledges :
- Fundamentals, principles of action and terminology of sports activities
- Criteria for observation, achievement and success.
Abilities :
- Assess your level of practice
- Build up a warm-up
- Set goals for progress
- Manage physical and mental potential

2* Work, learn and develop independently
Knowledge :
- PSAA rules
- Observation criteria
- Principles of warm-up and cool-down
Abilities :
- Mobilise resources
- Analyse, observe, question
- Take on different roles (referee, choreographer)

3* Interact with others, work as part of a team
Knowledges :
- Roles and functions in each sports activity
Abilities :
- Communicate appropriately: verbal, non-verbal and postural communication.
- Integrate into a group
- Take part in and develop a group project
- Take the initiative
- Be a good listener

4* Be creative, innovative and enterprising
Knowledge :
- Artistic disciplines
Abilities :
- Draw on knowledge and resources from different artistic fields to produce an original work.
- Mobilise the imagination and sensibility and make them visible through dance movement
- Access the symbolism of the body

5* Act responsibly in a complex world
Knowledge :
- Safety and operating rules
Abilities :
- Identify uncertainties and risks and act to reduce them
- Integrate a responsible dimension into their actions
- Show respect and fair play in a power struggle

6* Working in an international context
Knowledge :
- Socio-cultural differences
Abilities :
- Integrate cultural diversity into group work
- Act with respect for self and others

CONTENT

Physical Education and Sport lessons are organised around traditional Physical Education lessons, or advanced lessons, or appropriate practices (EPSA), or competitive practices within the framework of the Section Sportive Haut Niveau.

1. Physcical Education lessons :
Students choose one or two physical and sporting activities per year from among the activities offered by the sports centre (individual, group, dual).
2. Appropriate Physical Education lessons: For all students who are exempt from physical activity for at least 2 months:
Swimming, Body-building, Nordic Walking, Somatic Exercise, Sophrology, Wheelchair Basketball, Pilates, Table Tennis, etc.
3. Advanced Physical Education courses :
Specialisation in a sporting activity, University training and competitions
4. SSHN (High-Level Athlete section)

University training and competitions

EPS5 GMPP OYONNAX :Group cohesion project
Autonomy Lessons at S1 on Wednesday afternoons
Hiking outing

BIBLIOGRAPHY

OTTAWA Charter (1986): ‘health is seen as a resource for everyday life; it is a positive concept that highlights social and individual resources, as well as physical abilities’.

PRE-REQUISITES

- EPS: none
- Appropriate Physical Education: subject to medical advice
- Advanced courses and competitive practice: previous practice required subject to specific selection according to each activity
- SHN: ministerial list

Levels 1 and 2: Physical Education, Appropriate physical education
Level 3: Advanced courses and competitive practice, SHN

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www.insa-lyon.fr

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

IDENTIFICATION

CODE : HU-0-S1-EC-S-PPH
ECTS : undefined

HOURS

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

ASSESMENT METHOD

Written report (10 pages minimum) and oral defence (in presence of tutor and guest).

TEACHING AIDS

Présentation du PPH sur Moodle : http://moodle.insa-lyon.fr

TEACHING LANGUAGE

French

CONTACT

AIMS

The PPH is an individual exercise where the student carries out an investigation or some research into a subjet of particular interest to them in the aim of developing some form of critical analysis of the subject. The PPH is a means by which the student can show their ability to build an analysis based on a rigorously developed thesis. The analysis is based on a personal approach to the subject (openness to the wider world), the way the subject is dealt with (for example the use of a personal experience as a way of seeing the world or the chosen subject), or in certain cases the creative approach used (for example, for an artistic experience).
The PPH requires the ability to work autonomously.

The PPH contributes primarily to the development of competencies CT2.1-4 and CT3.1 ; other competencies can be developed depending on the choice of project.

CONTENT

Work on a particular theme with a tutor chosen by the student.
Filling in of a project sheet (elaboration of the question, definition of the personal approach, bibliography, etc),
Step by step meetings with the tutor (plan, analysis, etc),
Report writing and oral presentation.

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE : GM-5-S1-EC-PPP
ECTS : 1

HOURS

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

ASSESMENT METHOD

- one French written page in which the student explains the vision he has of the differentiated path that he will follow in 4th and 5th year.
- one English written page in which the student explains his choice of mobility abroad and an analysis of the developed skills.
- a French written page to justify the choice of the training periods and an analysis of the developed skills.
- an inventory of skills at the end of each year with an assessment at the end of the 5th year.

TEACHING AIDS

Personal tests
Presentation slides when allowed by the speaker
Online self-assessment materials

TEACHING LANGUAGE

French

CONTACT

MME SALLE Emmanuelle :
emmanuelle.vidal-salle@insa-lyon.fr

AIMS

The overall objective is to build his/her own professional project. If the assessment takes place in the 5th year, the work must start during the 3rd year.
The aim is :
- Allow the student to choose his/her 4th and 5th year differentiated path
- Understand and know the trades and sectors associated with the different aspects of training
- Self-assessment and identification of competencies acquired or to be acquired
- Choose the aspects of its training to be strengthened
- Establish his/her professional project based on personal skills and self-knowledge.

CONTENT

1. Evaluation of the spontaneous representations on the differentiated paths
2. Interventions of partner companies and other engineers
3. Active participation in at least one collective activity (promotion of the department, management of the FabLab of the department, Professional day, company coffees, contacts with alumni, sponsorship of the promotion, presentation of the department, organization of the integration week , Inter-Semester Week, End-of-Studies Travel, GM Awards, Graduation Ceremony)
4. Self-Assessment Techniques and Building a personal skills Portfolio

If needed,a methodological aid can be provided for the writing of their CV and their cover letters during their search for internship.

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE
Humanities and social sciences

IDENTIFICATION

CODE : HU-0-S1-EC-S-SERIE3
ECTS : undefined

HOURS

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

ASSESMENT METHOD

Assessment will be conducted through continuous evaluation. The assessment methods will be presented at the beginning of the semester by the teaching team.

TEACHING AIDS

Materials are chosen by the instructor based on the module:
•Didactic documents related to the module
•Audiovisual materials
•Recommended readings

TEACHING LANGUAGE

French

CONTACT

Mme JOUISHOMME Delphine :
delphine.jouishomme@insa-lyon.fr
Mme GOUTALAND Carine :
carine.goutaland@insa-lyon.fr

AIMS

A series of elective courses in Humanities and Social Sciences (HSS) offers several options for students to choose from, allowing them to develop and deepen specific skills. This course aims to develop one or more transversal skills among the following:
• CT1: Self-awareness and self-management
• CT2: Working, learning, and evolving independently
• CT3: Interacting with others, working in a team
• CT4: Demonstrating creativity
• CT5: Acting responsibly in a complex world
• CT6: Navigating and evolving within an organization
• CT7: Working in an international and intercultural context
The list of options available in Series 1 and the specific competencies for each option are detailed in the catalog on the IntranetHumas:
https://intranethumas.insa-lyon.fr/sciences-humaines-sociales/offre-de-formation/cours-la-carte-0

CONTENT

Each module is designed to encourage interaction and active student participation. The content is structured around the following key aspects:
• Theoretical deepening related to the theme
• Reflection on the topic
• Practical exercises and activities
• Assessments and presentation of work

BIBLIOGRAPHY

The bibliography is selected by the instructor based on the module.

PRE-REQUISITES

French

IDENTIFICATION

CODE : GM-5-S1-EC-STAGEL
ECTS : 30

HOURS

Cours :	0h
TD :	1h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	2h
Travail personnel :	400h
Total :	402h

ASSESMENT METHOD

50% by the industry through a grid given by GM /
25% by an oral presentation evaluted by GM's teachers /
25% by a written report evaluated by GM's teachers

TEACHING AIDS

None

TEACHING LANGUAGE

French

CONTACT

M. Mauger Cyril :
cyril.mauger@insa-lyon.fr

M. Morterolle Sebastien :
sebastien.morterolle@insa-lyon.fr

Mme Paredes Astudillo Yenny :
yenny.paredes-astudillo@insa-lyon.fr

AIMS

M1- To integrate an organization, to lead and help it to evolve
M2- To take account for constraints such as professionnal, economical and industrials ones.
M3- To take account for societal values (ethical, and ethics) and help them being respected
M4- To dialogue with specialists as with not specialists
M5- To work in international context: speak one or several langages, cultural openings,
M6- To work with autonomy, critical faculty, and curiosity

CONTENT

26 weeks of industrial intership

BIBLIOGRAPHY

Documents with details informations about progress of the intership and associated regulations are avalaible on Moodle website

PRE-REQUISITES

All teachings of GM for 3rd and 4th years

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

CENTRE DES SPORTS
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Sports

IDENTIFICATION

CODE : CDS-5-S1-EC-EPS
ECTS :

HOURS

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

ASSESMENT METHOD

Assessment in Physical Education concerns the teaching of Sports and Artistic Physical Activities (APSA), and will take the form of continuous assessment with half-yearly marking.

The mark depends on the degree of acquisition of the skills expected in each of the activities, and the progress made over all the sessions in the cycle. The mark takes into account :

Individual and/or team performance
mastery of execution
Progress in the sports project
Responsibility and autonomy

TEACHING AIDS

All physical, sporting, artistic and competitive activities

TEACHING LANGUAGE

French

CONTACT

MME JAUSSAUD Marie :
marie.jaussaud@insa-lyon.fr

AIMS

This EC is part of the Teaching Unit: SHS and contributes to the development of the School's transversal competences

1*Auto-evaluating one's own performance
Knowledges :
- Fundamentals, principles of action and terminology of sports activities
- Criteria for observation, achievement and success.
Abilities :
- Assess your level of practice
- Build up a warm-up
- Set goals for progress
- Manage physical and mental potential

2* Work, learn and develop independently
Knowledge :
- PSAA rules
- Observation criteria
- Principles of warm-up and cool-down
Abilities :
- Mobilise resources
- Analyse, observe, question
- Take on different roles (referee, choreographer)

3* Interact with others, work as part of a team
Knowledges :
- Roles and functions in each sports activity
Abilities :
- Communicate appropriately: verbal, non-verbal and postural communication.
- Integrate into a group
- Take part in and develop a group project
- Take the initiative
- Be a good listener

4* Be creative, innovative and enterprising
Knowledge :
- Artistic disciplines
Abilities :
- Draw on knowledge and resources from different artistic fields to produce an original work.
- Mobilise the imagination and sensibility and make them visible through dance movement
- Access the symbolism of the body

5* Act responsibly in a complex world
Knowledge :
- Safety and operating rules
Abilities :
- Identify uncertainties and risks and act to reduce them
- Integrate a responsible dimension into their actions
- Show respect and fair play in a power struggle

6* Working in an international context
Knowledge :
- Socio-cultural differences
Abilities :
- Integrate cultural diversity into group work
- Act with respect for self and others

CONTENT

Physical Education and Sport lessons are organised around traditional Physical Education lessons, or advanced lessons, or appropriate practices (EPSA), or competitive practices within the framework of the Section Sportive Haut Niveau.

1. Physcical Education lessons :
Students choose one or two physical and sporting activities per year from among the activities offered by the sports centre (individual, group, dual).
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3. Advanced Physical Education courses :
Specialisation in a sporting activity, University training and competitions
4. SSHN (High-Level Athlete section)

University training and competitions

EPS5 GMPP OYONNAX :Group cohesion project
Autonomy Lessons at S1 on Wednesday afternoons
Hiking outing

BIBLIOGRAPHY

OTTAWA Charter (1986): ‘health is seen as a resource for everyday life; it is a positive concept that highlights social and individual resources, as well as physical abilities’.

PRE-REQUISITES

- EPS: none
- Appropriate Physical Education: subject to medical advice
- Advanced courses and competitive practice: previous practice required subject to specific selection according to each activity
- SHN: ministerial list

Levels 1 and 2: Physical Education, Appropriate physical education
Level 3: Advanced courses and competitive practice, SHN

INSA LYON
Campus LyonTech La Doua
20, avenue Albert Einstein - 69621 Villeurbanne cedex - France
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INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

IDENTIFICATION

CODE : HU-0-S1-EC-S-PPH
ECTS : undefined

HOURS

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

ASSESMENT METHOD

Written report (10 pages minimum) and oral defence (in presence of tutor and guest).

TEACHING AIDS

Présentation du PPH sur Moodle : http://moodle.insa-lyon.fr

TEACHING LANGUAGE

French

CONTACT

AIMS

The PPH is an individual exercise where the student carries out an investigation or some research into a subjet of particular interest to them in the aim of developing some form of critical analysis of the subject. The PPH is a means by which the student can show their ability to build an analysis based on a rigorously developed thesis. The analysis is based on a personal approach to the subject (openness to the wider world), the way the subject is dealt with (for example the use of a personal experience as a way of seeing the world or the chosen subject), or in certain cases the creative approach used (for example, for an artistic experience).
The PPH requires the ability to work autonomously.

The PPH contributes primarily to the development of competencies CT2.1-4 and CT3.1 ; other competencies can be developed depending on the choice of project.

CONTENT

Work on a particular theme with a tutor chosen by the student.
Filling in of a project sheet (elaboration of the question, definition of the personal approach, bibliography, etc),
Step by step meetings with the tutor (plan, analysis, etc),
Report writing and oral presentation.

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE : GM-5-S1-EC-PPP
ECTS : 1

HOURS

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

ASSESMENT METHOD

- one French written page in which the student explains the vision he has of the differentiated path that he will follow in 4th and 5th year.
- one English written page in which the student explains his choice of mobility abroad and an analysis of the developed skills.
- a French written page to justify the choice of the training periods and an analysis of the developed skills.
- an inventory of skills at the end of each year with an assessment at the end of the 5th year.

TEACHING AIDS

Personal tests
Presentation slides when allowed by the speaker
Online self-assessment materials

TEACHING LANGUAGE

French

CONTACT

MME SALLE Emmanuelle :
emmanuelle.vidal-salle@insa-lyon.fr

AIMS

The overall objective is to build his/her own professional project. If the assessment takes place in the 5th year, the work must start during the 3rd year.
The aim is :
- Allow the student to choose his/her 4th and 5th year differentiated path
- Understand and know the trades and sectors associated with the different aspects of training
- Self-assessment and identification of competencies acquired or to be acquired
- Choose the aspects of its training to be strengthened
- Establish his/her professional project based on personal skills and self-knowledge.

CONTENT

1. Evaluation of the spontaneous representations on the differentiated paths
2. Interventions of partner companies and other engineers
3. Active participation in at least one collective activity (promotion of the department, management of the FabLab of the department, Professional day, company coffees, contacts with alumni, sponsorship of the promotion, presentation of the department, organization of the integration week , Inter-Semester Week, End-of-Studies Travel, GM Awards, Graduation Ceremony)
4. Self-Assessment Techniques and Building a personal skills Portfolio

If needed,a methodological aid can be provided for the writing of their CV and their cover letters during their search for internship.

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE
Humanities and social sciences

IDENTIFICATION

CODE : HU-0-S1-EC-S-SERIE3
ECTS : undefined

HOURS

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

ASSESMENT METHOD

Assessment will be conducted through continuous evaluation. The assessment methods will be presented at the beginning of the semester by the teaching team.

TEACHING AIDS

Materials are chosen by the instructor based on the module:
•Didactic documents related to the module
•Audiovisual materials
•Recommended readings

TEACHING LANGUAGE

French

CONTACT

Mme JOUISHOMME Delphine :
delphine.jouishomme@insa-lyon.fr
Mme GOUTALAND Carine :
carine.goutaland@insa-lyon.fr

AIMS

A series of elective courses in Humanities and Social Sciences (HSS) offers several options for students to choose from, allowing them to develop and deepen specific skills. This course aims to develop one or more transversal skills among the following:
• CT1: Self-awareness and self-management
• CT2: Working, learning, and evolving independently
• CT3: Interacting with others, working in a team
• CT4: Demonstrating creativity
• CT5: Acting responsibly in a complex world
• CT6: Navigating and evolving within an organization
• CT7: Working in an international and intercultural context
The list of options available in Series 1 and the specific competencies for each option are detailed in the catalog on the IntranetHumas:
https://intranethumas.insa-lyon.fr/sciences-humaines-sociales/offre-de-formation/cours-la-carte-0

CONTENT

Each module is designed to encourage interaction and active student participation. The content is structured around the following key aspects:
• Theoretical deepening related to the theme
• Reflection on the topic
• Practical exercises and activities
• Assessments and presentation of work

BIBLIOGRAPHY

The bibliography is selected by the instructor based on the module.

PRE-REQUISITES

French

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Production systems engineering

IDENTIFICATION

CODE : GM-5-S1-EC-IPISP
ECTS : 5

HOURS

Cours :	2h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	34h
Travail personnel :	10h
Total :	44h

ASSESMENT METHOD

3 IM (3x 30min)

TEACHING AIDS

- 1 handout (lecture notes + exercices)
- moodle platform with autocorrected online exercices for self-training

TEACHING LANGUAGE

French

CONTACT

M. CHEUTET Vincent :
vincent.cheutet@insa-lyon.fr

AIMS

- Get general knowledge on the variety of production systems
- Know the basic principles of production planning
- Be able to plan the layout and size of a workshop
- Know the basic methods in inventory management
- Be able to handle a business information system

CONTENT

- Typology of production systems
- Introduction to technical data management
- Production planning: S&OP, MPS, MRP, capacity planning, scheduling
- CAPE (computer-aided production engineering)
- Production system layout and sizing
- Inventory management: ABC method, classic replenishment methods, focus on EOQ (economic order quantity) model
- Information systems for business: ERP, PLM

BIBLIOGRAPHY

PRE-REQUISITES

N/A

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Advanced modeling of manufacturing processes

IDENTIFICATION

CODE : GM-5-S1-EC-IPPAS
ECTS : 5

HOURS

Cours :	0h
TD :	32h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	33h
Travail personnel :	10h
Total :	43h

ASSESMENT METHOD

1 one hour test, 1 technical report and 1 project presentation

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. CHAISE Thibaut :
thibaut.chaise@insa-lyon.fr

AIMS

The general purpose of this course is to present the theoretical basis and the methodology of the modelling of additive and soustractive manufacturing processes. Numerical and analytical approaches, based on the thermal, microstructural and mechanical behaviour of the materials are studied. The students will be capable of designing a modelling approach for processes accounting for thermo-metallurgical couplings.

CONTENT

Machining - Welding - Additive manufacturing

BIBLIOGRAPHY

PRE-REQUISITES

Industrial maintenance

IDENTIFICATION

CODE : GM-5-S1-EC-IPMAI
ECTS : 5

HOURS

Cours :	0h
TD :	32h
TP :	4h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	36h
Travail personnel :	10h
Total :	46h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. ANTONI Jérôme :
jerome.antoni@insa-lyon.fr

AIMS

CONTENT

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Structural integrity under extreme loadings

IDENTIFICATION

CODE : GM-5-S1-EC-IPDSX
ECTS : 5

HOURS

Cours :	0h
TD :	28h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	28h
Travail personnel :	10h
Total :	38h

ASSESMENT METHOD

TEACHING AIDS

Moodle e-learning

TEACHING LANGUAGE

French

CONTACT

M. EL GUEDJ :
thomas.elguedj@insa-lyon.fr

AIMS

At the end of this module the student will be able to design mechanical parts with a good level of reliability and mechanical durability in response to intense stresses: resistance to impacts, buckling, damage by fatigue ... This module will be based on TD-courses, and a design project using numerical codes (ABAQUS) applied to typical parts encountered in production systems.

CONTENT

BIBLIOGRAPHY

PRE-REQUISITES

Solid Mechanics, Non-Linear Mechanics, Mechanical Design

Composite manufacturing

IDENTIFICATION

CODE : GM-5-S1-EC-IPMIC
ECTS : 5

HOURS

Cours :	0h
TD :	32h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	32h
Travail personnel :	10h
Total :	42h

ASSESMENT METHOD

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

MME SALLE Emmanuelle :
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M. NAOUAR Naim :
naim.naouar@insa-lyon.fr

AIMS

At the end of this module, students will be able to:
- to know the different types of composite materials and their fields of application;
- know the main processes of shaping composites
- know the models of behavior in shaping of composites
- choose and implement a simulation model of composite material shaping

CONTENT

I- Technology
A) Presentation of the main types of composites: matrix, fibers, field of application ...
(B) Various types of processes, including draping of thermo-hardenable prepregs, thermoforming of thermoplastic prepregs, Liquid composite molding, RTM and infusion processes, filament winding, pultrusion, sheet molding compound (SMC).

II- Modeling and simulation of processes:
(A) Geometrical approach to the ""net""
B) Mechanical behavior of fibrous reinforcements,
C) Finite element simulation of shaping,
D) injection on reinforcement, permeability, approach of Darcy

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Final project master thesis

IDENTIFICATION

CODE : GM-5-S1-EC-COPRI
ECTS : 16

HOURS

Cours :	0h
TD :	1h
TP :	0h
Projet :	200h
Evaluation :	1h
Face à face pédagogique :	2h
Travail personnel :	200h
Total :	402h

ASSESMENT METHOD

Ongoing evaluation, final report and defense

TEACHING AIDS

Depending on the topic

TEACHING LANGUAGE

French
English

CONTACT

M. BUFFIERE Jean-Yves :
jean-yves.buffiere@insa-lyon.fr

AIMS

To train students in the performance of industrial analysis and design or research, possibly funded by industrial partners.

CONTENT

Practice of knowledges and knowhow studied during the whole cursus

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE : GM-5-S1-EC-STAGEL
ECTS : 30

HOURS

Cours :	0h
TD :	1h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	2h
Travail personnel :	400h
Total :	402h

ASSESMENT METHOD

50% by the industry through a grid given by GM /
25% by an oral presentation evaluted by GM's teachers /
25% by a written report evaluated by GM's teachers

TEACHING AIDS

None

TEACHING LANGUAGE

French

CONTACT

M. Mauger Cyril :
cyril.mauger@insa-lyon.fr

M. Morterolle Sebastien :
sebastien.morterolle@insa-lyon.fr

Mme Paredes Astudillo Yenny :
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AIMS

M1- To integrate an organization, to lead and help it to evolve
M2- To take account for constraints such as professionnal, economical and industrials ones.
M3- To take account for societal values (ethical, and ethics) and help them being respected
M4- To dialogue with specialists as with not specialists
M5- To work in international context: speak one or several langages, cultural openings,
M6- To work with autonomy, critical faculty, and curiosity

CONTENT

26 weeks of industrial intership

BIBLIOGRAPHY

Documents with details informations about progress of the intership and associated regulations are avalaible on Moodle website

PRE-REQUISITES

All teachings of GM for 3rd and 4th years

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Final project master thesis

IDENTIFICATION

CODE : GM-5-S1-EC-COPRI
ECTS : 16

HOURS

Cours :	0h
TD :	1h
TP :	0h
Projet :	200h
Evaluation :	1h
Face à face pédagogique :	2h
Travail personnel :	200h
Total :	402h

ASSESMENT METHOD

Ongoing evaluation, final report and defense

TEACHING AIDS

Depending on the topic

TEACHING LANGUAGE

French
English

CONTACT

M. BUFFIERE Jean-Yves :
jean-yves.buffiere@insa-lyon.fr

AIMS

To train students in the performance of industrial analysis and design or research, possibly funded by industrial partners.

CONTENT

Practice of knowledges and knowhow studied during the whole cursus

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

CENTRE DES SPORTS
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Sports

IDENTIFICATION

CODE : CDS-5-S1-EC-EPS
ECTS :

HOURS

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

ASSESMENT METHOD

Assessment in Physical Education concerns the teaching of Sports and Artistic Physical Activities (APSA), and will take the form of continuous assessment with half-yearly marking.

The mark depends on the degree of acquisition of the skills expected in each of the activities, and the progress made over all the sessions in the cycle. The mark takes into account :

Individual and/or team performance
mastery of execution
Progress in the sports project
Responsibility and autonomy

TEACHING AIDS

All physical, sporting, artistic and competitive activities

TEACHING LANGUAGE

French

CONTACT

MME JAUSSAUD Marie :
marie.jaussaud@insa-lyon.fr

AIMS

This EC is part of the Teaching Unit: SHS and contributes to the development of the School's transversal competences

1*Auto-evaluating one's own performance
Knowledges :
- Fundamentals, principles of action and terminology of sports activities
- Criteria for observation, achievement and success.
Abilities :
- Assess your level of practice
- Build up a warm-up
- Set goals for progress
- Manage physical and mental potential

2* Work, learn and develop independently
Knowledge :
- PSAA rules
- Observation criteria
- Principles of warm-up and cool-down
Abilities :
- Mobilise resources
- Analyse, observe, question
- Take on different roles (referee, choreographer)

3* Interact with others, work as part of a team
Knowledges :
- Roles and functions in each sports activity
Abilities :
- Communicate appropriately: verbal, non-verbal and postural communication.
- Integrate into a group
- Take part in and develop a group project
- Take the initiative
- Be a good listener

4* Be creative, innovative and enterprising
Knowledge :
- Artistic disciplines
Abilities :
- Draw on knowledge and resources from different artistic fields to produce an original work.
- Mobilise the imagination and sensibility and make them visible through dance movement
- Access the symbolism of the body

5* Act responsibly in a complex world
Knowledge :
- Safety and operating rules
Abilities :
- Identify uncertainties and risks and act to reduce them
- Integrate a responsible dimension into their actions
- Show respect and fair play in a power struggle

6* Working in an international context
Knowledge :
- Socio-cultural differences
Abilities :
- Integrate cultural diversity into group work
- Act with respect for self and others

CONTENT

Physical Education and Sport lessons are organised around traditional Physical Education lessons, or advanced lessons, or appropriate practices (EPSA), or competitive practices within the framework of the Section Sportive Haut Niveau.

1. Physcical Education lessons :
Students choose one or two physical and sporting activities per year from among the activities offered by the sports centre (individual, group, dual).
2. Appropriate Physical Education lessons: For all students who are exempt from physical activity for at least 2 months:
Swimming, Body-building, Nordic Walking, Somatic Exercise, Sophrology, Wheelchair Basketball, Pilates, Table Tennis, etc.
3. Advanced Physical Education courses :
Specialisation in a sporting activity, University training and competitions
4. SSHN (High-Level Athlete section)

University training and competitions

EPS5 GMPP OYONNAX :Group cohesion project
Autonomy Lessons at S1 on Wednesday afternoons
Hiking outing

BIBLIOGRAPHY

OTTAWA Charter (1986): ‘health is seen as a resource for everyday life; it is a positive concept that highlights social and individual resources, as well as physical abilities’.

PRE-REQUISITES

- EPS: none
- Appropriate Physical Education: subject to medical advice
- Advanced courses and competitive practice: previous practice required subject to specific selection according to each activity
- SHN: ministerial list

Levels 1 and 2: Physical Education, Appropriate physical education
Level 3: Advanced courses and competitive practice, SHN

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INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

IDENTIFICATION

CODE : HU-0-S1-EC-S-PPH
ECTS : undefined

HOURS

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

ASSESMENT METHOD

Written report (10 pages minimum) and oral defence (in presence of tutor and guest).

TEACHING AIDS

Présentation du PPH sur Moodle : http://moodle.insa-lyon.fr

TEACHING LANGUAGE

French

CONTACT

AIMS

The PPH is an individual exercise where the student carries out an investigation or some research into a subjet of particular interest to them in the aim of developing some form of critical analysis of the subject. The PPH is a means by which the student can show their ability to build an analysis based on a rigorously developed thesis. The analysis is based on a personal approach to the subject (openness to the wider world), the way the subject is dealt with (for example the use of a personal experience as a way of seeing the world or the chosen subject), or in certain cases the creative approach used (for example, for an artistic experience).
The PPH requires the ability to work autonomously.

The PPH contributes primarily to the development of competencies CT2.1-4 and CT3.1 ; other competencies can be developed depending on the choice of project.

CONTENT

Work on a particular theme with a tutor chosen by the student.
Filling in of a project sheet (elaboration of the question, definition of the personal approach, bibliography, etc),
Step by step meetings with the tutor (plan, analysis, etc),
Report writing and oral presentation.

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE : GM-5-S1-EC-PPP
ECTS : 1

HOURS

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

ASSESMENT METHOD

- one French written page in which the student explains the vision he has of the differentiated path that he will follow in 4th and 5th year.
- one English written page in which the student explains his choice of mobility abroad and an analysis of the developed skills.
- a French written page to justify the choice of the training periods and an analysis of the developed skills.
- an inventory of skills at the end of each year with an assessment at the end of the 5th year.

TEACHING AIDS

Personal tests
Presentation slides when allowed by the speaker
Online self-assessment materials

TEACHING LANGUAGE

French

CONTACT

MME SALLE Emmanuelle :
emmanuelle.vidal-salle@insa-lyon.fr

AIMS

The overall objective is to build his/her own professional project. If the assessment takes place in the 5th year, the work must start during the 3rd year.
The aim is :
- Allow the student to choose his/her 4th and 5th year differentiated path
- Understand and know the trades and sectors associated with the different aspects of training
- Self-assessment and identification of competencies acquired or to be acquired
- Choose the aspects of its training to be strengthened
- Establish his/her professional project based on personal skills and self-knowledge.

CONTENT

1. Evaluation of the spontaneous representations on the differentiated paths
2. Interventions of partner companies and other engineers
3. Active participation in at least one collective activity (promotion of the department, management of the FabLab of the department, Professional day, company coffees, contacts with alumni, sponsorship of the promotion, presentation of the department, organization of the integration week , Inter-Semester Week, End-of-Studies Travel, GM Awards, Graduation Ceremony)
4. Self-Assessment Techniques and Building a personal skills Portfolio

If needed,a methodological aid can be provided for the writing of their CV and their cover letters during their search for internship.

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE
Humanities and social sciences

IDENTIFICATION

CODE : HU-0-S1-EC-S-SERIE3
ECTS : undefined

HOURS

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

ASSESMENT METHOD

Assessment will be conducted through continuous evaluation. The assessment methods will be presented at the beginning of the semester by the teaching team.

TEACHING AIDS

Materials are chosen by the instructor based on the module:
•Didactic documents related to the module
•Audiovisual materials
•Recommended readings

TEACHING LANGUAGE

French

CONTACT

Mme JOUISHOMME Delphine :
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Mme GOUTALAND Carine :
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AIMS

A series of elective courses in Humanities and Social Sciences (HSS) offers several options for students to choose from, allowing them to develop and deepen specific skills. This course aims to develop one or more transversal skills among the following:
• CT1: Self-awareness and self-management
• CT2: Working, learning, and evolving independently
• CT3: Interacting with others, working in a team
• CT4: Demonstrating creativity
• CT5: Acting responsibly in a complex world
• CT6: Navigating and evolving within an organization
• CT7: Working in an international and intercultural context
The list of options available in Series 1 and the specific competencies for each option are detailed in the catalog on the IntranetHumas:
https://intranethumas.insa-lyon.fr/sciences-humaines-sociales/offre-de-formation/cours-la-carte-0

CONTENT

Each module is designed to encourage interaction and active student participation. The content is structured around the following key aspects:
• Theoretical deepening related to the theme
• Reflection on the topic
• Practical exercises and activities
• Assessments and presentation of work

BIBLIOGRAPHY

The bibliography is selected by the instructor based on the module.

PRE-REQUISITES

French

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Energy conversions

IDENTIFICATION

CODE : GM-5-S1-EC-MSCEN
ECTS : 5

HOURS

Cours :	0h
TD :	20h
TP :	16h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	38h
Travail personnel :	12h
Total :	50h

ASSESMENT METHOD

2 Final Exam (2x2h) + oral speech

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. LEFEVRE Stephane :
stephane.lefevre@insa-lyon.fr

AIMS

- Describe and analyze thermodynamically the operating principles of energy conversion systems in sectors such as transport, industry or energy production.
- Identify the different components of a turbomachine and explain the role of each element.
- Modeling and analyzing, from the point of view of fluid mechanics, the performance of a turbomachine.
- Identify the different components of an internal combustion engines, know the different way to control and to optimise an internal combustion engine

CONTENT

BIBLIOGRAPHY

PRE-REQUISITES

Thermodynamics, Fluid mechanics

Ecodesign

IDENTIFICATION

CODE : GM-5-S1-EC-MSECO
ECTS : 5

HOURS

Cours :	0h
TD :	32h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	32h
Travail personnel :	22h
Total :	54h

ASSESMENT METHOD

Project

TEACHING AIDS

Lecture + Tutorials - Software : Gabi

TEACHING LANGUAGE

French

CONTACT

M. MAHFOUD Jarir :
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AIMS

1. Taking into account environmental impacts in the process of integrated design of an industrial product.
2. Be aware of eco-design practices in the industry, and have a first application approach.
3. Be aware of different industrial organization approaches (small, medium or large enterprises).
4. Be aware of standards,
5. Practice tools used in the industry.
6. Be aware of the limitations of current tools and approaches (what can be considered valid today, may not be in 5 years).
7. Sustainable development during the design or during the development of an industrial product

CONTENT

- Studying and aanalyzing the life cycle of a mechanism, a machine, (application to structures control, different types of actuators, different control algorithm)
- Considering the constraints induced by the standards,
- Establish a simple environmental assessment of one phase of the life cycle,
- Establish an environmental assessment of a process or system
- Life cycle analysis of a simple system: Approach with simplified Eco-design-pilot tools, OKALA / Ecolyser, Bilan Produit ADEME, BEE, ECO FAIRE,
- Eco-Design (Economy, functionality, branding)
- Life Cycle Analysis of a Simple System: Approach with Industrial Tools (GABI)
- Studying and aanalyzing the design of an industrial product. Establishing its LCA, proposing perspective for improving the design and, when possible, the realization of prototypes

BIBLIOGRAPHY

PRE-REQUISITES

No

Smart structures

IDENTIFICATION

CODE : GM-5-S1-EC-MSSS
ECTS : 5

HOURS

Cours :	0h
TD :	22h
TP :	8h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	32h
Travail personnel :	30h
Total :	62h

ASSESMENT METHOD

Final exam 2h

TEACHING AIDS

lecture handout

TEACHING LANGUAGE

French

CONTACT

M. CHESNE Simon :
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AIMS

The aim of this course, which involves the physics and models of smart transducers and their integration, is to acquire a methodology for designing and testing multiphysic systems. By the use of smart transducers coupled with mechanical structures, we develop the design of integrated active / semi-passive or semi-active control or energy harvesting devices .

CONTENT

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Vehicule dynamics

IDENTIFICATION

CODE : GM-5-S1-EC-MSDV
ECTS : 5

HOURS

Cours :	0h
TD :	20h
TP :	12h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	33h
Travail personnel :	40h
Total :	73h

ASSESMENT METHOD

1 evaluation of 1h

TEACHING AIDS

Lecture notes and slides.
Exercises notes.
Softwares : Maplesim, Amesim, Oktal Scaner,

TEACHING LANGUAGE

French

CONTACT

M. MORTEROLLE Sebastien :
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AIMS

This course is oriented towards the design of innovative vehicles, with a vehicle approach as a complex system: study of vehicle dynamics, new means of operation, design of a hybrid system, simulation of the vehicle in its environment. It is through this course to give students the skills to:
- Understand the behavior of a vehicle as a whole.
- Design and dimensioning of vehicles for industrial applications.
- Implement systems of management of the motorization and the direction.

CONTENT

BIBLIOGRAPHY

Brossard J.-P., Dynamique du véhicule, PPUR, 2006.
Brossard J.-P., Dynamique du freinage, PPUR, 2009.
Matschinky W., Road Vehicule Suspensions,PEP, 2000.
Pacejka H., Tire and vehicule Dynamics, Third Edition, Elsevier, 2012.

PRE-REQUISITES

Multibody dynamics

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Optimisation for systems design

IDENTIFICATION

CODE : GM-5-S1-EC-MSOPT
ECTS : 5

HOURS

Cours :	0h
TD :	32h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	34h
Travail personnel :	33h
Total :	67h

ASSESMENT METHOD

1x1h30

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. BRIBIESCA ARGOMEDO :
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AIMS

Optimization are a recurring theme encountered by engineers all along their careers. The objective of this module is to introduce future engineers to the fomulation, analyisis and solution of optimization problems. The guiding principle will be to give students "good practices" when using toolboxes included in different software packages (such as Matlab)

CONTENT

The first half of this module will deal with the principles of optimization and the introduction of some basic solution methods applied to examples issued from mechatronic design problems. This introduction aims to define the notions of constrained and unconstrained optimization, single or multi-objective optimization, local or global optimization and optimality conditions. Numerical methods such as gradient descent, Hooke and Jeeves method, the Simplex algorithm, some convex optimization methods or simulated reannealing will support this introduction to parametric optimization.
The second part of this module will deal with dynamic optimization problems. This topic will be presented first in its general form based on the Euler-Lagrange formulation, and then, particular methods such as Pontryagin's maximum principle or Bellman's optimality principle will be applied to concrete examples such as path finding or optimal control.
A sensibilization to meta-heuristic models (genetic algorithms, particle filters, etc.) will be provided at the end of this module.

BIBLIOGRAPHY

[1] Rao, S. S. ""Engineering Optimization Theory and Practice"", Wiley, 2009.
[2] Boyd, S. and L. Vandenberghe, ""Convex Optimization"", Cambride University Press, 2004.

PRE-REQUISITES

Robotics

IDENTIFICATION

CODE : GM-5-S1-EC-MSROB
ECTS : 5

HOURS

Cours :	0h
TD :	24h
TP :	8h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	34h
Travail personnel :	40h
Total :	74h

ASSESMENT METHOD

1 evaluation of 2h

TEACHING AIDS

Lecture notes and slides.
Exercises notes.
Softwares : Maple/Maplesim, Matlab, Adams.

TEACHING LANGUAGE

French

CONTACT

M. PHAM Minh :
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AIMS

This course offers an introduction to robotics and is based on tools that are widely used in industrial environments. It is through this course to give students the skills to:
- Understand the creation of a robotic system
- Design and dimensioning of robotic systems for industrial applications, mobile robotics, biomechanics
- Implement robotic system control laws

CONTENT

Technology of the components of a robotic system (terminology, mechanical system, terminal organ, proprioceptive and external sensors, actuators, human-machine interface).
Bases in identification and dynamic control of robots.
Basis of the generation of movements and the synthesis of trajectory.
Control of robots in position or effort for open and closed kinematic chains.
Geometric modeling, kinematics, dynamics: direct and inverse models.
Parameterization by a systematic method of description (Denavit-Hartenberg, Euler parameters, quaternions).
Analysis of the operation of a robot and singular points.
Use of software to solve a system of algebra-differential equations.

BIBLIOGRAPHY

Dombre E. et Khalil Wisama, Modélisation et commande des robots, Hermes, 1988.
Khalil W., Dombre E., Modelisation, identification and control of robots, Hermes, 2002.
Liégeois A., Les Robots Tome 7 : Analyse des performances et CAO, Hermès, 1984.

PRE-REQUISITES

Multibody dynamics

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

CENTRE DES SPORTS
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Sports

IDENTIFICATION

CODE : CDS-5-S2-EC-EPS
ECTS :

HOURS

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

ASSESMENT METHOD

Assessment in Physical Education concerns the teaching of Sports and Artistic Physical Activities (APSA), and will take the form of continuous assessment with half-yearly marking.

The mark depends on the degree of acquisition of the skills expected in each of the activities, and the progress made over all the sessions in the cycle. The mark takes into account :

Individual and/or team performance
mastery of execution
Progress in the sports project
Responsibility and autonomy

TEACHING AIDS

All physical, sporting, artistic and competitive activities

TEACHING LANGUAGE

French

CONTACT

MME JAUSSAUD Marie :
marie.jaussaud@insa-lyon.fr

AIMS

This EC is part of the Teaching Unit: SHS and contributes to the development of the School's transversal competences

1*Auto-evaluating one's own performance
Knowledges :
- Fundamentals, principles of action and terminology of sports activities
- Criteria for observation, achievement and success.
Abilities :
- Assess your level of practice
- Build up a warm-up
- Set goals for progress
- Manage physical and mental potential

2* Work, learn and develop independently
Knowledge :
- PSAA rules
- Observation criteria
- Principles of warm-up and cool-down
Abilities :
- Mobilise resources
- Analyse, observe, question
- Take on different roles (referee, choreographer)

3* Interact with others, work as part of a team
Knowledges :
- Roles and functions in each sports activity
Abilities :
- Communicate appropriately: verbal, non-verbal and postural communication.
- Integrate into a group
- Take part in and develop a group project
- Take the initiative
- Be a good listener

4* Be creative, innovative and enterprising
Knowledge :
- Artistic disciplines
Abilities :
- Draw on knowledge and resources from different artistic fields to produce an original work.
- Mobilise the imagination and sensibility and make them visible through dance movement
- Access the symbolism of the body

5* Act responsibly in a complex world
Knowledge :
- Safety and operating rules
Abilities :
- Identify uncertainties and risks and act to reduce them
- Integrate a responsible dimension into their actions
- Show respect and fair play in a power struggle

6* Working in an international context
Knowledge :
- Socio-cultural differences
Abilities :
- Integrate cultural diversity into group work
- Act with respect for self and others

CONTENT

Physical Education and Sport lessons are organised around traditional Physical Education lessons, or advanced lessons, or appropriate practices (EPSA), or competitive practices within the framework of the Section Sportive Haut Niveau.

1. Physcical Education lessons :
Students choose one or two physical and sporting activities per year from among the activities offered by the sports centre (individual, group, dual).
2. Appropriate Physical Education lessons: For all students who are exempt from physical activity for at least 2 months:
Swimming, Body-building, Nordic Walking, Somatic Exercise, Sophrology, Wheelchair Basketball, Pilates, Table Tennis, etc.
3. Advanced Physical Education courses :
Specialisation in a sporting activity, University training and competitions
4. SSHN (High-Level Athlete section)

University training and competitions

BIBLIOGRAPHY

OTTAWA Charter (1986): 'health is seen as a resource for everyday life; it is a positive concept that highlights social and individual resources, as well as physical abilities'.

PRE-REQUISITES

EPS: none
- Appropriate Physical Education: subject to medical advice
- Advanced courses and competitive practice: previous practice required subject to specific selection according to each activity
- SHN: ministerial list

Levels 1 and 2: Physical Education, Appropriate physical education
Level 3: Advanced courses and competitive practice, SHN

INSA LYON
Campus LyonTech La Doua
20, avenue Albert Einstein - 69621 Villeurbanne cedex - France
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www.insa-lyon.fr

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

IDENTIFICATION

CODE : HU-0-S2-EC-S-PPH
ECTS : undefined

HOURS

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

ASSESMENT METHOD

Written report (10 pages minimum) and oral defence (in presence of tutor and guest).

TEACHING AIDS

Présentation du PPH sur Moodle : http://moodle.insa-lyon.fr

TEACHING LANGUAGE

French

CONTACT

AIMS

The PPH is an individual exercise where the student carries out an investigation or some research into a subjet of particular interest to them in the aim of developing some form of critical analysis of the subject. The PPH is a means by which the student can show their ability to build an analysis based on a rigorously developed thesis. The analysis is based on a personal approach to the subject (openness to the wider world), the way the subject is dealt with (for example the use of a personal experience as a way of seeing the world or the chosen subject), or in certain cases the creative approach used (for example, for an artistic experience).
The PPH requires the ability to work autonomously.
The PPH contributes primarily to the development of competencies CT2.1-4 and CT3.1 ; other competencies can be developed depending on the choice of project.

CONTENT

Work on a particular theme with a tutor chosen by the student.
Filling in of a project sheet (elaboration of the question, definition of the personal approach, bibliography, etc),
Step by step meetings with the tutor (plan, analysis, etc),
Report writing and oral presentation.

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE : GM-5-S2-EC-PPP
ECTS :

HOURS

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

ASSESMENT METHOD

- one French written page in which the student explains the vision he has of the differentiated path that he will follow in 4th and 5th year.
- one English written page in which the student explains his choice of mobility abroad and an analysis of the developed skills.
- a French written page to justify the choice of the training periods and an analysis of the developed skills.
- an inventory of skills at the end of each year with an assessment at the end of the 5th year.

TEACHING AIDS

Personal tests
Presentation slides when allowed by the speaker
Online self-assessment materials

TEACHING LANGUAGE

French

CONTACT

MME SALLE Emmanuelle :
emmanuelle.vidal-salle@insa-lyon.fr

AIMS

The overall objective is to build his/her own professional project. If the assessment takes place in the 5th year, the work must start during the 3rd year.
The aim is :
- Allow the student to choose his/her 4th and 5th year differentiated path
- Understand and know the trades and sectors associated with the different aspects of training
- Self-assessment and identification of competencies acquired or to be acquired
- Choose the aspects of its training to be strengthened
- Establish his/her professional project based on personal skills and self-knowledge.

CONTENT

1. Evaluation of the spontaneous representations on the differentiated paths
2. Interventions of partner companies and other engineers
3. Active participation in at least one collective activity (promotion of the department, management of the FabLab of the department, Professional day, company coffees, contacts with alumni, sponsorship of the promotion, presentation of the department, organization of the integration week , Inter-Semester Week, End-of-Studies Travel, GM Awards, Graduation Ceremony)
4. Self-Assessment Techniques and Building a personal skills Portfolio

If needed,a methodological aid can be provided for the writing of their CV and their cover letters during their search for internship.

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE
Humanities and social sciences

IDENTIFICATION

CODE : HU-0-S2-EC-S-SERIE2
ECTS : undefined

HOURS

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

ASSESMENT METHOD

Assessment will be conducted through continuous evaluation. The assessment methods will be presented at the beginning of the semester by the teaching team.

TEACHING AIDS

Materials are chosen by the instructor based on the module:
• Didactic documents related to the module
• Audiovisual materials
• Recommended readings

TEACHING LANGUAGE

French

CONTACT

Mme JOUISHOMME Delphine :
delphine.jouishomme@insa-lyon.fr
Mme GOUTALAND Carine :
carine.goutaland@insa-lyon.fr

AIMS

A series of elective courses in Humanities and Social Sciences (HSS) offers several options for students to choose from, allowing them to develop and deepen specific skills. This course aims to develop one or more transversal skills among the following:
• CT1: Self-awareness and self-management
• CT2: Working, learning, and evolving independently
• CT3: Interacting with others, working in a team
• CT4: Demonstrating creativity
• CT5: Acting responsibly in a complex world
• CT6: Navigating and evolving within an organization
• CT7: Working in an international and intercultural context
The list of options available in Series 1 and the specific competencies for each option are detailed in the catalog on the IntranetHumas:
https://intranethumas.insa-lyon.fr/sciences-humaines-sociales/offre-de-formation/cours-la-carte-0

CONTENT

Each module is designed to encourage interaction and active student participation. The content is structured around the following key aspects:
• Theoretical deepening related to the theme
• Reflection on the topic
• Practical exercises and activities
• Assessments and presentation of work

BIBLIOGRAPHY

The bibliography is selected by the instructor based on the module.

PRE-REQUISITES

French

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Final project master thesis

IDENTIFICATION

CODE : GM-5-S2-EC-COPRI
ECTS : 16

HOURS

Cours :	1h
TD :	1h
TP :	0h
Projet :	200h
Evaluation :	1h
Face à face pédagogique :	3h
Travail personnel :	200h
Total :	403h

ASSESMENT METHOD

Ongoing evaluation, final report and defense

TEACHING AIDS

Depending on the topic

TEACHING LANGUAGE

French
English

CONTACT

M. BUFFIERE Jean-Yves :
jean-yves.buffiere@insa-lyon.fr

AIMS

To train students in the performance of industrial analysis and design or research, possibly funded by industrial partners.

CONTENT

Practice of knowledges and knowhow studied during the whole cursus

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Geometry and 3D imaging

IDENTIFICATION

CODE : GM-5-S2-EC-CEGEO
ECTS : 5

HOURS

Cours :	0h
TD :	8h
TP :	20h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	28h
Travail personnel :	10h
Total :	38h

ASSESMENT METHOD

Report and case studie

TEACHING AIDS

Slides (pdf)

TEACHING LANGUAGE

French

CONTACT

M. RAYNAUD Stephane :
stephane.raynaud@insa-lyon.fr

AIMS

In the design phase, the engineer must master the prismatic or surface geometric definition of the products. He must ascertain at the earliest possible feasibility of manufacture, geometric quality and material.
This course allows us to master the various "links of the geometric digital chain" of the mechanical products of the design to the service quality.
- To analyze manufacturing returns and to take into account the geometric quality of the real products,
- Proficiency in 3D scanning and imaging tools for product design,
- Understand the role of non-destructive testing (NDT) methods in the life cycle of a product,
- Knowledge of advanced NDT methods such as radiography or X-ray tomography,
- Know how to analyze reconstructed images in 3D.

CONTENT

TOMOGRAPHY / NDT (16H Labsession/Project)¿ Jean Michel LETANG and Jean-Yves BUFFIERE
-Basic copncepts of physics, of technologies and of instrumentation in x-ray imaging
-Study and parametrisation of digital X-ray imaging
-Use of simulation modeling toolboxes and experimental benches of radiography and tomography
-Processing of 2D and 3D reconstructed images

GEOMETRIC AND SURFACE CONTROL (2H Tutotrials + 12H Labsession/Project)- Stéphane RAYNAUD and Adrien CHOUVIER
-Digital metrology chain
-Technology of contact or laser
-Analysis of specifications
-Capabilities of the means of acquisition and treatment
-Implementation of inspection with 3D means to contact or with laser scanner (MMT contact and laser, ARM laser scanner, large laser scanner)
-Point cloud processing
-Control report and mapping of defects
-Geometric expertise, decision making
-Implementation of large-scale scanning for TQC, implantation, augmented reality applications, meter surveyor.

BIBLIOGRAPHY

Advanced Tomographic Methods in Materials Research and Engineering, J. Banhart, OUP Oxford, 2008
- Industrial Tomography: Systems and Applications, M. Wang, Woodhead Publishing, 2015
- Nondestructive Testing of Materials and Structures, O. Büyüköztürk, Springer, 2013

PRE-REQUISITES

Bachelor in Mechanical Engineering

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Multiphysics systems modeling

IDENTIFICATION

CODE : GM-5-S2-EC-CEASM
ECTS : 5

HOURS

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

ASSESMENT METHOD

4h:
- 1h: mid-term exam,
- 3h: final-term exam.

TEACHING AIDS

Course and exercice handouts, synthesis slides, Moodle course

TEACHING LANGUAGE

French

CONTACT

M. BOULANGER Thomas :
thomas.boulanger@insa-lyon.fr

AIMS

To be able to :
- design new power transmission architectures (multi-energy).

CONTENT

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Bioinspiration and ecodesign

IDENTIFICATION

CODE : GM-5-S2-EC-CEBED
ECTS : 5

HOURS

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

ASSESMENT METHOD

MCQ + report on one of the 4 themes

TEACHING AIDS

handout

TEACHING LANGUAGE

French

CONTACT

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M. VILLE Fabrice :
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MME BEL Aline :
aline.bel-brunon@insa-lyon.fr

AIMS

By changing paradigm, studying bio-inspiration, eco-design, design or nanoscale design, students develop new methods of creativity and / or innovation in the design of products or systems.

CONTENT

- introduction to bio-inspiration
- Eco-design methodology
- exchange on design
- design at the nanometric scale

BIBLIOGRAPHY

PRE-REQUISITES

Innovative tools for design

IDENTIFICATION

CODE : GM-5-S2-EC-CEOAC
ECTS : 5

HOURS

Cours :	0h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	32h
Travail personnel :	45h
Total :	77h

ASSESMENT METHOD

Written Exam + report on one of the 3 themes

TEACHING AIDS

handout

TEACHING LANGUAGE

French

CONTACT

MME TANGUY Anne :
anne.tanguy@insa-lyon.fr

AIMS

The students will learn how to use innovative tools for design assistance: sensory perception, imaging, non-conventional materials (foams, glasses, biological tissues..)

CONTENT

Contribution of sensory perception to conception; Use of imagery for mechanical analysis; Adapted choice of non-conventional materials (wood, glasses, mousses, biological tissues ..)

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE : GM-5-S2-EC-CEFPI
ECTS : 5

HOURS

Cours :	0h
TD :	22h
TP :	8h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	30h
Travail personnel :	12h
Total :	42h

ASSESMENT METHOD

TEACHING AIDS

TUTORIELS - MOODLE - LOGICIEL CATIA FTA 3DCS - FAO ESPRIT OU NX CAM

TEACHING LANGUAGE

French

CONTACT

M. RAYNAUD Stephane :
stephane.raynaud@insa-lyon.fr

AIMS

In the design phase, the BE engineer must master the prismatic or surface geometric definition of the products. He must ascertain at the earliest possible feasibility of manufacture, geometric quality.
This course allows us to master the various -links of the geometric digital chain- of the mechanical products of the BE to the service quality. The mastery of the geometric definition for the manufacture and in order to guarantee the functionalities required,
- Know the modern means of production and their possibilities of realization by mastering the cost and the quality,
- To analyze manufacturing returns and to take into account the geometric quality of the real products,

CONTENT

1) TOLERANCING ISO GPS and 3D GEOMETRIC SIMULATION (4h of course + 4h of TD + 8h Project) - Stéphane RAYNAUD and Valerie WOLFF
- Definition of the TOLERANCE of the products from a functional analysis
- Placement of tolerances on the 3D model using the FTA tool
- Modeling of MIPs or links on the 3D model with the 3DCS tool,
- Definition of functional conditions (play, flush, alignment, ..., between geometric elements of 3D components)
- Simulation of manufacturing and assembly of product systems
- Development of tolerance values, specification capabilities, link games, design or query semantics.
- Consideration of component deformation in 3DCS ""compliant modler"" and using Abaqus for CATIA
- Optimization of tolerance and control and semi-rigid or very flexible parts.
2) FAO 3AXES / 5 AXES / NX CAM or ESPRIT (4h class 6h TD / TP) - Thibaut CHAISE and Nicolas TARDIF
-The digital chain, from CAD to the actual part
- Technology
- Functional bases of a Digital Drive/NC and CAD/CAM software
- Manufacturing range and manufacturing preparation using CAM tools
- Simulation of manufacturing from 3 to 5 axes
- Manufacturing tuning and adjustments
- Product realizations
3) INDUSTRIAL QUALITY SURVEY (4h TP) - Stéphane RAYNAUD
- Implementation of conventional metrology resources for dimensional, geometric control.
- Realization of 3D control for the optimization of manufacturing
- Roughness Control
Different quality surveys will be carried out for the development of manufacturing and the control of dispersions or capabilities of manufacturing processes

BIBLIOGRAPHY

PRE-REQUISITES

COMMON AREA 3GM

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Energy conversions

IDENTIFICATION

CODE : GM-5-S2-EC-CECEN
ECTS : 5

HOURS

Cours :	0h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	32h
Travail personnel :	12h
Total :	44h

ASSESMENT METHOD

Final Exam (2h)+ rapport

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. LEFEVRE Stephane :
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AIMS

- Describe and analyze thermodynamically the operating principles of energy conversion systems in sectors such as transport, industry or energy production.
- Identify the different components of a turbomachine and explain the role of each element.
- Modeling and analyzing, from the point of view of fluid mechanics, the performance of a turbomachine.
- Identify the different components of an internal combustion engines, know the different way to control and to optimise an internal combustion engine

CONTENT

BIBLIOGRAPHY

PRE-REQUISITES

Thermodynamics, Fluid mechanics

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Mechanical design and optimisation

IDENTIFICATION

CODE : GM-5-S2-EC-CECOP
ECTS : 5

HOURS

Cours :	0h
TD :	26h
TP :	4h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	30h
Travail personnel :	10h
Total :	40h

ASSESMENT METHOD

Report and case studie

TEACHING AIDS

Slides (pdf)

TEACHING LANGUAGE

French

CONTACT

MME MICHEL Chantal :
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M. RAYNAUD Stephane :
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AIMS

In the design phase, the BE engineer must master the prismatic or surface geometric definition of the products. He must ascertain at the earliest possible feasibility of manufacture, geometric quality and material.
This module makes it possible to master the various links of the geometric digital chain of the mechanical products of the BE to the service quality. The mastery of the surface design tools from a specification or an existing product in surface retro-design. Proficiency in 3D scanning and imaging tools for product design assistance and proficiency topologic optimisation softs.

CONTENT

- DESIGN AND TOPOLOGIc optimization (2h cours + 4h of TD + 4h Projet) - Nadine NOEL
- Optimized geometry definition from stress conditions
- INSPIRE optimization tools, case study for mass optimization, stiffness, natural frequency.
- Optimization from the point of view of the process - additive manufacture or foundry - SURFACIC CAD (2h of course + 4h TD + 4h Project) - Michele GUINGAND
- Generative Shape Design workshop
- Imagine and Shape/Free style workshops
- 3D SCANNING AND SURFACIC RETROCONCEPTION (2h of course + 4h TD + 4hTP)
- St¿phane RAYNAUD and Adrien CHOUVIER
- Acquisition of laser scanner on measuring arm, MMT, large dimension scanner
- Processing, Filtering, Resetting Clouds, AC (As constructed)

- STL mesh
- Retro surface design with DSE (Digitalized Shape Editor) and QSR (Quick Surface Reconstruction) workshops

BIBLIOGRAPHY

PRE-REQUISITES

Bachelor in Mechanical Engineering

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Biomechanics, art, luxury, architecture

IDENTIFICATION

CODE : GM-5-S2-EC-CEBAL
ECTS : 5

HOURS

Cours :	0h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	30h
Travail personnel :	45h
Total :	75h

ASSESMENT METHOD

Report + Oral defence

TEACHING AIDS

handout

TEACHING LANGUAGE

French

CONTACT

MME TANGUY Anne :
anne.tanguy@insa-lyon.fr
M. VILLE Fabrice :
fabrice.ville@insa-lyon.fr
MME BEL Aline :
aline.bel-brunon@insa-lyon.fr

AIMS

The goal of this teaching is for the students to investigate and solve a problem arising from a professional in one of the domains listed in the title (Biomechanics, Arts, Luxury, Architecture)

CONTENT

This teaching is organized in 3 domains (Biomechanics and Sports, Arts, Luxury, Civil Engineering, Architecture). Each student has to choose a domainn. He will profit of an additional teaching of 4hFaF, and then 28h of project (in order to meets the expectation of a professionnal)

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Power transmission

IDENTIFICATION

CODE : GM-5-S2-EC-CESTP
ECTS : 5

HOURS

Cours :	0h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	31h
Travail personnel :	30h
Total :	61h

ASSESMENT METHOD

- 1h: exam,

TEACHING AIDS

Course and exercice handouts, synthesis slides, Moodle course

TEACHING LANGUAGE

French

CONTACT

M. BIDEAUX Eric :
eric.bideaux@insa-lyon.fr

AIMS

To be able to :
- Technology of electrical actuators and components.
- Basic modeling of electrical components and their performances (efficiency...).
- design an electrictal actuated transmission.
- address multi-physics system modelling, formulate the objectives, the hypotheses and the validity limits of modelling.
- use the model in order to answer the given engineering study objectives (the analysis of behavior and performances, and the design/control of multi-technological and multi-physics systems).
- use analogies in electrical, mechanical and hydraulic power transmission systems and compare their performances.

CONTENT

Part I:
1. Introduction to power transmission problematic in mechanical systems.
2. Electrical actuation : basis of electromagnetism (Maxwell, field, energy, ...) and technology of electrical power transmission chains and their control

Part II:
1. Introduction of the multi-physics modelling context: modelling objectives, multi-technology and multi-physics approach, notions of circuits and networks, system functions and hypotheses.
2. Elements of multi-physics modelling: energy and coupling approach, physical laws and behavioral laws, analogy and bond graph elements, construction of the bond graph representation.
3. Analysis of multi-physics models: bond graph causality, systems of equations, model properties.

Part III:
1. Analogies: Electrical, mechanical and hydraulic domain.
2. Modeling and studying new power transmission architectures (multi-energy).

BIBLIOGRAPHY

- Dauphin-Tanguy, G. Les bond graphs. IC2 : Série Systèmes automatisés. Hermès Science Publications, 2000.
- Borutzky, W. Bond graph modelling of engineering systems. Springer, 2011.
- Karnopp, D. C., Margolis, D. L., Rosenberg, R. C. System dynamics: Modeling, Simulation, and Control of Mechatronic Systems. 5th Ed., John Wiley & Sons, 2012.

PRE-REQUISITES

Physics of preparatory classes and of the common core courses of GM department.
Mathematics of preparatory classes and of the common core courses of GM department (differential equations, partial derivative equations, integration numerical methods,...).

IDENTIFICATION

CODE : GM-5-S2-EC-STAGEL
ECTS : 30

HOURS

Cours :	0h
TD :	1h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	2h
Travail personnel :	400h
Total :	402h

ASSESMENT METHOD

50% by the industry through a grid given by GM /
25% by an oral presentation evaluted by GM's teachers /
25% by a written report evaluated by GM's teachers

TEACHING AIDS

None

TEACHING LANGUAGE

French

CONTACT

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M. Morterolle Sebastien :
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Mme Paredes Astudillo Yenny :
yenny.paredes-astudillo@insa-lyon.fr

AIMS

M1- To integrate an organization, to lead and help it to evolve
M2- To take account for constraints such as professionnal, economical and industrials ones.
M3- To take account for societal values (ethical, and ethics) and help them being respected
M4- To dialogue with specialists as with not specialists
M5- To work in international context: speak one or several langages, cultural openings,
M6- To work with autonomy, critical faculty, and curiosity

CONTENT

26 weeks of industrial intership

BIBLIOGRAPHY

Documents with details informations about progress of the intership and associated regulations are avalaible on Moodle website

PRE-REQUISITES

All teachings of GM for 3rd and 4th years

IDENTIFICATION

CODE : GM-5-S2-EC-STAGEL
ECTS : 30

HOURS

Cours :	0h
TD :	1h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	2h
Travail personnel :	400h
Total :	402h

ASSESMENT METHOD

50% by the industry through a grid given by GM /
25% by an oral presentation evaluted by GM's teachers /
25% by a written report evaluated by GM's teachers

TEACHING AIDS

None

TEACHING LANGUAGE

French

CONTACT

M. Mauger Cyril :
cyril.mauger@insa-lyon.fr
M. Morterolle Sebastien :
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Mme Paredes Astudillo Yenny :
yenny.paredes-astudillo@insa-lyon.fr

AIMS

M1- To integrate an organization, to lead and help it to evolve
M2- To take account for constraints such as professionnal, economical and industrials ones.
M3- To take account for societal values (ethical, and ethics) and help them being respected
M4- To dialogue with specialists as with not specialists
M5- To work in international context: speak one or several langages, cultural openings,
M6- To work with autonomy, critical faculty, and curiosity

CONTENT

26 weeks of industrial intership

BIBLIOGRAPHY

Documents with details informations about progress of the intership and associated regulations are avalaible on Moodle website

PRE-REQUISITES

All teachings of GM for 3rd and 4th years

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Rotor dynamics

IDENTIFICATION

CODE : GM-5-S2-EC-MEDYR
ECTS : 5

HOURS

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

ASSESMENT METHOD

Project

TEACHING AIDS

Handouts

TEACHING LANGUAGE

French

CONTACT

M. DUFOUR Regis :
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AIMS

The course has the objective to understand the dynamic behavior of rotating machines, to design them, to implement modifications in accordance with standards, to optimize their operation, to control their vibratory levels, and to detect potential failures as soon as possible.
To this end, it is necessary to know how to establish a mechanical model, to understand the basic phenomena with quasi-analytical and Finite Element methods. With an engineer objective, the program addresses the assumptions formulation and the relevance of the solutions obtained. The chapter devoted to the dynamic behavior monitoring uses powerful signal processing tools to identify and locate faults.
The students must have autonomy, ability to synthesize and to interpret linear or nonlinear basic phenomena during these course-TD-TP sessions, using numerical and experimental demonstrators.

CONTENT

1- Rotor
Modeling of components ; Basic Phenomena ; Finite element modeling. API Standards ; Parametric instabilities and excitation ;Balancing methods. Experimental Demonstrator ; Industrial Illustrations and Applications

2- Aubages
Modeling of blades, axisymmetric assemblies ; Calculation of the Campbell diagram and responses

3- Nonlinear dynamics
Phenomena and basic techniques ;Application to rotating machines.

4- Follow-up of the behavior of the rotors
Troubleshooting and understanding of defects ;Interests of signal processing tools ; Experimental approach of bearing defects.

Tools used: FE codes ROTORINSA, ANSYS and Matlab software: behavior monitoring, nonlinear oscillator, balancing, etc.

BIBLIOGRAPHY

M. LALANNE, G. FERRARIS, Rotordynamics Prediction in Engineering, J. Wiley & Sons, 2nd Ed. 1998
H. DRESIG, F. HOLZWEISSIG, Dynamics of Machinery - Theory and applications. Springer, 2010
N. BACHSCHMID, P. PENNACHI E. TANZI, Cracked Rotors, A survey on static and dynamic behavior including modelling and diagnostic. Springer, 2010
G. GENTA, Dynamics of Rotating Systems. Springer, 2005
M.L. ADAMS, Jr, Rotating Machinery Vibration. From Analysis to Troushooting. CRC Press, 2010.
A.H. NAYFEH, B. BALACHANDRAN, Applied Nonlinear Dynamics, 686p, J. Wiley, 1995

PRE-REQUISITES

Vibration, computational methods, FEM, data processing

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Computational fluid dynamics

IDENTIFICATION

CODE : GM-5-S2-EC-MECFD
ECTS : 5

HOURS

Cours :	0h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	32h
Travail personnel :	12h
Total :	44h

ASSESMENT METHOD

Final exam (2h)

TEACHING AIDS

Digital pdf class notes; Exercice paper folders

TEACHING LANGUAGE

French

CONTACT

M. MIGNOT Emmanuel :
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AIMS

* Being able to simulate flows using CFD methods (Newtonian flows with simple boundary conditions): 2D or 3D approaches, finite-volume methods, turbulence models for engineers, wall functions, time schemes, validation and convergence strategies.
* Introduction to CFD in modre complex configurations: compressible flows, with heat/mass trasnfers, free surfaces.

CONTENT

* Introduction to basic equations, physical interpretation of the flows - closure models
* Identifying laminar/turbulent, 2D/3D, visquous/inviscid, steady/unsteady flows; introduction to compressibility.
* Numerical schemes and discretisations specific to CFD, including compressible flows.
* Turbulence models for engineers. Wall treatments and detachment.
* Introduction to more comple real flows: 2-phase, with heat/mass transfer, free surface

Application: Simulations of +/- complex configurations using commercial code ANSYS-FLUENT or Star CCM+

BIBLIOGRAPHY

Versteeg & Malalasekera, an introduction to computational Fluid Dynamics, Pearson Prentice hall, 1995.
Ferziger & Peric, Computational Methods for Fluid Dynamics, 2002.

PRE-REQUISITES

Basics Fluid mechanics & numerical methods

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Noise and vibration control in industry

IDENTIFICATION

CODE : GM-5-S2-EC-MESAV
ECTS : 5

HOURS

Cours :	0h
TD :	18h
TP :	12h
Projet :	0h
Evaluation :	0h
Face à face pédagogique :	30h
Travail personnel :	20h
Total :	50h

ASSESMENT METHOD

Reports

TEACHING AIDS

lecture handout

TEACHING LANGUAGE

French

CONTACT

M. PARIZET Etienne :
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M. LECLERE Quentin :
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AIMS

Introduction of vibration and acoustic challenges usually faced by engineers working in transportation industry. Presentation of some trouble shooting solutions.

CONTENT

Automotive noise: description of noise sources. Generation of engine noise, transmission of forces from the powertrain to the body, propagation in the passenger compartment. Improvement solutions (balancing shafts, shock absorbers, dynamic absorbers ...)
Evaluation of the acoustic and vibratory comfort and identification of the ways of perceptual improvement.
Aeronautical noise: acoustic transparency of complex walls.
Railway noise: wheel-rail contact and wheel radiation, braking noise.
Insulation of machines in industry.
Passive systems for vibration control in aeronautics:
-Insulation,
- Absorbers and resonators.
Active / semi-active systems for vibration control in aeronautics / aerospace:
- Introduction to active vibration control
- Piezoelectric transducers
- Electromagnetic Transducers

BIBLIOGRAPHY

Bernard Swoboda : Mécanique des moteurs alternatifs, Technip (1984).
Helmut Fuchs : Applied Acoustics. Concepts, absorbers and silencers for acoustical comfort and noise control, Springer (2013).
Thomasz Krysinski "Origine et contrôle des vibrations mécaniques" (2003),
André Preumont " Vibration Control of active Structures" (2011).

PRE-REQUISITES

GM-3-VIBAC-S2; GM-4-MEMDS-S1;GM-4-MEAVS-S2

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Structural acoustics

IDENTIFICATION

CODE : GM-5-S2-EC-MERAY
ECTS : 5

HOURS

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

ASSESMENT METHOD

Reports

TEACHING AIDS

Course materials; Tutorials

TEACHING LANGUAGE

French

CONTACT

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AIMS

Mastering the formalisms involved in the acoustic radiation of vibrating structures: the integral formulation and the acoustic finite element methods and the ray tracing method.

CONTENT

Radiation of elementary sources, monopoles and dipoles, Radiation of an electrodynamic loudspeaker, Radiation of the plates in bending, notion of radiating modes, radiated power and radiation efficiency, Integral formulation of an external and internal problem, Finite Boundary element method, singular frequencies for the external problem, example of cavity plate problem, Acoustic finite elements and application for the description of the "PML" method, Perfect match layer. Ray tracing method, useful in the context of environmental acoustics to plot noise maps. Numerical simulation work with the commercial software ACTRAN. Use of Code Tympan, open source software of ray tracing.

BIBLIOGRAPHY

Rayonnement acoustique des structures. C. Lesueur ; Acoustics, A.D. Pierce; Phénomènes fondamentaux de l'acoustique linéaire, J.L Migeot, éditions Lavoisier

PRE-REQUISITES

GM-4-MEAVS-S2; GM-3-VIBAC-S2

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Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Advanced heat transfer

IDENTIFICATION

CODE : GM-5-S2-EC-METTA
ECTS : 5

HOURS

Cours :	0h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	4h
Face à face pédagogique :	34h
Travail personnel :	12h
Total :	46h

ASSESMENT METHOD

Final Exam (4h) + oral speech (30min)

TEACHING AIDS

Written notes, collection of exercices, use of numerical softwares

TEACHING LANGUAGE

French

CONTACT

M. BOUTAOUS M'hamed :
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AIMS

- To acquire advanced skills on coupled heat transfers introducing the phase changes undergone by the materials, their kinetics and their modeling.
- To address thermal radiations methods, radiation in semi-transparent materials and extreme cases: optically thin and optically tick materials.
- To quantify thermal contact resistances, thermal stresses.
- To know the definition and to identify of thermophysical parameters as a function of temperature (inverse methodes)
- To estimate and quantify of the heat fluxes and temperature fields
- To realize thermal design of systems by multiphysics modeling

CONTENT

- Recall of basics of heat transfer modes
- Radiation in semi-transparent and participating media
- Energy balance, heat equation
- Estimation of interfacial heat transfer rates, thermal resistances¿
- Expression of viscous dissipation,
- Phase change (evaporation, condensation, crystallization, ...)
- Coupling with flow
- Identification of thermophysical parameters versus temperature (inverse methods)
- Presentation of the various exchanger architectures
- Different heating and cooling technologies.
- Nodal modeling, numerical schemes, models reduction (system)
- Conventional courses and practical projects using matlab, comsol ...

BIBLIOGRAPHY

- M.N. Ozisik, Heat Conduction, 2d Edition, John Wiley & Sons, NY (1993)
- M F.MODEST; Radiative Heat Transfer; McGRAW-HILL Inter. Editions, 1993
- Bejan A., Convection Heat Transfer, 2nd Ed., 1995, John Wiley & Sons, NY
- J.-F. Sacadura, Transferts thermiques. Initiation et approfondissement, Tec & Doc Lavoisier, Paris, 2015.
- Techniques de l'ingénieur
- F. P. Incropera, D. P. DeWitt, Fundamentals of Heat and Mass Transfer , Wiley, N.Y., 2002.

PRE-REQUISITES

Initiation to Heat transfers, thermodynamics, fluid mechanics

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Tribology

IDENTIFICATION

CODE : GM-5-S2-EC-METRI
ECTS : 5

HOURS

Cours :	0h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	32h
Travail personnel :	20h
Total :	52h

ASSESMENT METHOD

oral and written exam

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

M. FILLOT Nicolas :
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AIMS

The aim is to give both experimental and numerical skills in tribology for mechanical engineers and thus through industrial applications and future research challenges in tribology.

CONTENT

- Part #1: History, definitions and fundamentals
o History and definitions for tribology
o Friction and Wear: basics, classical laws and limits
o Lubrication: solid or fluid, a question of strategy
o Tribological concept: tribological triplet and tribological circuit
o Failures analyses
o From contact conditions to their consequences

- Part #2: Interface rheology, a central key of tribology
o Definition of rheology
o Measurement of rheological parameters and their limits
o Rheological models and their limits
o Link between rheology and 3rd body structure

- Part #3: Numerical tribology
o Finite Element Modelling, experimental validation and applications
o Discrete Element Modelling, experimental validation and applications
o Molecular Dynamics Modelling, experimental validation and applications
o Coupled Multi-scales Models, experimental validation and application

- Part #4: Applications
o 5 industrial and R&D cases

- Part #5: Synthesis

BIBLIOGRAPHY

- History of Tribology D. Dowson, Longman, London and New York, ISBN 0-582-44766-4

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Engin and power train analysis

IDENTIFICATION

CODE : GM-5-S2-EC-MEEPT
ECTS : 5

HOURS

Cours :	0h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	3h
Face à face pédagogique :	33h
Travail personnel :	15h
Total :	48h

ASSESMENT METHOD

written exam and project

TEACHING AIDS

hand-outs of slides

TEACHING LANGUAGE

English

CONTACT

M. LUBRECHT Antonius :
ton.lubrecht@insa-lyon.fr

AIMS

Main objectives are
a) to master the basic concepts and reduce the power loss in IC engines and gear transmissions
b) transient and dynamic models applied to cams, spur and helical gears,
c) case studies by industrials.

CONTENT

Vue d'ensemble sur les moteurs à combustion interne, études des pertes de puissance dans le vilbrequin, les arbres à cames et segments. Introduction des modèles de base pour les engrenages: raideurs d'engrènement variables, erreurs de transmission, sauts d'amplitude et chocs, régimes à vitesses variables, optimisation des dentures.

BIBLIOGRAPHY

Internal combustion engine fundamentals, J.R.Heywood
Elastohydrodynamic lubrication, course notes 4GMD, A.A. Lubrecht
D. W. Dudley, `Handbook of Practical Gear Design¿, CRC, 1994
J. D. Smith, ` Gear Noise and Vibration¿, CRC, 2003, 320 p.
Selected articles in the ASME Journal of Mechanical Design, the Journal of Sound and Vibration, Mechanism and Machine Theory

PRE-REQUISITES

Contact Mechanics, Lubrication, Rigid-solid kinematics and dynamics.

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Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Experimental fluid mechanics

IDENTIFICATION

CODE : GM-5-S2-EC-MEMFE
ECTS : 5

HOURS

Cours :	0h
TD :	18h
TP :	12h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	32h
Travail personnel :	10h
Total :	42h

ASSESMENT METHOD

Written exam & reports

TEACHING AIDS

Course outline

TEACHING LANGUAGE

French

CONTACT

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M. EL HAJEM :
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AIMS

- Have an overview of the advanced experimental methods used in the fields of fluid mechanics and heat transfer.
- To allow R & D engineers interested in the preparation and implementation of experiments for the determination of physical quantities (such as velocity, pressure, concentration and temperature) to choose the appropriate instrumentation.
- Also master the processing of the results, their interpretation as well as the dimensional analysis.

CONTENT

Emphasis will be placed on measuring instruments specific to:
- Scalar quantities: flowrate, pressure, temperature; concentration...
- Vector quantities: velocity; turbulence, Shearing ...
Presentation of non-intrusive optical measuring techniques:
- Doppler laser anemometry,
- Particle Imaging Velocimetry (PIV),
- Planar Laser-induced fluorescence (PLIF),
- Visualization by Digital Holography
Data acquisition systems;flow visualization.
Hot Wire Anemometry.

BIBLIOGRAPHY

- Springer Handbook of Experimental Fluid Mechanics, Cameron Tropea , Alexander Yarin , John F. Foss
- Fluid Mechanics Measurements, R. Goldstein

PRE-REQUISITES

Thermodynamics, Fluid mechanics

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
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Advanced numerical methods for modeling in mechanics

IDENTIFICATION

CODE : GM-5-S2-EC-MEMN2
ECTS : 5

HOURS

Cours :	0h
TD :	30h
TP :	0h
Projet :	0h
Evaluation :	2h
Face à face pédagogique :	32h
Travail personnel :	10h
Total :	42h

ASSESMENT METHOD

2 written tests and Report

TEACHING AIDS

TEACHING LANGUAGE

English

CONTACT

M. LUBRECHT Antonius :
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AIMS

The aim of this class is to give future engineers some detailed insight in the numerical methods applied for mechanical problems.

CONTENT

1. MultiGrid Methods: system of equations obtained from discretising a differential equation on a (regular) grid. Fast solution using MG, implementation.
2. Molecular Dynamics: approximation order in time , choice of interaction laws, conservation of discrete quantities, boundary conditions.
3. Approximation of the contact prolem under small and large strains using finite element methods: lagrangian and augmented lagrangiian, numerical approximation. Application through the COMSOL software.
4. Coupled models: principal difficulties, applied to fluid-structure interaction, ALE method. Application through the COMSOL software.

BIBLIOGRAPHY

- Numerical Recipes in C: Press, Teukolsky, Vetterling, Flannery
- The Art of Computer Programming: Knuth
- Multilevel Methods in Lubrication: Venner, Lubrecht
- The finite element method for solid an structural mechanics, Zienkiewicz, Taylor
- Nonlinear finite elements for continua and structures, Belytschko, Liu, Moran
- Contact problems in elasticity: a study of variational inequalities and finite element methods. Kikuchi, Oden
- Computational contact and impact mechanics. Laursen

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Ingénieur, spécialité génie mécanique

Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Final project master thesis

IDENTIFICATION

CODE : GM-5-S2-EC-COPRI
ECTS : 16

HOURS

Cours :	1h
TD :	1h
TP :	0h
Projet :	200h
Evaluation :	1h
Face à face pédagogique :	3h
Travail personnel :	200h
Total :	403h

ASSESMENT METHOD

Ongoing evaluation, final report and defense

TEACHING AIDS

Depending on the topic

TEACHING LANGUAGE

French
English

CONTACT

M. BUFFIERE Jean-Yves :
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AIMS

To train students in the performance of industrial analysis and design or research, possibly funded by industrial partners.

CONTENT

Practice of knowledges and knowhow studied during the whole cursus

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

CENTRE DES SPORTS
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

Sports

IDENTIFICATION

CODE : CDS-5-S2-EC-EPS
ECTS :

HOURS

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

ASSESMENT METHOD

Assessment in Physical Education concerns the teaching of Sports and Artistic Physical Activities (APSA), and will take the form of continuous assessment with half-yearly marking.

The mark depends on the degree of acquisition of the skills expected in each of the activities, and the progress made over all the sessions in the cycle. The mark takes into account :

Individual and/or team performance
mastery of execution
Progress in the sports project
Responsibility and autonomy

TEACHING AIDS

All physical, sporting, artistic and competitive activities

TEACHING LANGUAGE

French

CONTACT

MME JAUSSAUD Marie :
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AIMS

This EC is part of the Teaching Unit: SHS and contributes to the development of the School's transversal competences

1*Auto-evaluating one's own performance
Knowledges :
- Fundamentals, principles of action and terminology of sports activities
- Criteria for observation, achievement and success.
Abilities :
- Assess your level of practice
- Build up a warm-up
- Set goals for progress
- Manage physical and mental potential

2* Work, learn and develop independently
Knowledge :
- PSAA rules
- Observation criteria
- Principles of warm-up and cool-down
Abilities :
- Mobilise resources
- Analyse, observe, question
- Take on different roles (referee, choreographer)

3* Interact with others, work as part of a team
Knowledges :
- Roles and functions in each sports activity
Abilities :
- Communicate appropriately: verbal, non-verbal and postural communication.
- Integrate into a group
- Take part in and develop a group project
- Take the initiative
- Be a good listener

4* Be creative, innovative and enterprising
Knowledge :
- Artistic disciplines
Abilities :
- Draw on knowledge and resources from different artistic fields to produce an original work.
- Mobilise the imagination and sensibility and make them visible through dance movement
- Access the symbolism of the body

5* Act responsibly in a complex world
Knowledge :
- Safety and operating rules
Abilities :
- Identify uncertainties and risks and act to reduce them
- Integrate a responsible dimension into their actions
- Show respect and fair play in a power struggle

6* Working in an international context
Knowledge :
- Socio-cultural differences
Abilities :
- Integrate cultural diversity into group work
- Act with respect for self and others

CONTENT

Physical Education and Sport lessons are organised around traditional Physical Education lessons, or advanced lessons, or appropriate practices (EPSA), or competitive practices within the framework of the Section Sportive Haut Niveau.

1. Physcical Education lessons :
Students choose one or two physical and sporting activities per year from among the activities offered by the sports centre (individual, group, dual).
2. Appropriate Physical Education lessons: For all students who are exempt from physical activity for at least 2 months:
Swimming, Body-building, Nordic Walking, Somatic Exercise, Sophrology, Wheelchair Basketball, Pilates, Table Tennis, etc.
3. Advanced Physical Education courses :
Specialisation in a sporting activity, University training and competitions
4. SSHN (High-Level Athlete section)

University training and competitions

BIBLIOGRAPHY

OTTAWA Charter (1986): 'health is seen as a resource for everyday life; it is a positive concept that highlights social and individual resources, as well as physical abilities'.

PRE-REQUISITES

EPS: none
- Appropriate Physical Education: subject to medical advice
- Advanced courses and competitive practice: previous practice required subject to specific selection according to each activity
- SHN: ministerial list

Levels 1 and 2: Physical Education, Appropriate physical education
Level 3: Advanced courses and competitive practice, SHN

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INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE

IDENTIFICATION

CODE : HU-0-S2-EC-S-PPH
ECTS : undefined

HOURS

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

ASSESMENT METHOD

Written report (10 pages minimum) and oral defence (in presence of tutor and guest).

TEACHING AIDS

Présentation du PPH sur Moodle : http://moodle.insa-lyon.fr

TEACHING LANGUAGE

French

CONTACT

AIMS

The PPH is an individual exercise where the student carries out an investigation or some research into a subjet of particular interest to them in the aim of developing some form of critical analysis of the subject. The PPH is a means by which the student can show their ability to build an analysis based on a rigorously developed thesis. The analysis is based on a personal approach to the subject (openness to the wider world), the way the subject is dealt with (for example the use of a personal experience as a way of seeing the world or the chosen subject), or in certain cases the creative approach used (for example, for an artistic experience).
The PPH requires the ability to work autonomously.
The PPH contributes primarily to the development of competencies CT2.1-4 and CT3.1 ; other competencies can be developed depending on the choice of project.

CONTENT

Work on a particular theme with a tutor chosen by the student.
Filling in of a project sheet (elaboration of the question, definition of the personal approach, bibliography, etc),
Step by step meetings with the tutor (plan, analysis, etc),
Report writing and oral presentation.

BIBLIOGRAPHY

PRE-REQUISITES

IDENTIFICATION

CODE : GM-5-S2-EC-PPP
ECTS :

HOURS

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

ASSESMENT METHOD

- one French written page in which the student explains the vision he has of the differentiated path that he will follow in 4th and 5th year.
- one English written page in which the student explains his choice of mobility abroad and an analysis of the developed skills.
- a French written page to justify the choice of the training periods and an analysis of the developed skills.
- an inventory of skills at the end of each year with an assessment at the end of the 5th year.

TEACHING AIDS

Personal tests
Presentation slides when allowed by the speaker
Online self-assessment materials

TEACHING LANGUAGE

French

CONTACT

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AIMS

The overall objective is to build his/her own professional project. If the assessment takes place in the 5th year, the work must start during the 3rd year.
The aim is :
- Allow the student to choose his/her 4th and 5th year differentiated path
- Understand and know the trades and sectors associated with the different aspects of training
- Self-assessment and identification of competencies acquired or to be acquired
- Choose the aspects of its training to be strengthened
- Establish his/her professional project based on personal skills and self-knowledge.

CONTENT

1. Evaluation of the spontaneous representations on the differentiated paths
2. Interventions of partner companies and other engineers
3. Active participation in at least one collective activity (promotion of the department, management of the FabLab of the department, Professional day, company coffees, contacts with alumni, sponsorship of the promotion, presentation of the department, organization of the integration week , Inter-Semester Week, End-of-Studies Travel, GM Awards, Graduation Ceremony)
4. Self-Assessment Techniques and Building a personal skills Portfolio

If needed,a methodological aid can be provided for the writing of their CV and their cover letters during their search for internship.

BIBLIOGRAPHY

PRE-REQUISITES

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Centre des Humanités
Domaine Scientifique de la DOUA
20 Avenue Albert Einstein - 69100 VILLEURBANNE
Humanities and social sciences

IDENTIFICATION

CODE : HU-0-S2-EC-S-SERIE2
ECTS : undefined

HOURS

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

ASSESMENT METHOD

Assessment will be conducted through continuous evaluation. The assessment methods will be presented at the beginning of the semester by the teaching team.

TEACHING AIDS

Materials are chosen by the instructor based on the module:
• Didactic documents related to the module
• Audiovisual materials
• Recommended readings

TEACHING LANGUAGE

French

CONTACT

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Mme GOUTALAND Carine :
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AIMS

A series of elective courses in Humanities and Social Sciences (HSS) offers several options for students to choose from, allowing them to develop and deepen specific skills. This course aims to develop one or more transversal skills among the following:
• CT1: Self-awareness and self-management
• CT2: Working, learning, and evolving independently
• CT3: Interacting with others, working in a team
• CT4: Demonstrating creativity
• CT5: Acting responsibly in a complex world
• CT6: Navigating and evolving within an organization
• CT7: Working in an international and intercultural context
The list of options available in Series 1 and the specific competencies for each option are detailed in the catalog on the IntranetHumas:
https://intranethumas.insa-lyon.fr/sciences-humaines-sociales/offre-de-formation/cours-la-carte-0

CONTENT

Each module is designed to encourage interaction and active student participation. The content is structured around the following key aspects:
• Theoretical deepening related to the theme
• Reflection on the topic
• Practical exercises and activities
• Assessments and presentation of work

BIBLIOGRAPHY

The bibliography is selected by the instructor based on the module.

PRE-REQUISITES

French

IDENTIFICATION

CODE : GM-5-S2-EC-STAGEL
ECTS : 30

HOURS

Cours :	0h
TD :	1h
TP :	0h
Projet :	0h
Evaluation :	1h
Face à face pédagogique :	2h
Travail personnel :	400h
Total :	402h

ASSESMENT METHOD

50% by the industry through a grid given by GM /
25% by an oral presentation evaluted by GM's teachers /
25% by a written report evaluated by GM's teachers

TEACHING AIDS

None

TEACHING LANGUAGE

French

CONTACT

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AIMS

M1- To integrate an organization, to lead and help it to evolve
M2- To take account for constraints such as professionnal, economical and industrials ones.
M3- To take account for societal values (ethical, and ethics) and help them being respected
M4- To dialogue with specialists as with not specialists
M5- To work in international context: speak one or several langages, cultural openings,
M6- To work with autonomy, critical faculty, and curiosity

CONTENT

26 weeks of industrial intership

BIBLIOGRAPHY

Documents with details informations about progress of the intership and associated regulations are avalaible on Moodle website

PRE-REQUISITES

All teachings of GM for 3rd and 4th years