ULT Mechatronics Engineering

Subjects Modules for S2

Semester 2 Year 1

U2.1: Engineering Tools 2

U2.1.1 Math for Engineering 2

Module designation	Engineering Tools 2
Module level, if applicable	1st year
Code, if applicable	U2.1
Subtitle, if applicable	
Courses, if applicable	Math for Engineering 2
Semester (s) in which the module is taught	Semester 2 (S2)
Person responsible for the module	Emna Rabhi
Lecturer	M. Slim HOUIMLI
Language	French
Relation to curriculum	Integrated course module
Type of teaching, contact hours	Lecture, 42 hours of classroom course/semester
Workload	Total 84 hours/semester (42 hours of Self-Study/semester)
Credit points	3 credits
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Math for Engineering 1
Module objectives/intended learning outcomes	**Objectives:** This module aims to provide students with sufficient mathematical tools and techniques to tackle a variety of design engineering problems. **Learning Outcomes:** Students will be able to : 1. Understand differents types of Series. 2..compute the numerical series on an unbounded interval 3.Understand Integral, Convolution, and distribution

Content	**Continue from Semester 1** **VI. Linear Algebra** 1. Vector spaces 2. Linear maps 3. Matrices: Operations on matrices, rank, eigenvalues, eigenvectors 4. Determinants 5. Diagonalization 6. Linear systems: Resolution by Gaussian Pivot **VII. Matrix analysis:** 1. Reduction of matrices 2. Standards, matrix standards: • Usual standards and subordinate standards • Matrix norms and spectral radius 3. Conditioning issues: • Introductory example • Definition 4. Estimation of errors **VIII. Numerical series:** 1. Definition 2. Properties 3. Series with positive or zero terms 4. Cauchy and d'Alembert criteria 5. Any term series 6. Sum of series 7. Speed of convergence **IX.Power series:** 1. Definition 2. Area of Convergence 3. Examples 4. Operations on entire series 5. Normal convergence of an entire series 6. Continuity, integration and differentiation of an integer series 7. Functions that can be developed into whole series 8. Application to ordinary differential equations **X. Fourier series:** 1. Reminder of functional analysis 2. Definition 3. Parity 4. Complex series 5. Convergence of Fourier series 6. Identity of Parseval 7. Gibbs Phenomenon 8. Derivatives and primitives of Fourier series
Study and examination requirements and forms of examination	Written Mid-term Exam (40%) + Written Final Exam (60%)

Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT)
Reading List	1. « Analysis Course IV : Sequences and series of functions » L. Pujo-Menjouet, Claude Bernard University, Lyon I 2. « Mathematics of the deterministic signal » POINT Nelly, ' MAA107' 3. Walter Appel. Mathématiques pour la physique et les physiciens, H & K Éditions (2e édition), 2002. 4. François Roddier. Distributions et transformation de Fourier (à l'usage des physiciens et des ingénieurs) Ediscience, 1971. 5. Joel L. Schiff. The Laplace Transform: Theory and Applications. Springer-Verlag, 1999. 6. Cours de Mathématiques Sup MPSI PCSI PTSI TSI, Alain Soyeur - François Capaces - Emmanuel Vieillard-Baron23 mars 2011 7. Ayres F (1978) Matrices : Cours et problèmes, Serie Schaum. 8. Mathematiques pour l'ingenieur 1, Martine Olivi, National Institute for Research in Computer Science and Control, https://www.researchgate.net/publication/237270342 9. Cours d'Analyse IV Suites et Séries de fonctions, L. Pujo-Menjouet, Université Claude Bernard, Lyon I 10. Séries numériques. Séries de fonctions. Séries entières. Séries de Fourier., Daniel ALIBERT

U2.1: Engineering Tools 2

U2.1.2: Calculus

Module designation	Engineering Tools 2
Module level, if applicable	Year 1 , Semester 2
Code, if applicable	U2.1
Subtitle, if applicable	
Courses, if applicable	Calculus
Semester(s) in which the module is taught	Semester 2
Person responsible for the module	Dr Emna RABHI
Lecturer	Dr. Slim Houimli
Language	French
Relation to curriculum	Compulsory module ,
Type of teaching, contact hours	Lecture, 12 hours Classroom Lecture/ Semester 9 h for workshop in lab using Matlab
Workload	Total 51 hours/ Semester (30 hours of Self Study)
Credit points	2
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Algebra & Calculus – Preparatory Cycle
Module objectives/intended learning outcomes	**Objectives:** 1.To develop the mathematical skills of the students in the areas of numerical methods. 2.To teach theory of solving differential equations. 3Understand the theory of unconstrained and constrained optimization in finite dimension. Numerical optimization methods are also discussed for the two optimization problems. **Learning Outcomes** Students will be able to : 1. Apply numerical methods to find out solution of algebraic equations 2.Apply various interpolation methods and finite difference concepts. 3. Work out numerical differentiation and integration. 4. Work numerically on the ordinary differential equations 5. Apply Optimisation Method

Content	**Lectures :** **I. Numerical differentiation** 1. First derivative 2. Second derivative 3. Estimation of the error 4. Applications and examples **II. Numerical integration** 1. Rectangles method • Right rectangle • Rectangle on the left • Middle rectangle 1.1. Error estimate 2. Trapezoid method • Simple trapezoids • Composite trapezoids 2.1. Error estimate 3. Quadrature formula 3.1. Gaussian quadrature formula 3.2. Degree of precision 3.3. Error estimate **III. Numerical solutions of ordinary differential equations** 1. Euler's method • Implicit Euler • Explicit Euler 2. Runge-Kutta methods • Second order Runge-Kutta • Runge-Kutta on orders 3 and 4 2.1 Coherence, convergence and stability 2.2 Estimation of the error **IV. Polynomial interpolation** 1. Lagrange interpolation 1.1. Applications and examples 2. Newton's interpolation 2.1. Applications and examples 3. Hermit interpolation 3.1. Applications and examples 4. Estimation of the error **V. Solving nonlinear equations** 1. Motivation 2. Fixed point method 2.1. Principle of the method 2.2. Convergence 3. Dichotomy method 3.1. Principle of the method 3.2. Stop criterion 3.3. Convergence 4. Secant method 4.1. Principle of the method 4.2. Convergence 5. Newton's method 5.1. Principle of the method

	5.2. Convergence 6. Application examples **V Optimization Methods** 1. Optimization without constraints: 1.1 First-order optimality condition. 1.2 Least square problem. 1.3 Descent methods and Algorithm: - gradient with fixed step, -from gradient to optimal step - the conjugate gradient. 2. Optimization with constraint: 2.1 Optimality condition and Euler inequality. 2.2 Application to a quadratic problem with linear constraints: Condition of Kuhn and Tucker. 2.3 Projected gradient method. **Workshops :** 1. Matlab Programs - Vectors, Functions, and Plots in Matlab 2. Differential Equations : 1. Using Matlab to solve a system of ODE's 2. Euler Methods 3. ODE Boundary Value Problems and Finite Differences
Study and examination requirements and forms of examination	Written Mid-Term Exam (25%) + Practical Workshop (25%) +Written Final Exam (50%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Video projection
Reading list	1. Jean-Pierre Demailly, « Analyse numérique et équations différentielles »,EDP Sciences - Collection : Grenoble Sciences - 4e édition - mai 2016 2. Méthodes d'analyse numérique élémentaire; J. G. Dion, R. Gaudet; 3. Introduction to Numerical Methods and Matlab Programming for Engineers, Todd Young and Martin J. Mohlenkamp, **2021** 4. P.G. Ciarlet, Introduction a l'analyse numerique matricielle et a l'optimisation. Edition Masson, 1982. 5. P.G. Ciarlet, B. Miara, J.M. Thomas, Exercices d'analyse numerique matricielle et d'optimisation avec solutions. Edition Masson, 1991.

U2.2: Electronics Electrotechnics EE2

U2.2.1: Electrotechnics

Module designation	**Electronics Electrotechnics EE2**
Module level, if applicable	Year 1 , Semester 2
Code, if applicable	U2.2
Subtitle, if applicable	
Courses, if applicable	Electrotechnics
Semester(s) in which the module is taught	Semester 2
Person responsible for the module	Dr Emna RABHI
Lecturer	Mme Saloua Ben Said
Language	French
Relation to curriculum	Compulsory module ,
Type of teaching, contact hours	Lecture, 21 hours Classroom Lecture/ Semester
Workload	Total 51hours/ Semester (30 hours of Self Study)
Credit points	2
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Electrical Circuits, Magnetism, Complex numbers
Module objectives/intended learning outcomes	**Objectives:** 1- Understand the architecture of a three-phase network and its advantages compared to a single-phase network. 2- Understand the operation of magnetic circuits 3- Understand the operation and constitution of an iron core coil 4- Understand the operation and the dimensioning of single-phase and three-phase transformers.

Content	**Chapter 1 Three-phase circuits** I- General: 1. Advantages over single-phase 2. Distribution II- Tension studies: 1- Simple voltages 2- Compound voltages 3- Balanced three-phase system III- Coupling of receivers. 1. Balanced receivers 2. Star coupling 3. Triangle coupling IV- Three-phase power: 1. Active power 2. Reactive power 3. Apparent power 4. Power factor V- Increase in power factor 1. Advantages 2. Calculation of capacities **Chapter 2 Magnetic circuits** I General 1. Definition of magnetic circuit 2. Notions of magnetic field, induction and flux II Analogy between electric and magnetic circuit 1. Concept of reluctance 2. Concept of magnetomotive force 3. Ampere's theorem III Fundamental laws 1. Laplace force 2. Faraday and Lenz's law **Chapter 3 Iron core coil** I Constitution II General laws 1. Voltage equations 2. Equations of Amperes turns 3. Hopkinton relationship III Equivalent diagram **Chapter 4 Single-phase transformer** I General 1. Definition and role 2. Constitution 3. Symbol II Study of a perfect transformer 1. Principle of operation 2. Voltage equations 3. Equations of currents 4. Impedance transfer

	III Study of an industrial transformer 1. Equivalent diagram 2. No-load test 3. Short circuit test 4. Load test **Chapter 5 Three-phase transformer** I General 1. Definition and role 2. Constitution 3. Symbol 4. Pairing II Study of a three-phase transformer 1. Column transformer method 2. Thevenin equivalent circuit method
Study and examination requirements and forms of examination	Written Mid-Term Exam (40%) + Written Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Video projection
Reading list	1- Francis MILSANT : électrotechnique, éditions ELLIPSES. 2- Jean Louis DALMASSO : Electrotechnique Tome I : transfo. et MCC–cours et problèmes, éditions DIA-BELIN. 3- Jean Louis DALMASSO : Electrotechnique Tome II : Machines à courant alternatif–cours et problèmes, éditions DIABELIN -

U2.2: Electronics Electrotechnics EE2

U2.2.2: Electronic Functions

Module designation	**Electronics Electrotechnics EE2**
Module level, if applicable	Year 1 , Semester 2
Code, if applicable	U2.2
Subtitle, if applicable	
Courses, if applicable	Electronic Functions
Semester(s) in which the module is taught	Semester 2
Person responsible for the module	Dr Emna RABHI
Lecturer	Dr. Harabi ferid
Language	French
Relation to curriculum	Compulsory module ,
Type of teaching, contact hours	Lecture, 21 hours of Classroom Lecture/ Semester 21 hours for Workshop in Lab/ semester
Workload	Total 84 hours/ Semester (42 hours of Self Study)
Credit points	3
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Basic Electricity and Electronics
Module objectives/intended learning outcomes	**Objectives:** 1. study basic electronic functions; such as Operational Amplifiers, Oscillators and Active Filters 2. Understand operation of the different power amplifiers and analysis methods during practical workshops.

Content	**Chapter 1: Power Amplifiers** 1. Amplifier class A 2. Amplifier class B 3. Amplifier class C **Chapter 2: Differential Amplifiers and Current Mirrors** 1. Differentials Amplifiers 2. the current mirror assemblies 3.the Darlington assembly **Chapter 3: The Feedback** 1. Types of feedback 2. Properties of feedback 3. The input and output impedances of the feedback circuits **Chapter 4: Operational Amplifiers** 1. Definition and symbol, 2. The operational amplifiers in linear mode 3.Arithmetic operations 4. Operational Amplifiers in nonlinear regime (Schmitt comparator) **Chapter 5: Oscillators** 1. Different types of oscillators 2. Berkhausen Criteria **Chapter 6: Active Filters** 1. First order active filters 2. Second Order Active filters **Practical workshop in Laboratory** **Exercise 1:** Bipolar transistor-based amplifiers (Static and dynamic study) • Analyse the static characteristics of the transistor • Study of bipolar transistor in dynamic regime **Exercise 2**: Power amplifiers (Study of PUSH PULL amplifiers) • Understand how amplifiers of different classes work • Learn the operating principle of PUSH PULL amplifiers **Exercise 3**: Operational amplifiers • Study of the operational amplifiers characteristics using the basic assemblies: inverter, non-inverter, adder, integrator
Study and examination requirements and forms of examination	Written Mid-Term Exam (25%) + Practical Workshop (25%) + Written Final Exam (50%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Workshop Handbook in Lab Video projection
Reading list	[1] gte.unilittoral.fr/sections/documents...courant/.../file/Elec-S1-2-Continu.pdf?...28 [2] www.tdee.ulg.ac.be/userfiles/file/elem-circ2010.pdf

U2.3: Mechanics 2

U2.3.1: Workshop Mechatronics systems Design 2 (CATIA V5)

Module designation	Mechanics 2
Module level, if applicable	Year 1, Semester 2
Code, if applicable	U2.3
Subtitle, if applicable	
Courses, if applicable	Workshop Computer Aided Design CAD2 (CATIA V5)
Semester(s) in which the module is taught	Semester 2
Person responsible for the module	Dr Emna RABHI
Lecturer	M Bilel Ben Ammar
Language	French
Relation to curriculum	Compulsory module ,
Type of teaching, contact hours	21 hours for Workshop in Lab/ semester
Workload	Total 51hours/ Semester (30 hours of Self Study)
Credit points	2
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Basic CAD, Technical Drawing, Tri dimensional Geometry, mechanical design basic concept understanding
Module objectives/intended learning outcomes	**Objectives:** 1- Acquire the necessary knowledge for the 3D Part design 2- Practice Part assembly 3- Design Sheet metal and apply Surface design 4- Use CAD design knowledge to Work on application project

Content	**TP 01 " Designing a valve "** *Working Steps:* 1. Creation of sketches. 2. The functions of creation of matter. 3. The functions of material removal. 4. Analysis of sketches, constraints, transformations ... 5. Parts Design: create and modify components from sketches (extrusions, holes, pockets, grooves, revolutions, multi-extrusion, parameters and limits, fillets, chamfers, shells, tapping and threads, ...) 6. Use transformations: General, symmetry, miro.ir, repetitions. 7. Drawing: definition drawing. 8. Drawing: General drawing for assembly. 9. Assembly Design. 10. Use of design library. 11. Modification of parts in the Assembly design workshop. 12. Addition of parts in the Assembly design workshop. **TP 02 " Hub Puller Design "** *Working Steps:* 1. Creation of sketches. 2. The functions of creation of matter. 3. The functions of material removal. 4. Assembly Design. 5. Use of design library. 6. Drawing: definition drawing. 7. Drawing: General drawing for assembly. **TP 03 " Design of sheet metal part 1 "** *Working Steps:* 1. Production of sheet metal parts (generative sheet-metal). 2. Folding process. 3. Drawing: definition drawing. 4. Modification of parts in the Assembly design workshop. 5. Addition of parts in the Assembly design workshop. **TP 04 'Design of sheet metal part 2' '** *Working Steps:* 1. Production of sheet metal parts (generative sheet-metal). 2. Folding process. 3. Drawing: definition drawing. **TP 05 'Washbasin Design'** *Working Steps:* 1. Production of sheet metal parts (generative sheet-metal). 2. Folding process. 3. Stamping process. 4. Drawing: definition drawing.

Study and examination requirements and forms of examination	Continuous Assessment 40% (Report for each workshop required) +Semester Workshop Exam 60 %
Media employed	Workshop handbook (soft/hard)
Reading list	3DS Guides and Tutorials for CATIA

U2.3: Mechanics 2

U2.3.2: Theory of Materials

Module designation	**Mechanics 2**
Module level, if applicable	Year 1,Semester 1
Code, if applicable	U2.3
Subtitle, if applicable	
Courses, if applicable	Theory of Materials
Semester(s) in which the module is taught	Semestre 2
Person responsible for the module	Dr Emna RABHI
Lecturer	Dr. Yosra Abdallah
Language	French
Relation to curriculum	Compulsory module ,
Type of teaching, contact hours	Lecture, 21 hours Classroom Lecture/ Semester
Workload	Total 30 hours/ Semester (9 hours of Self Study)
Credit points	1
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Basic Mathematics, Chemistry
Module objectives/intended learning outcomes	**Objectives:** 1. Understand the properties-behaviour correlations 2. Acquire the basics during a metallurgical transformation 3. Understand the main standardized tests for the characterization of materials **Learning Outcomes:** Students will be able to : 1. Describe the basic concepts of microstructural parameters of metals. 2. Choose, for a given application, the properties making it possible to satisfy the targeted service functions. 3. Identify the microstructural parameters of ferrous alloys; 4. Establish an experimental process for heat treatment of steels; 5. Choose the appropriate treatment, its parameters and the operating mode, associated cooling to meet a given industrial requirement.

Content	**Part A Crystallography** **Chapter I. Introduction** Classifications of materials: 1. According to their composition 2. According to their microstructure **Chapter II. Microstructure of crystalline materials** 1. Crystal Systems and Networks 2. Defects in crystalline materials **Chapter III. Application:** Calculation of the compactness and density of α iron and γ iron **Part B Mechanical characterization of materials** **Chapter I. Introduction** 1. Material selection criteria 2. Importance of Mechanical Properties **Chapter II. Quasi static uniaxial tensile test** **Chapter III. Hardness tests** **Chapter IV. Impact test** **Part C Phase diagram at equilibrium** **Chapter I. Useful definitions** **Chapter II. Solid solutions** **Chapter III. Binary balance diagrams** **Chapter IV. Study of the iron-carbon diagram** **Chapter VI. Heat treatments and CCT and TTT diagrams of ferrous alloys** **CCT: Continuous Cooling Temperature Diagram* **TTT: Temperature-Time-Transformation Diagram*
Study and examination requirements and forms of examination	Written Mid-Term Exam (40%) + Written Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Video projection

Reading list	-Précis de métallurgie : élaboration, structures, propriétés et normalisation. J. BARRALIS, G. MAEDER, 6ème édition. AFNOR, NATHAN. -Métallurgie du minerai au matériau. Jean Philibert, Alain Vignes, Yves Bréchet et Pierre Combrade, 2ème édition. DUNOD. -Métallurgie structurale théorique et appliquée. ALBERT DE SY, JULIEN VIDTS, 2ème édition. NICI, DUNOD.P.Lyonnet 3ème Edition. -Principes de base des traitements thermiques, thermomécaniques et thermochimiques des aciers. A. Constant, G.Henry et J.C.Charbonnier. PYC édition. - Matériaux tome1: propriétés et applications. M.F Ashby -1 et D.R.H. Jones. DUNOD. Matériaux tome2 : Microstructure et mise en oeuvre. -2 M.F Ashby et D.R.H. Jones. DUNOD.

U2.3: Mechanics 2

U2.3.3: Solid Mechanics

Module designation	Mechanics 2
Module level, if applicable	Year 1 , Semester 2
Code, if applicable	U2.3
Subtitle, if applicable	
Courses, if applicable	Solid Mechanics
Semester(s) in which the module is taught	Semester 2
Person responsible for the module	Dr Emna RABHI
Lecturer	Dr. Yosra Ben Abdallah
Language	French
Relation to curriculum	Compulsory module ,
Type of teaching, contact hours	Lecture, 21 hours Classroom Lecture/ Semester
Workload	Total 30 hours/ Semester (9 hours of Self Study)
Credit points	1
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Basic theoretical elements of mechanical design, Mechanics
Module objectives/intended learning outcomes	**Course Objectives:** Part1: Understand the mechanics of solids in the design of a technical system. Model or identify the kinematic performances of systems (or mechanisms). Model, predict and verify the static performance of mechanical systems Part2: - Determine if a problem of kinematics or statics / dynamics is soluble, - Criticize the choice of mechanism models, - Imagine models of kinematically equivalent isostatic mechanisms, - Imagine models of statically equivalent isostatic mechanisms, - Interpret the hyperstatism of a mechanism made up of different chains with n perfect bonds (influence on rigidity, mounting,...).

Content	**PART1: SOLID MECHANICS** **CHAPTER 1: TORSORS** I. Symmetric and antisymmetric application II. Vector field III. The torsors **CHAPTER 2: SETTINGS** I. Parameterization of a solid II. Parameterization of standard mechanical connections) III. Parameterization of a mechanism (system of solids) **CHAPTER 3: KINEMATICS OF INDEFORMABLE SOLID SYSTEMS** I. Introduction and definitions II. Vector derivative formula III. Kinematics of the undeformable solid **Chapter 4 Kinematics of solids in contact** I. Kinematics of solids in contact II. plane on plane motion (plane kinematics) III. Kinematic torsor of **CHAPTER 5; Modeling of external mechanical actions** I. Modeling of remote actions II. Modeling of actions with contact III Action transmissible by a mechanical link **CHAPTER 6: Statics of solids and the PFS** I. Definition II. Static balance III. Fundamental principle of statics **PART 2: THEORY OF MECHANISMS** 1- Kinematic diagram and graph of the links of a mechanism 2- Equivalent links 2-a- Study of connections in parallel; Torsor of equivalent forces for parallel connections; Equivalent kinematic torsor for parallel connections; Hyperstatism and mobility for parallel links; 2-b- Study of serial links; Torsor of equivalent forces for series connections; Equivalent kinematic torsor for series connections; Hyperstatism and mobility for serial links 3- Study of chains of perfect solids 3-a- Study of the closed continuous chain; Kinematic study of the closed continuous chain; Static study of the closed continuous chain; 3-b- Study of complex chains; Definition of the cyclomatic number of a complex chain; Kinematic study of a complex chain; Static study of a complex chain; Definition of the mobility index of a complex chain;

	4- Advantages and disadvantages of an isostatic mechanism compared to a hyperstatic mechanism; 6- Application exercises;
Study and examination requirements and forms of examination	Written Mid-Term Exam (40%) + Written Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Video projection
Reading list	1. GUIDE DU DESSINATEUR INDUSTRIEL, A. 2. CHEVALIER, HACHETTE, 2004, ISBN 978-2-01-168831-6 3. MECANIQUE DU SOLIDE – APPLICATIONS INDUSTRIELLES, P. AGATI, Y. BREMONT ET G. DELVILLE, DUNOD, 1996, ISBN 2-10-003223-6 4. R. le Borzec, « Principes de la théorie des mécanismes », édition Dunod 1975; 5. Ch. Laboulayé, « Traité de cinématique théorique et pratique ou théorie des mécanismes », troisième édition, librairie du dictionnaire des arts et manufacture, Paris 6. Mécanique 1 : Mécanique du solide indéformable, Calcul vectoriel, Cinématique, edition Ellyps

U2.3: Mechanics 2

U2.3.3: Mechanical Manufacturing

Module designation	Mechanics 2
Module level, if applicable	Year 1 , Semester 2
Code, if applicable	U2.3
Subtitle, if applicable	
Courses, if applicable	Mechanical Manufacturing
Semester(s) in which the module is taught	Semester 2
Person responsible for the module	Dr Emna RABHI
Lecturer	M Tsoumarev Oleg
Language	French
Relation to curriculum	Compulsory module ,
Type of teaching, contact hours	Lecture, 21 hours of Classroom Lecture/ Semester
Workload	Total 30 hours/ Semester (9 hours of Self Study)
Credit points	1
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Technical Drawing ; Material & Resistance Of Material ; Basic understanding of CAM
Module objectives/intended learning outcomes	**Objectives:** 1- Understand mechanical manufacturing process 2- To Know the manufacturing quality control methods 3- Study "conventional" machining methods

Content	**PART1:** **Chapter 1 Introduction to mechanical manufacturing technology:** 1. Generation of machined surfaces; 2. Characteristic machining movements; 3. Cutting speed settings. **Chapter 2 Machining by chip removal:** 1. Study of cutting tools: geometry, material; 2. Temperature in the cutting area; 3. Cutting force; 4. Lubrication; 5. Tool wear and machinability. **Chapter 3 Conventional machining technology:** 1. Filming; 2. Milling; 3. Drilling; 4. Thread 5. Correction. **PART 2:** **Chapter 1. Taking parts from the Machine Tools:** Definition; Set position ; Tightening ; Isostatism; Classic cases; Real cases; *Tutorial2: Technological application examples* **Chapter 2. Part Dimension:** Definition: -Functional Dimension: set by Design & Development Dept. -Manufacturing Dimension: set by Process Planning Dept. ; -Type of odds; -Direct / indirect ratings; *Tutorial3: Technological application* **Chapter 3. Dimensions Transfer:** Introduction; Dimensional Chains Theory; Feasibility condition; Case study; *Tutorial4: Technological application* **Chapter 4. Rough Metal Selection:** Machining allowance Machining; Types of rough; Condition and criteria for choosing Rough Metal; Methodology of the Rough Metal study; Drawing; *Tutorial5: Technological application* **Chapter 5. Machining Range:** Definition Types; Structure; Phases; Operation Sketch;

Study and examination requirements and forms of examination	Written Mid-Term Exam (40%) + Written Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Workshop in Lab Video projection
Reading list	1. production mécanique. castelli, 2004 2. Usinage : procédés et méthodes. cpu, 2002 3. précis construction mécanique. tome 1, tome 2. nathan, 2002 4. fabrication mécanique : notes des cours et exercices corrigées. cpu, 2006. 5. guide du technicien en productique. hachette, 2006

U2.4: Mechatronics Elements 2

U2.4.1: Mechatronics Systems Simulation- LabView

Module designation	Mechatronics Elements 2
Module level, if applicable	Year 1 , Semester 2
Code, if applicable	U2.4
Subtitle, if applicable	
Courses, if applicable	Mechatronics Systems Simulation- LabView
Semester(s) in which the module is taught	Semester 2
Person responsible for the module	Dr Emna RABHI
Lecturer	Dr Emna RABHI
Language	French
Relation to curriculum	Compulsory module ,
Type of teaching, contact hours	21 hours for Workshop in Lab/ semester
Workload	Total 51 hours/ Semester (30 hours of Self Study)
Credit points	2
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Basic Algorithmic, Programming
Module objectives/intended learning outcomes	**Objectives:** 1. Introduction to the Labview Programming 2. Presentation of the Labview environment, error resolution techniques 3. Presentation of basic programming concepts, data, resources, models, variables, functions 4. Presentation of OOP models, Petri network creation, 5. Familiarization with the creation of user interface 6. Presentation of error management and event management architectures

Content	**Chapter I: Labview Tool environment** 1. Virtual Instruments (VI) 2. Parts of a VI 3. Front face 4. Diagram 5. Principle of data flow 6. Implement Simple VIs 7. Using Labview 8. Correction of a VI (broken) 9. Debugging techniques **Chapter II: Implementing a VI** 1. Data types in Labview 2. The case structure 3. While Loop 4. For loop 5. The notion of "timing" 6. Iterative data transfer **Chapter III: Types** 1. Paintings 2. Clusters 3. Definition of types **Chapter IV: Resource Management** 1. I / O files 2. Low level and high level I / O files 3. DAQ programming 4. Communication with VISA **Chapter V: Develop modular applications** 1. Modularity 2. Icon and connection panel 3. Use of Sub VI **Chapter VI: the usual techniques** 1. Sequential programming 2. State machine
Study and examination requirements and forms of examination	100 % Practical Workshop evaluation (Oral presentation+ Report)
Media employed	Workshop handbook in Lab Video projection
Reading list	1. F. COTTET, M. PINARD ET L. DESRUELLE, LABVIEW PROGRAMMATION ET APPLICATIONS, DUNOD - 2. G. W. JOHNSON, LABVIEW GRAPHICAL PROGRAMMING: PRACTICAL APPLICATIONS IN INSTRUMENTATION AND CONTROL, MCGRAW-HILL SCHOOL EDUCATION GROUP 3. C. CLARK, LABVIEW DIGITAL SIGNAL PROCESSING: AND DIGITAL COMMUNICATIONS, MCGRAW-HILL SCHOOL EDUCATION

U2.4: Mechatronics Elements 2

U2.4.2: Robotics 1

Module designation	**Mechatronics Elements 2**
Module level, if applicable	Year 1,Semester 2
Code, if applicable	U2.4
Subtitle, if applicable	
Courses, if applicable	Robotics 1
Semester(s) in which the module is taught	Semester 2 (S2)
Person responsible for the module	Dr Emna RABHI
Lecturer	Dr. Amjed Mouellhi
Language	French
Relation to curriculum	Compulsory module ,
Type of teaching, contact hours	Lecture, 21 hours Classroom Lecture/ Semester 21 hours for Workshop in Lab/ semester
Workload	Total 84 hours/ Semester (42 hours of Self Study)
Credit points	3
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Automatic Control, Solid Mechanics, Mathematics
Module objectives/intended learning outcomes	**Objectives:** 1. Learn some concepts on the design of mechatronic systems 2. Program and simulate some examples of simple mechatronic systems. 3. 3D animation of simple mechatronic systems. 4. Describe and analyze the movement of a rigid body. **5.** Deduce the forward kinematic model of a Robot manipulator

Content	**Part1: Robotic** **Chapter 1: Introduction: Terminologies and General Definitions** video projection **Chapter 2: Basic of robotics and Linear Algebra** 1. Introduction 2. Theoretical foundations 3. Representing positions and rotations 4. Rotational transformations and parameterizations of rotations 5. Homogeneous transformations, kinematic chains 6. Spatial descriptions **Chapter 3: Denavit-Hartenberg Convention and forward kinematics** **1.** Link Description **2.** Denavit-Hartenberg Notation **3.** Frame Attachment **4.** Forward Kinematics **Projects** **Exercise 1:** Getting started with the Kuka Agilus KR6 R700 sixx robot • Carry out a descriptive study of the Kuka Robot • Perform manual robot movement in order to familiarize with the portable control box and better understand the movement in different axes of the robot **Exercise 2:** Programming the trajectory • Program the robot in 3 different modes: linear trajectory, (Point-To-Point) PTP trajectory, circular trajectory **Exercise 3**: Calibration **Exercise 4**: Tool measurement Perform the CDO measurement in 2 methods: XYZ 4 points and XY 2 points **Part 2: Applied projects** **Chapter I: What is mechatronics?** 1. Mechatronics and multidisciplinarity 2. The key elements of mechatronics 3. Functions of mechatronic systems 4. Integration methods **Chapter II: The design of mechatronic systems** 1. Development of mechatronic systems: Matlab 2. Modelling of systems using Simulink 3. Discrete state machine (Simulink / Stateflow)

	4. Interfacing of multi-body dynamic simulation software (ADAMS) and control law prototyping software (Matlab Simulink) 5. Labview 6. Data acquisition with different interfaces and input / output control definition of control panels 7. The V-cycle 8. The design of an actuator chain **Chapter III: Case study: Robot at 1 DOF (simple pendulum)** **Chapter VI: Case Study: The Bouncing Ball** **Chapter V: Case study: Suspension of a car**
Study and examination requirements and forms of examination	Written Mid-Term Exam (25%) + Workshop oral exam (presentation) (25%)+Written Final Exam (50%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Workshop in Lab Video projection
Reading list	1. ROBOT MODELLING AND CONTROL: M.W.SPONG 2. Introduction to Robotics: Mechanics and Control (3rd Edition) 3rd Edition JOHN J. CRAIG 3. MATLAB & SIMULINK TUTORIALS

U2.5: Computer Science

U2.5.1: Embedded Systems

Module designation	Computer Science
Module level, if applicable	Year 1 , Semester 2
Code, if applicable	U2.5
Subtitle, if applicable	
Courses, if applicable	Embedded Systems
Semester(s) in which the module is taught	Semester 2 (S2)
Person responsible for the module	Dr Emna RABHI
Lecturer	M Moez Hamlaoui
Language	French
Relation to curriculum	Compulsory module ,
Type of teaching, contact hours	21 hours for Workshop in Lab/ semester 21 hours for Project in Lab/ semester
Workload	Total 51 hours/ Semester (9 hours of Self Study)
Credit points	2
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	C Language, CPU Architecture, Electronics
Module objectives/intended learning outcomes	**Objectives:** Understand the concept of on-board system 1- Understand the architecture of microcontrollers 2- Understand the development environment for microcontrollers 3- Use of the C language for microcontrollers programming 4- Familiarize with the STM32 microcontroller board and implement applications

Content	**C Language programming Embedded Systems** 1. Design of a structured code 2. Memory Mapping 3. The variables 4. Macros & functions 5. Pointers and their importance in the on-board context 6. Bit by bit manipulation, notion of mask ... 7. The rules and techniques of debugging 8. Development of function libraries 9. Introduction to the Architecture of STM32 microcontrollers 10. STM32 microcontroller peripherals presentation Each Student will develop a real embedded applications on STM32-based boards **Practical Workshop:** practical work on STM32 Discovery Kit prototyping boards
Study and examination requirements and forms of examination	100 % Practical Workshop (Oral presentation + report)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Workshop Handbook in Lab Video projection
Reading list	• Reference manual (STM32F4) • Datasheet (STM32F4) • User Manual Discovery Kit F4

U2.5: Computer Science

U2.5.2: Java Object Oriented Programming

Module designation	**Computer Science**
Module level, if applicable	Year 1 , Semester 2
Code, if applicable	U2.5
Subtitle, if applicable	
Courses, if applicable	Java Object Oriented Programming
Semester(s) in which the module is taught	Semester 2
Person responsible for the module	Dr Emna RABHI
Lecturer	Aida ben Salem
Language	French
Relation to curriculum	Compulsory module ,
Type of teaching, contact hours	21 hours for Workshop in Lab / semester
Workload	Total 30 hours/ Semester (9 hours of Self Study)
Credit points	1
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Basic knowledge in Algorithmic
Module objectives/intended learning outcomes	**Objectives:** 1. Learn object-oriented programming technique using Java 2. Understand the concept of encapsulation in Java. 3. Knowing how to manipulate inheritance relationships between Java classes. 4. Know how to program abstract classes and interfaces. 5. Master and know how to use the different types of polymorphism in Java. 6. Be able to manage exceptions

Content	**Chapter 1: Getting started with Java development environments** 1. IDE 2. The JDK 3. The JRE 4. JVM **Chapter 2: Basics** 1. Concept of object and class 2. Encapsulation and visibility 3. Packages 4. Inheritance 5. Polymorphism 6. Advantage of object technology **Chapter 3: Types and control structures in JAVA** 1. Historical reminder 2. Java version 3. Source file, compilation and virtual machine 4. Advantage of JAVA 5. Language structure 6. The types in JAVA 7. Control structures **Chapter 4: OOP in JAVA** 1. Creation and declaration of class 2. Using the classroom 3. The wrapper classes 4. The String class 5. The Object class 6. Object tables 7. Encapsulation in JAVA **Chapter 5: Inheritance and polymorphism** 1. Inheritance relationship 2. Access of a derived class to the members of its base class 3. Protected attributes 4. Construction and initialization of derived objects 5. Concept of redefinition of methods 6. Redefinition of methods and successive derivation 7. Interest of the redefinition of method in polymorphism 8. Final classes and methods 9. Abstract class 10. Polymorphism of objects **Chapter 6: Interfaces** 1. Definition of interfaces 2. Creation of interfaces and access to values 3. Implementation of interfaces 4. Serializable, Comparable and Clonable Interfaces **Chapter 7: Exception handling** 1. Handling a single exception 2. Handling of several exceptions 3. Standard exceptions

Study and examination requirements and forms of examination	100 % Practical Exam (Oral+ Report)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Workshop Handbook in Lab Video projection
Reading list	https://beginnersbook.com/java-tutorial-for-beginners-with-examples/

U2.5: Computer Science

U2.5.3: Unix Operating Systems

Module designation	Computer Science
Module level, if applicable	Year 1 , Semester 2
Code, if applicable	U2.5
Subtitle, if applicable	
Courses, if applicable	Unix Operating Systems
Semester(s) in which the module is taught	Semester 2 (S2)
Person responsible for the module	Dr Emna RABHI
Lecturer	Dr Emna RABHI
Language	French
Relation to curriculum	Compulsory module ,
Type of teaching, contact hours	21 Pratcical Workshop/ Semester
Workload	Total 51 hours/ Semester (30 hours of Self Study)
Credit points	2
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Objectives:** 1. Provide students with basic knowledge of the UNIX system. 2. Learn the basics needed to work with UNIX on a daily basis. *3.* Handle in detail the main file system commands *4.* Familiarize with Shell Script Programming Approach

Content	**CHAPTER 1: INTRODUCTORY CHAPTER** 1.1. Historical 1.2. Unix system architecture 1.3. System components 1.3.1 The kernel 1.3.2 The file system 1.3.3 Controls and users 1.3.4. The shell **CHAPTER 2: CONNECTION / DISCONNECTION** 2.1. Connection procedure 2.2. Password 2.3 Disconnection procedure 2.4 The super user **CHAPTER 3: THE FILES SYSTEM** 3.1. File system hierarchy 3.2. Access paths 3.2.1. The absolute path 3.2.2. The relative path 3.3. File types 3.4 Access rights 3.5. Common file system commands 3.5.1. The ls command 3.5.2. The pwd command 3.5.3. The cd command 3.6 Redirection of Inputs / Outputs 3.7 The pipe mechanism 3.7.1. The command goes out 3.7.2. The more command 3.7.3. The chmod command 3.7.4. The umask command 3.7.5. The find command 3.7.6. The wc command 3.7.7. The grep command 3.7.8. The cut command **CHAPTER 4: THE SHELL PROGRAMMING** 4.1 Introduction 4.2. Script settings 4.3. The variables 4.4. Control structures 4.4.1. Comparison operators 4.4.2. The instructions 4.5. Arithmetic and logical structures
Study and examination requirements and forms of examination	100 % Parctical exam In Lab (Presention+ Reports)
Media employed	Workshop Handbook in Lab Video projection
Reading list	-C. Blaess : « Shells Linux et Unix par la pratique »,edtion eyrolles,2013.-P. Cegielski. – Conception des systèmes d'exploitation - Le cas Linux. - https://www.tutorialspoint.com/unix/shell_scripting.htm

U2.6 : Languages & Social Science 1

U2.6.1 : English 2

Module designation	**Languages & Social Science 1**
Module level, if applicable	Year 1, Semester 2
Code, if applicable	U2.6
Subtitle, if applicable	
Courses, if applicable	**English 2**
Semester(s) in which the module is taught	Semester 2 (S2)
Person responsible for the module	Dr Emna RABHI
Lecturer	Mme Lilia zine edine
Language	English
Relation to curriculum	Compulsory module , Soft-Skills
Type of teaching, contact hours	Lecture, 21 hours Classroom Lecture/ Semester
Workload	Total 42 hours/ Semester (21 hours of Self Study)
Credit points	1.5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	A basic to average level of knowledge about the language used in professional settings.
Module objectives/intended learning outcomes	**Objectives:** 1. Developing understanding of language in use, mainly at the work place. 2. Vocabulary and grammatical understanding. 3. Developing self-confidence to take part in conversations and make presentations in English.

Content	**Chapter 1 : Careers and workplace** ***Reading comprehension:** Learning the necessary vocabulary about work and workplace. ***Grammar :** WH questions, propositions, articles, affixation ***Writing :** learning how to write a cv, a job application ***Speaking :** In pairs, prepare and perform a job interview **Chapter 2 : Communication** ***Reading comprehension:** Communication at work. ***Grammar: -**Use and meanings of the present perfect and past simple + the use of articles. -Practice activities. ***Listening:** Listening to news broadcasting. The types of questions of the activities will be similar to the ones of the TOEIC Listening Test. ***Speaking:** Practicing samples of telephoning conversations at work. **Chapter3 : Small Business (Retail, Industry, Money, Trade)** ***Reading comprehension:** Authentic articles about corporate culture/ entrepreneurship, leadership and management. ***Speaking:** Making power point presentations: presenting a product and describing a process. ***Listening:** Listening to conversations at work between professionals. The type of questions of the activities will be similar to the ones of the TOEIC Listening Test. ***Grammar :** Emphasizing question tag, passive, causative verbs, future , cause and effect ***Writing & speaking :** Describing graphs and charts and comparing facts **Chapter 4 : Introduction to the TOEIC Test :** *Who takes the TOEIC test? *Why take that TOEIC test? *What score do I take to pass the TOEIC test? *From what kind of contexts are the TOEIC test questions drawn? *How to get ready to take the TOEIC test ? *Types of TOEIC.
Study and examination requirements and forms of examination	Written Mid-Term Exam (40%) + Written Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Video projection
Reading list	1. Tactics for TOEIC, Listening and Reading Test (OXFORD UNIVERSITY PRESS) 2. Oxford English for Electrical and Mechanical Engineering, (Eric H. Glendinning, Norman Glendinning) 3. English for Mechanical Enginnering, (MILENA ŠTROVS GAGIČ)

U2.6 : Languages & Social Science 2

U2.6.2 : Engineering Ethics

Module designation	Languages & Social Sciences 2
Module level, if applicable	Year 1, Semester 2
Code, if applicable	U2.6
Subtitle, if applicable	
Courses, if applicable	Engineering Ethics
Semester(s) in which the module is taught	Semester 2
Person responsible for the module	Dr Emna RABHI
Lecturer	Dr Imed Maatouk
Language	French
Relation to curriculum	Compulsory module , Soft Skills
Type of teaching, contact hours	21 hours seminar/project
Workload	Total 30 hours/ Semester (21 hours of Self Study)
Credit points	1.5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Basic Communication technics & Skills

Module objectives/intended learning outcomes	**Objectives:** To provide Engineering students with: 1. An understanding of their duties and responsibilities as engineers. 2. Basic knowledge in decision making when confronted with problems during their professional career. 3. Improved awareness of potential ethical issues within an engineering context. 4. Team skills through working in groups on assignments and in-class assignments. **Learning Outcomes:** Students will be able to : 1. Identify and describe ethical dilemmas in the context of historical and developing technology and engineering practice, 2. Follow a structured, iterative decision-making process for moral reasoning to reach a supported conclusion regarding ethical dilemmas, 1. Use their own reflection on the moral reasoning process within multiple case studies to re-evaluate the coherence between the principles, codes, and theories involved in any given case.
Content	Chapter 1. Introduction Chapter 2. Ethics in Engineering Chapter 3. Important Skills for Ethical Reasoning Chapter 4. Engineering Ethics - Moral Dilemmas Chapter 5. Engineering Ethics - Moral Autonomy Chapter 6. Professions and Professionalism Chapter 7. Engineering Ethics - Social Experimentation Chapter 8. Engineering Ethics - Global Issues Chapter 9. Responsibilities of Engineers Chapter 10. Engineering Ethics - Moral Leadership
Study and examination requirements and forms of examination	100 % Oral Presentation+ Report
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Video projection
Reading list	1. Innovation process and ethics in technology: an approach to ethical (responsible) innovation governance. G. Nathan. Journal on Chain and Network Science 2015; 15(2): 119-134 2. - Responsabilité éthique de l'ingénieur dans les systèmes complexes, **IESF** –Société des Ingénieurs et Scientifiques de France

U2.7: Annual Project

U2.7.1: Annual Project 1

Module designation	**Annual Project**
Module level, if applicable	Year 1, Semester 2
Code, if applicable	U2.7
Subtitle, if applicable	
Courses, if applicable	**Annual Project 1**
Semester(s) in which the module is taught	Semester 2
Person responsible for the module	Dr Emna RABHI
Lecturer	Core Faculty Members
Language	French
Relation to curriculum	Compulsory module ,
Type of teaching, contact hours	21 hours project Supervision on Campus/ semester
Workload	Total 56 hours/ Semester (30 hours of Self Study)
Credit points	2
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Solidworks, Catia V5, Matlab, RDM6, Subjects S1-S2
Module objectives/intended learning outcomes	This is an exercise that will help student to apply knowledge's & Skills to work and present a basic project. **Objectives :** -Sizing and choice of solution -Project studies: functional and structural analysis, design (preparation of technical files) -Design Simulation using appropriate software & tools
Content	Theme of the projects: terrestrial robots 2019-2020 Project 1: Study and design of a robot for collecting tennis balls Project 2: Study, design and Modelling of a demining robot Project 3: Study and design of a vertical robot Project 4: Study, design and Modelling of a drawing arm Project 5: Study and Modelling of an IOT robot farmer Project 6: Study and design of a smart greenhouse

Study and examination requirements and forms of examination	Projects - 100% (Evaluation of the final report of project)
Media employed	On Campus & Remote Supervision Video projection
Reading list	DOCUMENT & REFERENCES ARE GIVEN BY SUPERVISORS DEPENDING ON EACH PROJECT