Profile II

First year

Common:

53001202	Integrated Manufacturing Systems
53001204	Chemical Processes
53001206	Hydraulic Machinery and Wind Turbine
53001209	Energy Sources
53001210	Electronic Systems Design
53001211	Control Systems and Automation

Depending on the access:

53001201	Electric Lines Technology and Design
53001219	Structural Analysis and Design

Basic Sciences and Engineering:

53001224	Complements of Calculus
53001225	Numerical Methods
53001226	Complements of Mechanics
53001227	Complements of Electromagnetism
53001228	Complements of Chemistry
53001229	Complements of Industrial Drawing
53001230	Complements of Thermodynamics
53001232	Complements of Materials
53001233	Complements of Materials Strength

Elective:

53001294	Knowledge Management for Technological Industries
53001295	History of Engineering
53001296	Organization, Development and Participation in Scientific Dissemination Events
53001980	Communication and outreach of Science and Technology

53001202 - INTEGRATED MANUFACTURING SYSTEMS

CREDITS:	3 ECTS
DEPARTMENT:	Mechanical Engineering (MEC)
COURSE COORDINATOR:	Antonio Vizán
TYPE:	Common
YEAR AND SEMESTER:	1st Year / Fall

LIST OF TOPICS

1. Analysis of manufacturing systems
1.1. Simulation of systems
1.2. Basic simulation elements
1.3. Obtaining simulation data
1.4. Programming features
2. Measurement and calculation of times
2.1. Case resolution
3. Flexibillity and efficiency
3.1. Case resolution
4. Cost estimation
5. General case analysis

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Ability to obtain production data identifying operation of a manufacturing system
- Ability to analyze the influence of certain variables on the efficiency of a process
- Ability to model a manufacturing system

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics
- ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration fo public health,safety,and welfare,as well as global,cultural,social,environmental,and economic factors
- ABET_3. An ability to communicate effectively with a range of audiences

BIBLIOGRAPHY

TEXT BOOKS

OTHER MATERIALS

Simulation program
Specific documentation in repository

53001204 - CHEMICAL PROCESSES

CREDITS:	3 ECTS
DEPARTMENT:	Chemical and Environmental Engineering (CHE)
COURSE COORDINATOR:	León, Salvador
TYPE:	Common
YEAR AND SEMESTER:	1st Year / Spring

LIST OF TOPICS

MODULE 1. Introduction to Chemical Process

- 1) Introduction. (1h)
- 2) Chemical plants. Reactors and basic operations. (1h)

MODULE 2. Mass balances

- 3) Mass balances in systems without chemical reaction (2h)
- 4) Mass balances in systems with chemical reaction (2h)

MODULE 3. Energy balances

- 5) Energy balances in systems without chemical reaction. (2h)
- 6) Energy balances in systems with chemical reaction. (2h)

MODULE 4. Chemical reactors

- 7) Fundamentals, definitions and classification. (2h)
- 8) Continuous and batch reactors. (4h)
- 9) Catalysis. (2h)

MODULE 5. Mass transfer operations

- 10) Distillation. Foundations, types and equipment. (6h)
- 11) Gas – liquid absorption. Foundations and equipment. (2h)
- 12) Liquid - liquid extraction. Foundations. (2h)

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

•

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics
- ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPHY

TEXT BOOKS

G. Towler and R. Sinnott, “ChemicalEngineeringDesign: Principles, Practiceand Economicsof Plantand ProcessDesign”, Butterworth-Heinemann, 2nd ed., 2012

E. E. Ludwig, “AppliedProcessDesignforChemicala nd PetrochemicalPlants: Volume1”, Butterworth-Heinemann, 3rd ed., 1995.

OTHER MATERIALS

Class notes and presentations

Theory and problems videos

Interactive python activities

53001206 - HYDRAULIC MACHINERY AND WIND TURBINE

CREDITS	3
DEPARTMEN	Energy Engineering (ENE)
COURSE	Prieto Ortiz, Juan Luis
TYPE	Common
YEAR AND	1st Year / Spring

LIST OF TOPICS

MODULE 1. Fundamentals of Hydraulic Machinery and Wind Turbines

- 1) Classification and description
- 2) Dimensional Analysis and Similarity

MODULE 2. Hydraulic Turbomachinery

- 3) Essential concepts
- 4) Euler’s Theorem
- 5) Unidimensional theory for centrifugal pumps
- 6) Hydraulic facilities and regulation in pumps
- 7) Cavitation
- 8) Pelton Turbine

MODULE 3. Wind Power Engineering

- 10) Actuator Disc Theory
- 11) Wind Turbine Aerodynamics

RECOMMENDED COURSES OR

RECOMMENDED PREVIOUS

COURSE: Fluid Mechanics, Fluid Mechanics II, Differential Equations, Mechanics

TOPIC: Fundamentals of Fluid Flow; Mathematical and Physical foundations

RECOMMENDED PREVIOUS KNOWLEDGE OR

- Advanced Calculus
- Expansion of Fluid Mechanics

SPECIFIC OUTCOMES FOR THE

At the end of the course, the student will be able to (or will have ability for):

- Perform regulation in hydraulic machines
- Understand the working principles of centrifugal pumps
- Apply similarity laws to hydraulic turbomachinery and wind turbines
- Control cavitation in hydraulic machines
- Understand Wind Power Generation
- Design Centrifugal Pumps
- Obtain a sound foundation in Hydraulic turbomachinery

STUDENT

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics
- ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration fo public health,safety,and welfare,as well as global,cultural,social,environmental,and economic factors
- ABET_4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments,which must consider the impact of engineering solutions in global,economic,environmental,and societal contexts
- ABET_5. An ability to function effectively on a team whose members together provide leadership,create a collaborative and inclusive environment,establish goals,plan tasks,and meet objectives
- ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPH

TEXT

Crespo, A., "Mecánica de Fluidos", Ed. Thomson, 2006.
Prieto Ortiz, J. L., "Máquinas e Instalaciones Hidráulicas y Eólicas", Univ.Politécnica de Madrid, 2016.
Viedma Robles, A., Zamora Parra, B., "Teoría y Problemas de Máquinas Hidáulicas", Univ. Politécnica de Cartagena, 2002.
Mataix, C.,"Turbomáquinas Hidráulicas", Ed. ICAI, 2011.
Dixon, S. L., 'Fluid Mechanics and Thermodynamics of Turbomachinery', Ed. Elsevier, 2010.
Burton, T., Sharpe, D., Jenkins, N., Bossanyi, E., ‘Wind Energy Handbook’, Ed. John Wiley & Sons, Ltd, 2001.
Krivechenko, G., 'Hydraulic Machines: Turbines and Pumps', Ed. CRC Press,1994.
Manwell, J.F., McGowan, J.G., Rogers, A.L., ‘Wind Energy Explained’, Ed. John Wiley & Sons, Ltd, 2010.
García Alarcón, C. J., "Saltos Hidroeléctricos: Conceptos Básicos y Aplicaciones", Ed. Delta, 2010.

OTHER

Lecture notes.

53001209 - ENERGY SOURCES

CREDITS: 3 ECTS

DEPARTMENT: Energy Engineering (ENE)

COURSE COORDINATOR: Cotelo Ferreiro, Manuel

TYPE: Common

YEAR AND SEMESTER: 1st Year / Fall

LIST OF TOPICS

MODULE 1. Introduction: common Energy Sources concepts

MODULE 2. Nuclear Fission

MODULE 3. Nuclear Fusion

MODULE 4. Solar thermal energy

MODULE 5. Photovoltaics

MODULE 6. Wind power

MODULE 7. Biomass

MODULE 8. Utilization of waste material

MODULE 9. Environmental problems of energy

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE: Thermodynamics

TOPIC: Thermodynamic process, Energy balance, Entropy, Exergy, Efficiency

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

• Using design tools and thermal systems

STUDENT OUTCOMES

• ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics

• ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration fo public health,safety,and welfare,as well as global,cultural,social,environmental,and economic factors

• ABET_4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments,which must consider the impact of engineering solutions in global,economic,environmental,and societal contexts

BIBLIOGRAPHY

TEXT BOOKS

Renewable Energy
Bent Sorensen Editorial Elsevier; Edición: 4

Nuclear Energy
Raymond L. Murray Editorial Butterworth-Heinemann, 2000

Nuclear Energy Encyclopedia
Steven Krivit Editorial Wiley John + Sons, 2011

Nuclear Technology
Joseph A. Jr. Angelo Editorial Greenwood, 2004

Nuclear Energy in the 21st Century
Ian Hore Lacy Editorial Asme Intl, 2013

Handbook of Energy Efficiency and Renewable Energy
D. Yogi Goswami, Frank Kreith Editorial CRC Press, 2007

Solar Engineering of Thermal Processes
John A. Duffie, William A. Beckman Editorial John Willey & Sons, Inc. 2nd Ed., 1991

Van Loo, Sjaak and Koppejan, Jaap.
The Handbook of Biomass Combustion and Co-firing. Earthscan, 2012. ISBN 9781849773041

Dahlquist, Erik.
Biomass as Energy Source: Resources, Systems and Applications. CRC, 2013. ISBN 9780415620871

Capareda , S.
Introduction to Biomass Energy Conversions. CRC, 2013. ISBN 9781466513334

Tchobanoglous, G et al.
Gestión Integral de residuos sólidos, McGraw Hill, 1994, ISBN 8448118308

OTHER MATERIALS

PV energy:: https://www.pveducation.org/

Web notes and slides in UPM Moodle: https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=6984

53001210 - ELECTRONIC SYSTEMS DESIGN

CREDITS:	3 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronics Engineering and Industrial Informatics (AEE)
COURSE COORDINATOR:	Alou Cervera, Pedro
TYPE:	Common
YEAR AND SEMESTER:	1st Year / Spring

LIST OF TOPICS

MODULE 1. Signals. Real Components. Analog signal processing. Noise

MODULE 2. Analog Filters. Electrical Isolation of signals. Power Supplies

MODULE 3. Sensors. Actuators.

MODULE 4. Data acquisition systems: A/D and D/A Converters

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

Fundamentos de Electrónica (GITI)

TOPIC:

Analog and Digital Electronics

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

Analysis of electric circuits

Fundamentals of Analog and Digital Electronics

Frequency Response and Bode Plots

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Ability to analyze sources of electromagnetic noise and coupling mechanisms
- Ability to analyze and design analog filters
- Ability to analyze and design digital filters
- Ability to analyze data acquisition systems

STUDENT OUTCOMES

- ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration fo public

health,safety,and welfare,as well as global,cultural,social,environmental,and economic factors

- ABET_6. An ability to develop and conduct appropriate experimentation,analyse and interpret data,and use engineering judgment to draw conclusions

BIBLIOGRAPHY

TEXT BOOKS

Integrated Electronics Analog And Digital & System
Author – Jacob Millman. Christos C. Halkias
Tata McGraw-Hill Publishing Company, 2001

OTHER MATERIALS

Slides with the content of the subject and exercises

Lab Instrumentation for tests of circuits

Computers

Pspice and LTspice electronic simulators

Basic electronic components

53001211 - CONTROL SYSTEMS AND AUTOMATION

CREDITS:	3 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronics Engineering and Industrial Informatics (AUT)
COURSE COORDINATOR:	Saltaren Pazmiño, Roque
TYPE:	Common
YEAR AND SEMESTER:	1st Year / Fall

LIST OF TOPICS

MODULE 1. Introduction to process control

1) Introduction
2) Features Process Control
3) Piping and instrumentation diagrams (P & IDs)
4) Types of process and control
5) Industrial process control systems

MODULE 2. Process modeling

6) Introduction
7) Control specifications
8) Nonlinear process modeling, linearization, and identification with Simulink
9) First-order PORP systems with delays
10) System plant modeling of tanks, pipes, and valves in cascade
11) Valve control modeling

MODULE 3. Basic PID control

12) Introduction
13) PID control structures
14) PID control design methods based on ZN, AMIGO, Closed-Loop ZN
15) Feedforward control
16) Feedforward control of the disturbance
17) Process control with great delays, the Smith Predictor
18) Optimization of PID design techniques, the Integral of error
19) Anti-windup techniques
20) Basic closed-loop control modeling, design, and simulation of tanks with Simulink

MODULE 4. Advanced PID Control

21) Introduction
22) Design of cascade closed loop systems
23) Feedforward control
24) Feedforward control of the disturbance
25) Advanced closed-loop control modeling, design, and simulation of tanks with Simulink

MODULE 5. Automation of process

26) Introduction to process automation, sensors and pneumatic systems control

26) Review of modeling and design of process with GRAFCET
56) The GEMMA Guide
57) Design of automation process based on the GEMMA guide and with Grafcet Studio Software Package

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

Introduction to automation.

The SFC language.

Input-output analysis of nonlinear dynamic systems open-loop and closed.

Digital simulation of dynamic systems

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

Ability to apply industrial computer simulation tools for the modeling, design and

simulation of process control

Ability to design basic and advanced PID control systems of industrial process

Ability to design the automation of industrial process based on GEMMA guide

STUDENT OUTCOMES

ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics

ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration fo public health,safety,and welfare,as well as global,cultural,social,environmental,and economic factors

BIBLIOGRAPHY

TEXT BOOKS

Control e instrumentación de procesos químicos, Pedro Ollero. Editorial: SINTESIS. ISBN: 9788477385172

OTHER MATERIALS

Matlab, Simulink. Guides, professor examples.

Grafcet Studio Tool Sofware Package. Guides, professor examples

Professor course slides.

1. Introducción al Control de Procesos.
2. Modelado de Sistemas y especificaciones de control
3. Control Regulatorio Básico.
4. Control avanzado de procesos
5. Introducción a la automatización
6. Diseño de sistemas de automatización

53001201 - ELECTRIC LINES TECHNOLOGY AND DESIGN

CREDITS:	3 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronics Engineering and Industrial Informatics (AUT)
COURSE COORDINATOR:	Pastor Gutierrez, Antonio
TYPE:	Common
YEAR AND SEMESTER:	1st Year / Spring

LIST OF TOPICS

MODULE 1. Electric power systems

- 1) Three-phase shortcircuit calculation, Symmetrical components

MODULE 2. Short-circuit currents

- 2) Asymmetrical shortcircuit calculation

MODULE 3. Analysis and Design

- 3) Modification of Zbus matrix

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC: Electric circuits (in Bachelor Degree)

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Models of the components of power systems

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Ability to understand the effects of short circuit currents.
- Ability to design the elements of the grid.
- Ability to determine the value of short circuit currents.
- Ability to understand the operation of commercial calculation programs.

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics
- ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration fo public health,safety,and welfare,as well as global,cultural,social,environmental,and economic factors
- ABET_4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments,which must consider the impact of engineering solutions in global,economic,environmental,and societal contexts
- ABET_6. An ability to develop and conduct appropriate experimentation,analyse and interpret data,and use engineering judgment to draw conclusions

BIBLIOGRAPHY

TEXT BOOKS

"Análisis de Sistemas de Potencia". J Grainger y W. Stevenson, edt McGraw-Hill,1996

"Análisis y Operación de Sistemas de Energía Eléctrica". A. Gómez Expósito, edt McGraw-Hill, 2002

"Sistemas de Energía Eléctrica". F. Barrero, Edt. Thomson, 2004

“Power System. Analysis and Design” J. Duncan Glover, Mulukutla S. Sarma, Thomas J. Overbye, edit. Cengage.

OTHER MATERIALS

Videos and notes prepared by the profesor.

53001219 - STRUCTURAL ANALYSIS AND DESIGN

CREDITS:	3 ECTS
DEPARTMENT:	Mechanical Engineering(MEC)
COURSE COORDINATOR:	Alberto Fraile de Lerma
TYPE:	Common
YEAR AND SEMESTER:	1st Year / Fall

LIST OF TOPICS

MODULE 1. Introduction

- 1) Scope of the course
- 2) Types of forces, elastic / plastic calculation
- 3) Structural Project: Procedure and objectives in new and existing structures
- 4) General aspects of a structural project. Process and phases (preliminary, basic and execution).
- 5) Standards and codes for structural assessment
- 6) Structural and non-structural elements. Primary and secondary structural elements
- 7) Structural Safety and Serviceability: methods in admissible stresses and methods in limit states SLS and ULS

MODULE 2. Structural Typologies

- 8) Structural elements and forces
- 9) Structures and their resistant considerations. Building, civil and industrial structures.
- 10) Structures that interact with the ground: foundation solutions

MODULE 3. Structural materials/products

- 11) Introduction. Differentiating factors in selecting materials. Mechanical and non-mechanical factors
- 12) Concrete structures
- 13) Structural steel
- 14) Soil mechanics

MODULE 4. Performance required for the structures

- 15) General principles
- 16) Performance in service
- 17) Security features
- 18) Verification of performance by calculation

MODULE 5. Loads

- 19) Definitions
- 20) Classification and normative regulations

MODULE 6. Structural analysis of linear systems

- 21) Calculation methods. Equations of equilibrium, constitutive relations and compatibility
- 22) Degrees of freedom. Boundary conditions. Symmetry and antisymmetry conditions
- 23) Matrix calculation
- 24) Commercial software tools for structural design

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Understand the general aspects of industrial construction.
- Gain knowledge on the different aspects involved: the phases required to develop a project, the industrial planning in the construction of industrial complex and facilities.
- Deepening specialty in typical structures.
- Understanding the behavior of the land to support the rest of the installation projects and their importance in the overall design.
- Understand and interpret building regulations. The definition of actions, limit States, the hypothesis of load combination, etc.
- Deepening in the knowledge of the materials used in the construction: how they work, their behavior and performance in the structural analysis, their advantages and disadvantages.
- Understand that Structural Analysis is one of the phases of a structural project; and by applying the principles of Deformable Solid Mechanics, it is necessary to check if the structure may perform the function for which it was initially conceived.
- Relate the displacements and stresses occurring in a bar structure with the actions applied on it. For it, the equilibrium, compatibility and constitutive equations will be applied.
- Understand the systematization in the calculation and its implementation in computers as an approximation to the use of this tool in the design of structures.

STUDENT OUTCOMES

- ABET_1. An ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
- ABET_3. An ability to communicate effectively with a range of audiences
- ABET_4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global,economic,environmental,and societal contexts
- ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPHY

TEXT BOOKS

[1] Iain A MacLeod, Modern Structural Analysis, Thomas Telford, 2005
[2] Mete A. Sozen, Toshikatsu, Understanding Structures, CRC Press 2008
[3] David Yeomans, How Structures Work. Wiley-Blackwell, 2009.
[4] E. Torroja. Razón y ser de los tipos estructurales. Capítulos 1 y 2.
[5] J.E. Gordon. Estructuras o por qué las cosas no se caen. Páginas 221-228.
[6] Salvadori, M. Estructuras para arquitectos. Capítulos 6,7,8,10,11,12
[7] Benavent-Climent A. Estructuras IV. Editorial Universidad de Granada. Capítulo 4 – apartados 4.4, 4.5, 4.6 y 4.7

OTHER MATERIALS

Blackboard
Computer equipment
Theoretical Notes and Solved Problems
Bibliography

53001224 - COMPLEMENTS OF CALCULUS

CREDITS: DEPARTMENT:	6 ECTS
COURSE COORDINATOR:	Industrial and Apllied Mathematics (MAT)
TYPE:	González Guillén, Carlos Eduardo
YEAR AND SEMESTER:	Elective - Track
	1st Year / Fall

LIST OF TOPICS

MODULE 1. Functions of one variable. Computational aspects

- 1) Review of the concepts of integral and differential calculus.
- 2) Interpolation and numerical integration.

MODULE 2. Multiple Riemann integral.

- 3) Multiple Riemann integral. Properties.
- 4) Iterated integration. Fubini theorem. Physical and geometric applications of the multiple integrals.
- 5) Numerical Integration

MODULE 3. Curves and surfaces in Rn. The path and surface integral.

- 6) Curves in Rn. Length of a curve.
- 7) Integrating a scalar field along a curve.
- 8) Integration of a vector field along a curve: circulation.
- 9) Surface and surface integral
- 10) Field theory

MODULE 4. Fundamental theorems of vector calculus.

- 11) Green, Gauss and Stokes theorems.
- 12) Physical interpretation of gradient, divergence and rotational operators
- 13) Conservation laws.

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Calculus.
- Algebra
- Computational notions

BIBLIOGRAPHY:

- T. M. Apostol, Calculus,(2 vol.) Reverté, 1980.
- R. Courant, F. John, Introducción al Cálculo y al Análisis Matemático (vol. II), Limusa, 1984.
- J. E. Marsden, A. J. Tromba, Cálculo Vectorial, Pearson Educación, 2004.
- V. Widder, Advanced calculus, Dover, 1989.
- N. Kemmer, Vector Analysis: A physicist's guide to the mathematics of fields in three dimensions,1977.
- J. A. Shercliff, Vector Fields: vector analysis developed through its application to engineering and physics. New York, Cambridge University Press, 1977.
- Hague, B. An introduction to vector analysis for physicists and engineers, 1970.
- Kincaid, D., W. Chenney, Análisis Numérico: las Matemáticas del Cálculo Científico. Addison-Wesley Iberoamericana, Wilmington, 1994.

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

-

STUDENT OUTCOMES

- ABET_1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- ABET_3. An ability to communicate effectively with a range of audiences
- ABET_6. An ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgment to draw conclusions
- ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPHY

TEXT BOOKS

OTHER MATERIALS

53001225 - NUMERICAL METHODS

CREDITS:	6 ECTS
DEPARTMENT:	Mathematics of the Industrial Area (MAT)
COURSE COORDINATOR:	Zarzo Altarejos, Alejandro
TYPE:	Elective - Track
YEAR AND SEMESTER:	1st Year / Fall

LIST OF TOPICS

MODULE 1. Introduction

- 1) Introduction to numerical calculation.

MODULE 2. Numerical linear Algebra problems

- 2) Solving systems of linear equations using direct methods.
- 3) Large systems: sparse matrices and iterative methods.
- 4) Calculation of values and eigenvectors.

MODULE 3. Interpolation and approximation

- 5) POLYNOMIAL INTERPOLATION.
- 6) Interpolation for splines.
- 7) Trigonometric interpolation.
- 8) Functional approach. Continuous squares.
- 9) Adjustment of data. Least squares linear discrete

MODULE 4. Roots of equations and systems of nonlinear equations

- 10) Scalar equations methods. Bisection, Secant and Newton-Raphson methods.
- 11) Of Newton, Broyden methods for systems of nonlinear equations.

MODULE 5. Numerical integrationand differentiation

- 12) Finite-difference formulas.
- 13) Newton-Cotes quadrature.
- 14) Gaussian quadrature

MODULE 6. Numerical resolution of problems of initial value in ordinary differential equations

- 15) Runge-Kutta methods.
- 16) Methods of Euler and Heun. Truncation error. Explicit and implicit methods.
- 17) Predictor-corrector methods
- 18) Stability. Stiff problems.

MODULE 7. Introduction to the finite element method (MEF)

- 19) Variational formulation of elliptic problems.
- 20) The Galerkin method.
- 21) The MEF. Local focus.
- 22) 1-D and 2-d interpolation functions
- 23) Applications.

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES: Knowledge of mathematics content taught in courses of engineering degrees.

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES: Basic knowledge of a programming language (MatLab or similar).

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Devise a resolution procedure/method.
- Execute the planned procedure. Evaluation and validation of the obtained result.
- The student analyzes the results obtained from the experiment, draws conclusions from them and formulates explanations.
- The student is able to assess the reliability and possible sources of error of an experiment designed and carried out by him/her.
- Assess and validate the result obtained.
- Identify, propose alternatives and choose according to the codes.
- Use the appropriate style to facilitate the reader's comprehension taking into account their expectations and previous knowledge.

STUDENT OUTCOMES

- ABET_1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- ABET_3. An ability to communicate effectively with a range of audiences
- ABET_6. An ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgment to draw conclusions
- ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPHY

TEXT BOOKS

OTHER MATERIALS

53001226 - COMPLEMENTS OF MECHANICS

CREDITS:	6 ECTS
DEPARTMENT:	Applied Physics and Materials Engineering (P&M)
COURSE COORDINATOR:	Jesús de Vicente y Oliva
TYPE:	Elective - Track
YEAR AND SEMESTER:	

LIST OF TOPICS

MODULE 1. Kinematics and kinetics of the solid rigid

- 1) Fields of velocities and accelerations in rigid body. Plane and Spherical Kinematics of rigid bodies. Overview of geometry of masses. Kinetic quantities.

MODULE 2. Static systems

MODULE 3. Rigid body dynamics

- 2) Newtonian and Analytical Statics of material systems. Reactions and internal efforts in rigid bodies.
- 3) Equations of dynamics. Solid with fixed axis. Solid with plane movement. Motorization of mechanisms.

MODULE 4. Lagrangian mechanics

- 4) Generalized coordinates. Principle of virtual work. Lagrange equations. Case in which the applied forces are derived from a potential. Equilibrium and its nature. Small oscillations around equilibrium. Normal modes of vibration.

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

"Differential and Integral Calculus", "Point Kinematics and Dynamics", "Linear Algebra", "Linear Differential Equations"

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

•STUDENT OUTCOMES

• ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics

• ABET_4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments,which must consider the impact of engineering solutions in global,economic,environmental,and societal contexts

• ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

•

BIBLIOGRAPHY

TEXT BOOKS

1. Díaz de la Cruz, J. M. y Sánchez Pérez. A. M.: "Mecánica para Ingenieros". Sección de Publicaciones ETSII-UPM, 2016.

2. Scala Estalella, J. J. y otros: "Problemas de examen resueltos de la asignatura de Mecánica", vol. 1. Sección de Publicaciones ETSII-UPM. ISBN 84-7484-100-3, 1996, 101 págs.

3. Sánchez Pérez, A. M. y Díaz de la Cruz Cano, J. M.: : "Problemas de examen resueltos de la asignatura de Mecánica", vol. 2. Sección de Publicaciones ETSII-UPM. ISBN 84-7484-132-1, 1998, 53 págs

OTHER MATERIALS

53001227 - COMPLEMENTS OF ELECTROMAGNETISM

CREDITS:	6 ECTS
DEPARTMENT:	Applied Physics and Materials Engineering (P&M)
COURSE COORDINATOR:	José Luis Ocaña Moreno
TYPE:	Elective - Track
YEAR AND SEMESTER:	1st Year / Spring

LIST OF TOPICS

MODULE 1. Maxwell Equations

Maxwell equations. Invariance in the frame of Special Relativity. Interrelation of Electric and Magnetic Fields in moving frames. Electrostatic and Magnetostatic approaches

MODULE 2. Electrostatics

Electrostatic Field and Potential. Poisson and Laplace Equations. Explicit solutions for the Electrostatic Potential. Conductors. Electric Field in material media. Electrostatic Energy and Mechanical actions.

MODULE 3. Magnetostatics

Electric currents. Charge conservation equation and electric current density. Magnetic fields due to stationary currents. Magnetic Vector Potential. Magnetic Fields in material media. Ferromagnetic materials. Magnetic circuits

MODULE 4. Electromagnetic induction

Induced Electromotive Force. Faraday-Henry Law of Electromagnetic Induction and Maxwell Equations. Autoinduction and mutual induction coefficient of electric circuits. Currents induced through magnetic flux variation and mechanical motion. Electric generators, motors and transformers. Electromagnetic energy and mechanical actions. High frequency effects.

MODULE 5. Electromagnetic waves

Electromagnetic energy balance and electromagnetic waves. Maxwell equations and wave equations for coupled electric and magnetic fields. Poynting vector. Propagation of waves in vacuum and material media at low frequencies. Emission by oscillating electric and magnetic dipoles

MODULE 6. Electromagnetic waves interaction with matter

Electromagnetic waves interaction with matter at low frequencies: Isolators and good conductive materials. Energy deposition by electromagnetic waves in matter. Reflectivity and attenuation coefficient. Skin depth in good conductors. Wave polarization effects.

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

Differential/Integral Calculus

Differential Equations

General Physics

Vector Mechanics

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Formal expression of Maxwell Equations and their possibility of simplification for stationary electric charge distributions and currents
- Interpret Electromagnetic Phenomena in the frame of Special Relativity. Recognize the interrelation between electric and magnetic fields.
- Analytical determination of electrostatic fields and potentials in vacuum and material media
- Evaluation of electrostatic energy and mechanical actions in typical charge/material configurations
- Analytical determination of magnetostatic fields in vacuum and material media
- Evaluation of electromagnetic energy and mechanical actions in typical current/material configurations
- Analytical coupled determination of induced electromagnetic fields due to non-stationary and/or moving currents.
- Electromagnetic energy balance and waves generation and propagation in vacuum and material media.
- Electromagnetic waves interaction and energy deposition to material media

STUDENT OUTCOMES

• ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics

• ABET_4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments,which must consider the impact of engineering solutions in global,economic,environmental,and societal contexts

• ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPHY

TEXT BOOKS

- A.M. Sánchez: "Ampliación de Física I". Publicaciones ETSII-UPM (2002)
- J.R. Reitz, F. Milford, R.W. Christy: "Fundamentos de la Teoría Electromagnética", 4ª Edición. Addison-Wesley Interamericana S.A. (1996).
- D.K. Cheng: "Fundamentos de Electromagnetismo para Ingeniería". Addison-Wesley Interamericana S.A. (1998).
- R.K. Wangsness: "Campos Electromagnéticos". Editorial Limusa S.A. (1992).
- P. Lorrain, D.R. Corson: "Campos y Ondas Electromagnéticos". Selecciones Científicas (1976).
- P. Lorrain, D.R. Corson, F. Lorrain: "Electromagnetic Fields and Waves". W. H. Freeman and Company (1988).
- D.J. Griffiths: "Introduction to Electrodynamics". Prentice Hall (1999).

OTHER MATERIALS

53001228 - COMPLEMENTS OF CHEMISTRY

CREDITS:	6 ECTS
DEPARTMENT:	Chemical and Environmental Engineering (CHE)
COURSE COORDINATOR:	Pilar García Armada
TYPE:	Elective - Track
YEAR AND SEMESTER:	1st Year / Spring

LIST OF TOPICS

MODULE 1. Material and Energy Balances.

- 1) Material and Energy Balances (7h)

MODULE 2. Inorganic Chemistry

- 2) Obtaining, properties and compounds of the non-metallic elements (8 h)
- 3) Obtaining, properties and compounds of representative metals and transition metals (6 h)
- 4) Obtaining, properties and compounds of the semi-metallic elements (2 h)

MODULE 3. Organic Chemistry

- 5) Fundamentals of Organic Chemistry (4h)
- 6) Hydrocarbons. (6 h)
- 7) Organic compounds: functional groups with single-bond (5 h).
- 8) Organic compounds: functional groups with multiple bond (5 h).

MODULE 4. Industrial applications

- 9) Applications of Instrumental Analysis (5 h)
- 10) Inorganic Industrial processes (5 h)
- 11) Organic Industrial processes (3)

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

-

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics
- ABET_4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments,which must consider the impact of engineering solutions in global,economic,environmental,and societal contexts
- ABET_6. An ability to develop and conduct appropriate experimentation,analyse and interpret data,and use engineering judgment to draw conclusions

BIBLIOGRAPHY

TEXT BOOKS

Organic Chemistry
Morrison y Boyd, Pearson Educación, 1998

General Chemistry. Modern Principles and Applications
Petrucci y Hardwood, Prentice Hall, 2002

Descriptive Inorganic Chemistry 2nd Ed
Geofrey Rainer-Canham, Pearson Education - Prentice Hall, 2000

Organic Chemistry. Structure and Function 5th Ed
K.P.C. Vollhardt, N. E. Schore, Omega, 2008

Introduction to Chemical Engineering
Guillermo Calleja Pardo, Síntesis, 1999

Inorganic Chemistry 4th Ed.
Shriver y Atkins, McGraw-Hill, 2008

OTHER MATERIALS

Supporting materials (Notes, slides, links, exercises, etc.)

53001229 - COMPEMENTS OF INDUSTRIAL DRAWING

CREDITS:	6 ECTS
DEPARTMENT:	Mechanical Engineering (MEC)
COURSE COORDINATOR:	Sanz Bobi, Juan de Dios
TYPE:	Elective - Track
YEAR AND SEMESTER:	1st Year / Fall

LIST OF TOPICS

MODULE 1. Standardization

- 1) Orthogonal views. Partial views. Auxiliary views. Simplified representations
- 2) Sectional views
- 3) Assembly drawings
- 4) Dimensioning

MODULE 2. Assembly drawings

- 5) Joint systems
- 6) Removable. Threads. Bolts, nuts, pins. Transformation of movement
- 7) Fixed joints. Welding and rivets

MODULE 3. Standard elements

- 8) Shafts, cams, keys.
- 9) Bearings
- 10) Gears and pulleys

MODULE 4. Tolerance

- 11) Tolerance Dimensioning
- 12) Geometrical Tolerance
- 13) Surface Roughness

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Engineering Graphics I, Theory of machines and mechanisms, Manufacturing

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Understanding of a technical drawing
- Ellaborate technical drawing
- Learn about representation and applications of the main mechanical elements
- Use technical standards

STUDENT OUTCOMES

- ABET_1. An ability to identify, formulate, and solve complex engineering problems by applying principles ofengineering, science, and mathematics
- ABET_3. An ability to communicate effectively with a range of audiences

BIBLIOGRAPHY

TEXT BOOKS

Ingeniería Gráfica y Diseño
J Felez y M.L. Martínez Editorial Sintesis, 2008

OTHER MATERIALS

moodle.upm.es / ? Mis cursos / ? E.T.S. DE INGENIEROS INDUSTRIALES / ? Máster Universitario en Ingeniería Industrial / ? Ampliación de Dibujo Industrial

53001230 - COMPLEMENTS OF TERMODYNAMICS

CREDITS:	3 ECTS
DEPARTMENT:	Energy Engineering (ENE)
COURSE COORDINATOR:	Rafael Nieto
TYPE:	Elective - Track
YEAR AND SEMESTER:	1st Year / Spring

LIST OF TOPICS

MODULE 1. Open systems

- 1) General equations. Flow exergy
- 2) Stationary and non-stationary processes

MODULE 2. Thermodynamic properties of multicomponent systems

- 3) Thermodynamic properties in multicomponent systems
- 4) Ideal models of mixing and real mixtures

MODULE 3. Statistical thermodynamics

- 5) Partition Function and thermodynamic properties
- 6) Third law of thermodynamics

MODULE 4. Systems with chemical reactions

- 7) Systems with chemical reactions
- 8) Equilibrium and stability in multi-component, multiphase and reactive systems

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Basic thermodynamics

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Calculate thermodynamic properties of mixtures
- Solve problems of physical equilibrium in multi-phase systems
- Calculate caloric effects in reactive systems
- Solve problems of chemical equilibrium in one-reaction and single phase systems

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics

BIBLIOGRAPHY

TEXT BOOKS

Termodinámica
R. Nieto, M.C. González, I. López, Á. Jiménez, J. Rodríguez Editorial Sección de Publicaciones de la ETSII, 2013

OTHER MATERIALS

Termodinámica

Tablas y gráficos de Termodinámica

53001232 - COMPLEMENTS OF MATERIALS

CREDITS:	3 ECTS
DEPARTMENT:	Applied Physics and Materials Engineering (P&M)
COURSE COORDINATOR:	García Ruiz, Ana M.
TYPE:	Elective - Track
YEAR AND SEMESTER:	1st Year / Spring

LIST OF TOPICS

MODULE 1. Processes of forming materials

- 1) Casting: metallic and non-metallic materials
- 2) Sintering: metallic and ceramic materials
- 3) Forming of metallic materials

MODULE 2. Joining Techniques

- 4) Welding processes
- 5) Adhesive joints
- 6) Mechanical joints
- 7) Hybrid joints

MODULE 3. performance in service

- 8) Corrosion
- 9) Fracture
- 10) Fatigue
- 11) Creep
- 12) Wear

MODULE 4. Defectologia, inspection and testing

- 13) Origin of materials discontinuities
- 14) Inspection
- 15) Non Destructive testing
- 16) Destructive testing

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE: Metallic Materials Science, Strength of Materials, Structure and Properties of Non-Metallic Materials

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

Materials structure and properties (crystal systems, microstructure, alloy phase diagrams)

Mechanical properties of materials: Elastic and plastic behaviour fundamentals

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

-

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles ofengineering,science,and mathematics
- ABET_4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments,which must consider the impact of engineering solutions in global,economic,environmental,and societal contexts

BIBLIOGRAPHY

TEXT BOOKS

Fundamentos de Manufactura Moderna. M.P. Groover. Ed Prentice. 1997

Introducción a la Pulvimetalurgia. P. Molera Solá. Ediciones Bellaterra. 1999

Tecnología Mecánica y Metrotecnia. J.M. Lasheras. Ed. Donostiarra. 2000

Diseño en ingeniería mecánica. J.E. Shigley, C.R. Mischke. Ed. McGraw Hill. 1990

Metal Casting. A.M. Mikhailov. Ed. Mir Publishers Moscow. 1989

Soldadura. Aplicaciones y práctica. H. Horwitz. Ed Alfaomega. 1997

Uniones adhesivas estructurales. J.C. Suarez Bermejo, F. López, J.M. Martín Martínez. Red CYTED. 2000

ASM Engineered Materials Handbook. Vol.3. Adhesives and sealants.1990

Corrosión y protección metálicas. Vol. I y II. S. Feliú, C. Andrade. CSIC. 1991

Fallos en servicio de los materiales metálicos. J.M. Pintado. INTA. 1992

Elementary Engineering Fracture Mechanics. D. Broek. Martinus Nljhoff Publishers. 1982

Métodos de Ensayos No Destructivos. Tomos I y II. E. Ramirez, M.A. Fernández Soler, A. Alonso, G. Delojo, C. Valdecantos, J.M. Ríos. INTA Publicaciones. 1996

ASM Handbook Vol. 6. Welding, Brazing, and Soldering. 1993

ASM Handbook Vol. 8. Mechanical Testing and Evaluation. 2000

ASM Handbook Vol. 12. Fractography. 1987

ASM Handbook Vol. 13. Corrosion. 1987

ASM Handbook Vol. 17. Non Destructive Testing and Quality Control. 1989

ASM Handbook Vol. 19. Fatigue and Fracture. 1996

OTHER MATERIALS

53001233 - COMPLEMENTS OF MATERIALS STRENGTH

CREDITS:	3 ECTS
DEPARTMENT:	Mechanical Engineering (MEC)
COURSE COORDINATOR:	David Portillo
TYPE:	Elective - Track
YEAR AND SEMESTER:	1st Year / Fall

LIST OF TOPICS

MODULE 1. Balance of the deformable solid against outside forces

- 1) Outside forces: point, area and volume. Equilibrium conditions
- 2) Actions and reactions. Link conditions
- 3) Prismatic solid efforts. Diagrams
- 4) Systems isostatic and hyperstatic
- 5) Work contributed by outside forces.

MODULE 2. Linear elastic behavior

- 6) tensile test
- 7) Cutting test

MODULE 3. Applications to the prismatic solid

- 8) Traction
- 9) Pure symmetrical bending
- 10) uniaxial bending
- 11) Elementary theory of torsion

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics
- ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration fo public health,safety,and welfare,as well as global,cultural,social,environmental,and economic factors

BIBLIOGRAPHY

TEXT BOOKS

OTHER MATERIALS

53001294 – Knowledge Management for Technological Industries

CREDITS:	3 ECTS
DEPARTMENT:	ENERGY ENGINEERING
COURSE COORDINATOR:	GONZALO JIMÉNEZ VARAS
TYPE:	ELECTIVE
YEAR AND SEMESTER:	1ST COURSE, 1ST SEMESTER

LIST OF TOPICS

MODULE 1. INTRODUCTION TO KNOWLEDGE MANAGEMENT

MODULE 2. CONCEPTS AND METHODS

MODULE 3. SELF KNOWLEDGE MANAGEMENT

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

No previous courses are needed.

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- No previous knowledge is needed.

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Designing a knowledge management strategy for a company.
- Designing a knowledge management strategy for themselves.

STUDENT OUTCOMES

ABET_3. An ability to communicate effectively with a range of audiences

BIBLIOGRAPHY

TEXT BOOKS

- Recommended textbook: Learning to Fly: Practical Knowledge Management from Leading and Learning Organizations. C. Collison and G. Parcell. John Wiley & Sons, 2004.

OTHER MATERIALS

The lectures are available in pdf at Moodle.

53001295 History of Engineering

CREDITS:	3
DEPARTMENT:	ENERGY ENGINEERIING
COURSE COORDINATOR:	NATIVIDAD CARPINTERO SANTAMARIA
TYPE:	OPTIONAL
YEAR AND SEMESTER:	2021-22 – SECOND SEMESTER

LIST OF TOPICS

MODULE 1. ANCIENT AND MEDIEVAL ENGINEERING

MODULE 2. INDUSTRIAL REVOLUTIONS

MODULE 3. UNIVERSAL SPANISH ENGINEERING DISCOVERIES

MODULE 4. 20TH CENTURY ENGINEERING

MODULE 5. 21th CENTURY ENGINEERING

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES: INTEREST IN SOCIOLOGICAL AND HISTORICAL ENGINEERING AND SCIENTIFIC DEVELOPMENT IN A UNIVERSAL CONTEXT.

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

To learn challenges of 21st engineering practices.

Universal achievements of Spanish engineers to development of mankind.

Knowledge and social responsibility.

STUDENT OUTCOMES

- ABET_1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration fo public he alth, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- ABET_3. An ability to communicate effectively with a range of audiences
- ABET_5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- ABET_6. An ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgment to draw conclusions
- ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPHY

TEXT BOOKS: GA_05_AZ_53001295

OTHER MATERIALS: GA_05_AZ_53001295

Apuntes disponibles para los alumnos en plataformas como Aulaweb o Moodle

53001296 – Organization, Development and Participation in Scientific Dissemination Events

CREDITS:	3 ECTS
DEPARTMENT:	Mechanical Enginering Department.
COURSE COORDINATOR:	Blanca Arenas-Ramírez
TYPE:	OP
YEAR AND SEMESTER:	1th - Second semester

LIST OF TOPICS

MODULE 1. Planning and organization of the event

MODULE 2. Planning the development of scientific events

MODULE 3. Preparation for participation in the scientific event

MODULE 4. Participation in the scientific event

MODULE 5. Closure of the scientific event and evaluation of the experience

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:
N/A

TOPIC:
N/A

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- English language
- Familiarity with the web search tools

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Challenges Analysis. The student analyze the challenges of engineering in the 21st century.
- Effective communication. The student use the appropriate style to facilitate the understanding of the reader taking into account their expectations and previous knowledge
- Flexible Behaviour. The student brings ideas to the group and is flexible to adapt his ideas to the group (observed in meetings of teams with the teacher).
- Self-Organization. The student is able to organize and direct their learning autonomously to expand their knowledge in a subject.
- Communication mean use. The student developed the ability to use graphic resources and the necessary means to effectively communicate information.

STUDENT OUTCOMES

- ABET_1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration fo public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- ABET_3. An ability to communicate effectively with a range of audiences
- ABET_5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- ABET_6. An ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgment to draw conclusions
- ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPHY

TEXT BOOKS

N/A

OTHER MATERIALS

Selection of scientific works and technological. Bibliography. Search in databases.

Thematic library in manager web references. Web resources.Library by topic in the reference manager

Mendeley.

Virtual class. Web resources.Telematics teaching with web resources: TEAMS, ZOOM, BLACKBOARD, etc.

53001980 – Communication and outreach of science and technology

CREDITS:	4,0 ECTS
DEPARTMENT:	Chemical and Environmental Engineering
COURSE COORDINATOR:	Gabriel Pinto Cañón
TYPE:	Elective (transversal competences)
YEAR AND SEMESTER:	First/Second Year, 2nd Semester

LIST OF TOPICS

MODULE 1. The language of science and technology.

MODULE 2. Communication and dissemination of science and technology

MODULE 3. Science and technology outreach

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Basic knowledge of science and technology
- Familiarity with the basics of computer programs for word processing and presentations.

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Know some contributions of engineering to the development of mankind.
- Organize the information
- Know the influence of scientific and technical discoveries in the transformation of societies.
- Ability to communicate their conclusions and knowledge to non-specialized audiences of a clear mode.
- Expand their communication skills (the ability to transmit knowledge, express ideas and arguments in a clear, rigorous and convincing way, both orally and written), using graphic resources and the necessary means.
- Correctly uses oral communication techniques.
- Ability to communicate their conclusions, and the knowledge and ultimate reasons that support them, to specialized audiences in a clear and unambiguous way.

STUDENT OUTCOMES

- ABET_3. An ability to communicate effectively with a range of audiences

BIBLIOGRAPHY

TEXT BOOKS

OTHER MATERIALS

Presentations and documents available to students on the Moodle platform