2nd Year

Common Courses

1. 55000011 Differential Equations
2. 55000012 Statistics
3. 55000013 Thermodynamics I
4. 55000014 Mechanics I
5. 55000015 Electrotechnics
6. 55000016 Environmental Engineering
7. 55000017 Electromagnetic Field and Waves
8. 55000018 The Corporation and its Environment
9. 55000019 Electrical Machines
10. 55000020 Experiments Designs and Regression Models
11. 55000021 Advanced Calculus
12. 55000023 Systems Dynamics
13. 55000029 Thermodynamics II

55000011 - DIFFERENTIAL EQUATIONS

CREDITS:	6 ECTS
DEPARTMENT:	Industrial and Applied Mathematics (MAT)
COURSE COORDINATOR:	Pedro Galán del Sastre
TYPE:	Common
YEAR AND SEMESTER:	2nd Year / Fall

LIST OF TOPICS

MODULE 1. Introduction to O.D.E.s (ordinary differential equations)

- 1) Formulation and solution to initial value and boundary value problems.
- 2) Elementary methods for solving O.D.E.s: exact, separable, linear, homogeneous and Bernoulli equations.

MODULE 2. Linear methods

- 3) First order linear differential systems. Exponential of a matrix. Non-homogeneous systems.
- 4) Higher order linear O.D.E.s. Fundamental system of solutions. Nonhomogeneous case: variation of constants and undeterminate coefficients.
- 5) Notions on O.D.E.s and linear differential systems with variable coefficients. Change of variables. Order reduction. Euler's equation.
- 6) Plane linear differential systems: nodes, spirals and centers.

MODULE 3. Partial differential equations (P.D.E.)

- 7) Notions on P.D.E.s Problems of mathematical physics: traffic flow model, wave equation, Laplace and heat equations.
- 8) Quasi linear first order P.D.E.s. Characteristic curves. Shock waves.
- 9) Solving P.D.E.s by the method of separation of variables. Fourier series.

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE: Calculus I, Calculus II, Algebra.

TOPIC: All the items on the above-mentioned courses are needed

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- A good command on mathematical language
- A knowledge of the rules of mathematical logic: implication, equivalence, necessary or sufficient condition, etc.
- An ability to make calculations with ease.
- A skill in the use of mathematical tools: a) Elementary techniques of Calculus: derivatives, chain rule, calculation of antiderivatives, differential calculus of real functions of several variables. b) Techniques of Linear Algebra: matrix calculus, diagonalization, eigenvalues and eigenvectors. c) Elementary handling of complex numbers: exponentials, plotting.
- Basic concepts of General Physics: velocity, acceleration, force fields, etc.
- Study and concentration skills.

SPECIFIC OUTCOMES FOR THE COURSE

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

- A capacity for abstraction and general concepts recognition in practical situations.
- Provides a diverse range of tools to address the treatment of natural processes.
- A skill to formulate and analyze models of natural processes.
- A skill to interpret the results obtained and evaluate the models that have been used.
- An ability to apply analytical methods for solving technical problems known from other subjects.
- Provides a wide panorama of classical models applied in very different fields: mechanics, theoretical ecology, economy, epidemiology, etc.

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_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPHY

TEXT BOOKS

Sistemas Dinámicos. Una introducción a través de ejercicios.
E. Sánchez, J. González y J. Gutiérrez Editorial Sección de Publicaciones de la E.T.S.I. Industriales de la U.P.M.

OTHER MATERIALS

There is a publication including exams of the last years with their solutions as well as a compilation of exercises to help students with the learning process.

55000012 - STATISTICS

CREDITS:	6 ECTS
DEPARTMENT:	Organization Engineering, Business Admnistration and Statistics(MAS)
COURSE COORDINATOR:	Jesús Juan Ruiz
TYPE:	Common
YEAR AND SEMESTER:	2nd Year / Fall

LIST OF TOPICS

MODULE 1:

1) Descriptive statistics.
2) Probability.
3) Random variable.

MODULE 2:

4) Probability models.
5) Point estimation.
6) Confidence intervals and hypothesis testing.

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE: Calculus, Algebra

TOPIC: Derivatives, integral, vector and matrix manipulation

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Numerical and spatial reasoning.
- Critical interpretation of results.

SPECIFIC OUTCOMES FOR THE COURSE

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

- Identify problems that may arise in statistical terms.
- Interpret and communicate the results of the statistical analysis rigorously using the appropriate language.
- Understand the limitations of the statistical models when working with real problems. Assess possible alternative methods.
- Used for general statistical analysis and scientific computation computer programs.
- Stand with critical attitude to the validity of the calculations and results.

STUDENT OUTCOMES

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

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

BIBLIOGRAPHY

TEXT BOOKS

OTHER MATERIALS

• Estadística (Transparencias y problemas). Servicio de Publicaciones ETSII (2012).

• Caro Huertas, E., Carpio Huertas, J., Juan Ruiz, J.; Rodriguez Gallego, A.; y Santos Penido, F. (2012), Estadística con R, Servicio Publicaciones ETSII.

• Peña, D. Fundamentos de Estadística, Alianza Editorial (2001).

• Juan, J.; Palomo, J.G.; Sánchez, M.J.; Sánchez, I. Problemas resueltos de Estadística, Síntesis (2000)

55000013 - THERMODYNAMICS I

CREDITS:	4.5 ECTS
DEPARTMENT:	Energy Engineering (ENE)
COURSE COORDINATOR:	Rafael Nieto
TYPE:	Common
YEAR AND SEMESTER:	2nd Year / Fall

LIST OF TOPICS

MODULE 1. Principles of thermodynamics in closed systems

- 1) Basic Concepts
- 2) Zero, first and second Principles.
- 3) Exergy, potentials, coefficients and partial differential relations

MODULE 2. Thermodynamic properties of pure substances

- 4) Thermodynamic equilibrium and stability
- 5) Heterogeneous systems and equations of State
- 6) Departure functions
- 7) Fugacity

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Abstract reasoning
- Handling of partial derivatives and change of variables
- Management of physical units
- Ability to express in mathematical language problems from the physical world and engineering.
- Skill in calculations with derivatives and integrals of elementary functions

SPECIFIC OUTCOMES FOR THE COURSE

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

- Apply the Principles of classical thermodynamics to closed systems
- Formulate differential relations between thermodynamic properties • Calculate thermodynamic properties of pure components
- Solve multi-phase equilibrium problems in one-component 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

Problemas de Termodinámica
J.M. Lacalle, R. Nieto, M.C. González Editorial Sección de Publicaciones de la E.T.S.I.I., 2002

Cuestiones de Termodinámica
R. Nieto, J.M. Lacalle, M.C. González, J. Honduvilla, A. Teijeiro, F. Herrero, J. Turet Editorial Síntesis, 1998

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

OTHER MATERIALS

55000014 - MECHANICS

CREDITS:	4.5 ECTS
DEPARTMENT:	Applied Physics and Materials Engineering (P&M) Jesús de
COURSE COORDINATOR:	Vicente y Oliva
TYPE:	Common
YEAR AND SEMESTER:	2nd Year / Fall

LIST OF TOPICS

MODULE 1. Kinematics of rigid body

- 1) General movement of rigid bodies
- 2) Plane Kinematics

MODULE 2. Static systems

- 3) Spherical Kinematics
- 4) Newtonian Statics
- 5) Analytical statics: principle of virtual works

MODULE 3. Rigid body dynamics

- 6) Statics of cables
- 7) Kinetics of systems: application to rigid body
- 8) Free rigid body dynamics
- 9) Dynamics of a rigid body with fixed axis
- 10) Dynamics of the rigid body in plane motion
- 11) Dynamics of a rigid body with a fixed point

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE: "Caculus I", "Calculus II", "Algebra" and "General Physics I"

TOPIC: Mathematics and Physics

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 resolve problems of kinematics of rigid body, especially in the cases of flat or spherical movement
- Ability to resolve problems of static systems with Newtonian or analytical approach (principle of virtual works)
- Ability to resolve problems of statics or dynamics of rigid solids in the presence of friction sliding, rolling and the balancing
- Ability to resolve problems of dynamics of elementary sets with movements that are predefined in the presence of engines or other actuators

STUDENT OUTCOMES

- ABET_1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- ABET_6. An ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgment to draw conclusions

BIBLIOGRAPHY

TEXT BOOKS

Problemas de examen resueltos de la asignatura de Mecánica.
Scala, J.J., Sánchez Pérez, A.M. y Díaz de la Cruz, J.M. Editorial Sección de Publicaciones ETSII-UPM., 1996 y 1998.

Problemas de Mecánica Teórica.
Mesherski, I. Editorial Mir, 1974

Mecánica Analítica.
Díaz de la Cruz Cano, J.M., Sánchez Pérez, A.M. y Ramiro Herranz, F. Editorial Sección de Publicaciones ETSII-UPM., 2001

Problemas de examen resueltos de la asignatura de Mecánica.
Scala, J.J., Sánchez Pérez, A.M. y Díaz de la Cruz, J.M. Editorial Sección de Publicaciones ETSII-UPM., 1996 y 1998.

Mecánica I
Díaz de la Cruz, J.M. y Sánchez Pérez, A.M. Editorial Sección de Publicaciones ETSII-UPM, 2001

Mecánica II.
Díaz de la Cruz Cano, J.M. y Sánchez Pérez, A.M. Editorial Sección de Publicaciones ETSII-UPM, 2001

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

OTHER MATERIALS

http://faii.etsii.upm.es/ http://mecfunnet.faii.etsii.upm.es/

https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=5892

55000015 - ELECTROTECHNICS

CREDITS:	4.5 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronics Engineering and Industrial Informatics (AUT)
COURSE COORDINATOR:	Mohamed Izzeddine Izzeddine
TYPE:	Common
YEAR AND SEMESTER:	2nd Year / Fall

LIST OF TOPICS

MODULE 1. Fundamentals of the theory of electrical circuits

- 1) Fundamentals of circuit theory.
- 2) Ideal circuit elements.
- 3) Actual circuit elements.
- 4) Power and energy in electrical circuits.

MODULE 2. Methods of analysis of electrical circuits

- 5) Associations of circuit elements.
- 6) Systematic methods of analysis of circuits.
- 7) Theorems of circuit theory.

MODULE 3. Alternating current circuits

- 8) Fundamentals of the sinusoidal steady-state.
- 9) Power in the sinusoidal steady-state.

MODULE 4. Polyphase circuits

- 10) Balanced three-phase systems.
- 11) Power on balanced three-phase systems.

MODULE 5. Transient Circuits

- 12) First order transient circuits.

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Critical thinking in the analysis of results and notion of the orders of magnitude.
- Capacity of abstraction and representation of engineering problems.
- Ability to establish interrelationships between different physical phenomena.

SPECIFIC OUTCOMES FOR THE COURSE

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

- Know and use the principles of circuit theory.
- Systematically analyze the behavior of electrical circuits, identifying specific performance characteristics of the most common schemes in electrical engineering: DC, AC and transients.
- Recognize some technological applications of electricity and use the knowledge gained in solving common problems.
- Know how to assemble electric circuits and use the basic measuring instruments: ammeter, voltmeter, wattmeter, and oscilloscope.

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

Circuitos Eléctricos. Volumen I
Pastor, A.; Ortega, J.; Parra V.M.; Pérez, A. Editorial Universidad Nacional de Educación a Distancia, 2003

Electrotecnia General (Problemas propuestos en examen)
VV. AA. Editorial Sección de Publicaciones de la ETSII. Madrid.

Problemas resueltos de Electrotecnia
A. Hernández, R. M.ª de Castro, M. Izzeddine, R. Asensi, J. Martínez, S. Martínez Editorial Sección de publicaciones de la ETSII,2007

OTHER MATERIALS

Los disponibles en la plataforma AulaWeb

55000016 - ENVIROMENTAL ENGINEERING

CREDITS:	3 ECTS
DEPARTMENT:	Chemical and Environmental Engineering (CHE)
COORDINATOR:	Rafael Borge
TYPE:	Common
YEAR AND SEMESTER:	2nd Year / Fall

LIST OF TOPICS

MODULE 1. Pollution Prevention and Control. Best Available Techniques

MODULE 2. Atmospheric pollution and gas treatment

MODULE 3. Water pollution and wastewater treatment

MODULE 4. Soil pollution and waste management

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

Basic knowledge of general chemistry and physics: fluid mechanics, mass and energy balances

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 knowledge
- Ability to identify, formulate, and solve engineering problems

- Understanding the impact of engineering solutions in a global and social context
- Knowledge of contemporary issues

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

BIBLIOGRAPHY

TEXT BOOKS

- Ingeniería ambiental, G. Kiely. McGraw Hill. 1999
- Ingeniería ambiental, Henry, J. Glynn. Prentice-Hall. 1999
- Manual de referencia de la ingeniería ambiental, Corbitt, Robert A. McGraw Hill. 2003
- Handbook of Environmental Engineering Calculations, C.C. Lee, Shun Dar Lin, McGraw Hill, 2007, 2nd ed.
- Ingeniería y control de la contaminación del aire, Noel de Nevers, McGraw Hill, 1998.
- Fundamentals of atmospheric modelling, Mark Z. Jacobson. Cambridge University Press. 2005. 2nd ed.
- Wastewater engineering treatment and reuse, Metcalf &Eddy. McGrawHill. 2003. 4th ed.
- Handbook of solid waste management, George Tchobanoglous y Frank Kreith. McGraw Hill. 2002. 2nd ed.
- Hazardous waste management, Michael D. LaGrega. McGraw Hill. 2001. 2nd ed.

OTHER MATERIALS

- Class presentations and exercises
- Thematic glossaries
- Class videos

55000017 - ELECTROMAGNETIC FIELDS AND WAVES

CREDITS:	6 ECTS
DEPARTMENT:	Applied Physics and Materials Engineering (P&M)
COURSE	José Mª Díaz de la Cruz
COORDINATOR: TYPE:	Common
YEAR AND	2nd Year / Spring

LIST OF TOPICS

MODULE 1. Maxwell equations and Electrostatics

MODULE 2. Maxwell equations and Magnetostatics

MODULE 3. Systems of conductors and currents in vacuum

MODULE 4. Energy and forces between conductors in vacuum

MODULE 5. Energy and forces between currents in vacuum

MODULE 6. Dielectric materials

MODULE 7. Magnetic materials

MODULE 8. Magnetic circuits

MODULE 9. Generalization of energy and forces in systems of conductors and currents in materials

MODULE 10. Basic principles of generators and motors

MODULE 11. Other applications of slowly varying electromagnetic fields

MODULE 12. Electromagnetic waves: propagation

MODULE 13. Generation of electromagnetic waves

MODULE 14. Propagation of waves in linear media.

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_6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

BIBLIOGRAPHY

TEXT BOOKS

Engineering Electromagnetics
Hayt, W.H.; Buck, J.A. Editorial McGraw-Hill, 2006

Fundamentos de la Teoría Electromagnética
Reitz, J. R.; Milford, F. J. y Christy, R. W. Editorial Addison-Wesley Iberoamericana, 1996

Elements of Electromagnetics
Sadiku, M.N.O. Editorial Saunders College Publishing, 1994

Campos y Ondas Electromagnéticos
Lorrain, P. y Corson, D. R Editorial Selecciones Científicas, 1972

Introduction to Electrodynamics
Griffiths, D.J. Editorial Prentice-Hall, 1989

OTHER MATERIALS

https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=6218

55000018 - THE CORPORATION AND ITS ENVIRONMENT

CREDITS:	6 ECTS
DEPARTMENT:	Organization Engineering, Business Admnistration and Statistics(MAS)
COURSE COORDINATOR:	Irene Sanz Mendiola / Ramón Fisac García
TYPE:	Common
YEAR AND SEMESTER:	2nd Year / Spring

LIST OF TOPICS

MODULE 1. Economics

- 1) Economic science and the bases of economic reasoning
- 2) The economy and the unit of consumption
- 3) Theory of Production and costs
- 4) The Markets
- 5) The national economy and GDP
- 6) Money and the money market
- 7) Inflation and unemployment. Aggregate supply and demand

MODULE 2. Management and administration of companies

- 8) Introduction to the company
- 9) Environment and evolution
- 10) investment decision
- 11) Staff, production and innovation
- 12) Financial management
- 13) Marketing management
- 14) CSR and laws

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Interrelation of expressions and resolutions analytical and graphic; interpretation of concepts in the real environment
- Numerical and spatial reasoning
- Critical interpretation of results

SPECIFIC OUTCOMES FOR THE COURSE

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

- Observation, identification, analysis and interpretation of the behavior of economic fundamentals
- Basic theoretical knowledge for the management of organizations
- Managerial skills (communication, motivation, conflict resolution), for the management of the common situations in the enterprise

STUDENT OUTCOMES

- 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

BIBLIOGRAPHY

TEXT BOOKS

Economía
N. Gregory Mankiw, M. P. Taylor
Ed. Paraninfo
2017

Economía : teoría y política
Francisco Mochón Morcillo
6ª ed., Madrid. McGraw-Hill
2009

Fundamentos de Dirección de Empresas.
M. Iborra, A. Dasí, C. Dolz y C. Ferrer.
Ed. Paraninfo, 2014.

OTHER MATERIALS

55000019 - ELECTRICAL MACHINES

CREDITS:	4.5 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronics Engineering and Industrial Informatics (AUT)
COURSE COORDINATOR:	Luis Fernández Beites
TYPE:	Common
YEAR AND SEMESTER:	2nd Year / Spring

LIST OF TOPICS

MODULE 1. Transformers (21 h)

- 1) Single phase transformer (4 h)
- 2) Equivalent circuit. Voltage drop and short circuit current (6 h)
- 3) Transformers working in parallel connection(4h)
- 4) Three-phase transformers. Index schedule (4 h).
- 5) Auto-transformers, instrument transformers (current transformers and voltaje transformers) (3 h).

MODULE 2. Rotating electrical machines. Synchronous machines. Direct current machines

- 6) Creating a rotating sine wave magnetic field (2 h)
- 7) EMF induced by a sine wave field (1 h)
- 8) S.M. Description. Cylindrical rotor machine / salient poles. Linear model. (2 h)
- 9) S.M. isolated operation and operation coupled to a network of infinite power. Regulation of Active Power and Reactive Power. (2 h)
- 10) Description and operation of DC machine. (2 h)

MODULE 3. Asynchronous machines (15 h)

- 11) Description. Equivalent circuit (5 h).
- 12) Operating as a motor. Mechanical characteristic (4 h).
- 13) Operating as generator and brake. Starting process. (4 h).
- 14) Speed regulation of asynchronous Motors (2 h).

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Ability to establish interrelationships between different physical phenomena.
- Critical thinking in the analysis of results and notion of the orders of magnitude
- Capacity of abstraction and representation of the engineering problems

SPECIFIC OUTCOMES FOR THE COURSE

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

• Analyze the model and parameters that are used for the operation of an electrical drive with asynchronous machine and their possible regimes (motor-generator - brake).

• Analyze the model and parameters that are used to control the operation of a synchronous generator working in isolated and coupled to the grid network.

• Basic knowledge of the functioning of machines of direct-current

• Know mount electric circuits and use the basic measuring instruments (ammeter, voltmeter, wattmeter, oscilloscope), for testing of electric machines

• Analyze the model and parameters that are used for the operation of a transformer and its limits

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

Máquinas Eléctricas
Jesús Fraile Mora Editorial Mc Graw Hill, 2003

Transformadores y Máquinas Eléctricas Asíncronas.
C. Veganzones, F. Blázquez, J. Rodríguez, A.M. Alonso. Editorial Sección de Publicaciones de la ETS de Ingenieros Industriales, 2004

Problemas Resueltos de Transformadores y Máquinas Asíncronas
F. Blázquez, L.F. Beites, C.A. Platero, D. Ramírez, J. Rodríguez, C. Veganzones Editorial Sección de Publicaciones de la ETS de Ingenieros Industriales., 2013

Ensayos Básicos de Máquinas Eléctricas
C.A. Platero, D. Ramírez, F. Blázquez. Editorial Sección de Publicaciones de la ETSI Industriales., 2010

OTHER MATERIALS

En Aulaweb: Colección de problemas, exámenes antiguos con solución, guiones de prácticas de laboratorio, presentaciones de clase, bibliografía complementaria, ejercicios de autoevaluación, horarios de tutoría, etc.

55000020 - EXPERIMENTAL DESIGNS AND REGRESSION MODELS

CREDITS:	3 ECTS
DEPARTMENT:	Organization Engineering, Business Admnistration and Statistics(MAS)
COURSE COORDINATOR:	Eduardo Caro Huertas
TYPE:	Common
YEAR AND SEMESTER:	2nd Year / Spring

LIST OF TOPICS

MODULE 1. Analysis of variance

- 1) Comparing two treatments
- 2) Comparison K treatments

MODULE 2. design of experiments

- 3) (Two factors) factorial designs
- 4) randomised blocks
- 5) (3 factors) factorial designs

MODULE 3. linear regression.

- 6) simple regression
- 7) Multiple regression

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Numerical and spatial reasoning.
- Critical interpretation of results.

SPECIFIC OUTCOMES FOR THE COURSE

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

- Stand with critical attitude to the validity of the calculations and results
- Identify problems that may arise in in statistical terms
- Interpret and communicate the results of the statistical analysis rigorously using the appropriate language
- Understand the limitations of the statistical models when you work with real problems
- Use for general statistical analysis and scientific computation computer programs

STUDENT OUTCOMES

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

Problemas resueltos de Estadística
Juan, J.; Palomo, J.G.; Sánchez, M.J.; Sánchez, I. Editorial Editorial Síntesis, 2000

Regresión y Diseño de Experimentos
Daniel Peña. Editorial Alianza Editorial, 2010

OTHER MATERIALS

Problemas resueltos de Estadística Juan, J.; Palomo, J.G.; Sánchez, M.J.; Sánchez, I. Editorial Síntesis, 2000 Regresión y Diseño de Experimentos Daniel Peña. Alianza Editorial, 2010 Diseño de experimentos y regresión (Transparencias y problemas). Servicio de Publicaciones ETSII (2012). Caro Huertas, E., Carpio Huertas, J., Juan Ruiz, J.; Rodriguez Gallego, A.; y Santos Penido, F. (2012), Estadística con R, Servicio Publicaciones ETSII.

55000021 - ADVANCED CALCULUS

CREDITS:	3 ECTS
DEPARTMENT:	Industrial and Applied Mathematics (MAT)
COURSE COORDINATOR:	Bernardo de la Calle Ysern
TYPE:	Common
YEAR AND	2nd Year / Spring

LIST OF TOPICS

MODULE 1. Multiple integrals.

• 1) Double integrals over rectangles, triple integrals over parallelepipeds. Iterated integration: Fubini's theorem. Integration of continuous functions over normal regions in two and three dimensions. Change of variables. Polar coordinates; cylindrical and spherical coordinates. Symmetry properties. Applications: area, volume, geometric center, center of mass, moment of inertia.

MODULE 2. Curves. Line integrals. Green's theorem.

• 2) Curves: implicit and parametric form. Arcs and closed curves. Tangent vector and length of a curve. Line integral of a scalar field along a curve. Line integral of a vector field. Independence of the path: conservative fields and gradient vectors. Potential function. Green's theorem.

MODULE 3. Three-Dimensional field theory.

• 3) Curl of a vector field. Irrotational and gradient fields. Simply connected regions. Sufficient condition for a vector field to be conservative. Potential function. Divergence of a vector field: solenoidal field. Vector potential. Star domains. Sufficient condition for a field to be solenoidal. Vector potential for a solenoidal field.

MODULE 4. Surfaces and surface integrals. Gauss and Stokes theorems.

• 4) Implicit and parametric representation. Surfaces of revolution and ruled surfaces. Tangent plane and normal vector. Orientable surfaces. Closed surfaces and surfaces with boundary. Area of a surface. Surface integral of a scalar field. Flux of a vector field across a surface.
• 5) Gauss divergence theorem and applications. Stokes's theorem and applications.

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE: Calculus I and II

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Study skills and concentration
- Knowledge of elementary plane and space geometry
- Ability to perform basic mathematics operations.
- Ability to use the tools of calculus: Differential calculus of one and several variables and integral calculus of one variable.

SPECIFIC OUTCOMES FOR THE COURSE

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

- Understanding the concept of multiple integral and its relation to various physical quantities. Acquisition of the techniques of integral calculus.
- Understanding the concepts of line integral and surface, their relationships with various physical quantities and their close relationship with the field theory.
- Understanding the basics of field theory.
- Acquisition of a global vision of the relationship between different types of integrals are introduced: multiple, curvilinear, and surface (Green theorems in the plane and Gauss and Stokes in space).
- Viewing through examples of the connection between mathematical concepts and other subjects of the degree.
- Development of the capacity for abstraction and deepening in acquiring the skills necessary to understand and demonstrate and apply the deductive method.
- Capacity building for distinguishing proofs from plausible or heuristics reasoning.
- Ability to formulate mathematical models of simple real problems and ability to apply analytical solutions to these problems.
- It provides tools and concepts in specific subjects of Engineering, and Mechanics, Electromagnetism and Electrical Machines.
- Capacity development of spatial vision. Acquiring analytical techniques and differential geometry for handling curves, surfaces and solids in the plane and space.

STUDENT OUTCOMES

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

BIBLIOGRAPHY

TEXT BOOKS

Cálculo inifitesimal de varias variables
J. de Burgos, McGraw-Hill, 1995.

Introducción al Cálculo y al Análisis Matemático (vol. II).
R. Courant, F. John, Limusa, 2005.

Cálculo Vectorial
J. E. Marsden, A. J. Tromba, 6ª ed., Pearson, 2018

Calculus. A Complete Course.
R. A. Adams, C. Essex, 9ª ed., Pearson 2018.

OTHER MATERIALS

- Collection of problems with detailed solutions. Collection of past exams with detailed solutions. Short videos and manuals.

55000023 - SYSTEMS DYNAMICS

CREDITS:	3 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronics Engineering and Industrial Informatics (AUT)
COURSE COORDINATOR:	Jaime del Cerro Giner
TYPE:	Common
YEAR AND SEMESTER:	2nd Year / Spring

LIST OF TOPICS

MODULE 1. Systems modelling

- 1) Introduction
- 2) Signals and systems
- 3) Modeling of physical systems
- 4) Laplace transform
- 5) Transfer function

MODULE 2. Systems analysis

- 6) Dynamic analysis
- 7) First order systems
- 8) Second order systems
- 9) Higher-order systems
- 10) Polynomial stability analysis

MODULE 3. Practice

- 11) Introduction to MATLAB. Systems modelling
- 12) Analysis of systems. SIMULINK

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Ability to understand the model in differential equation of a physical system.
- Ability to develop basic mathematical calculations.
- Capacity of critical interpretation of results.

SPECIFIC OUTCOMES FOR THE COURSE

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

- Ability to model linear dynamic systems by its transfer function.
- Ability to model non-linear systems by linear models approximated around its operating point.
- Ability to understand the dynamic behavior of any continuous linear system represented by its transfer function.
- Skill in the management of the control of MATLAB and Simulink Toolbox.
- Ability to work with physical systems via block and Simulink diagrams.
- Ability to analyze linear systems in the frequency domain.

STUDENT OUTCOMES

- ABET_1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- ABET_6. An ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgment to draw conclusions

BIBLIOGRAPHY

TEXT BOOKS

Sistemas de Control Automático
B. Kuo Editorial Prentice Hall, 7ª edición

Sistemas de Control Moderno
R.C. Dorf y R.H. Bishop Editorial Prentice Hall

Teoría de Sistemas
F. Matía, A. Jiménez, R. Aracil, E. Pinto Editorial Sección Publicaciones ETSIIM, 2006-4ª Edición

Ingeniería de Control Moderna
K. Ogata Editorial Prentice Hall, 4ª edición

Process Modeling, Simulation and Control for Chemical Engineers
W.L. Luyben Editorial McGraw Hill

Fundamentos de Control con Matlab
E. Pinto y F. Matía Editorial Pearson, 2010

OTHER MATERIALS

System Dynamics uses Moodle as LMS (learning Management System platform) so as to provide students with additional info such as laboratory info, videos, exam solutions and slides used by professor during the class.

55000029 - THERMODYNAMICS II

CREDITS:	4.5 ECTS
DEPARTMENT:	Energy Engineering (ENE)
COURSE COORDINATOR:	Rafael Nieto Carlier
TYPE:	Common
YEAR AND SEMESTER:	2nd Year / Spring

LIST OF TOPICS

MODULE 1. Diagrams and Statistical Thermodynamics

- 1) Thermodynamic diagrams
- 2) Statistical Thermodynamics and Third Law

MODULE 2. Principles of thermodynamics in open systems

- 3) General equations in open systems
- 4) Steady-state processes and applications on open systems
- 5) Non-steady-state processes

MODULE 3. Thermodynamic properties in multicomponent and reactive systems

- 6) Multicomponent homogeneous systems
- 7) Ideal models of mixing and real mixtures
- 8) Chemical reacting systems
- 9) Balance and stability in multicomponent multiphase and reactive systems

MODULE 4. Applications of thermodynamics to industrial systems

- 10) Rankine cycles. Other cycles: Brayton cycle cryogenic cycle

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Skill in calculations with derivatives and integrals of elementary functions
- Ability to express in mathematical language problems from the physical world and engineering.
- Principles of classic Ternodinamics in closed systems
- Formulate differential relations between the thermodynamic variables
- Determine thermodynamic properties of pure components
- Solve problems of phase equilibrium in one-component systems

SPECIFIC OUTCOMES FOR THE COURSE

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

- Calculate the significant thermodynamic properties and efficiency in direct and reverse cycles
- Interpret most commonly used thermodynamic diagrams
- Calculate thermodynamic properties of ideal mixtures
- Relate macroscopic and microscopic properties
- Apply the Principles of Thermodynamics to open systems
- Calculate caloric effects in one-reaction systems
- Solve problems of chemical equilibrium in one-reaction and one-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

Problemas de Termodinámica
J.M. Lacalle, R. Nieto, M.C. González Editorial Sección de Publicaciones de la E.T.S.I.I., 2002

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

Cuestiones de Termodinámica
R. Nieto, J.M. Lacalle, M.C. González, J. Honduvilla, A. Teijeiro, F. Herrero, J. Turet Editorial Síntesis, 1998

OTHER MATERIALS