3rd/4th Year

Track 3: Smart Systems and Structures

1	55001094	Applied Mathematics
2	55001069	Structural Analysis and Simulation
3	55000302	Civil Engineering Graphics
4	55000303	Industrial Architecture and Construction
5	55000304	Structural Analysis I
6	55000305	Matrix Methods and Structural Dynamics
7	55000306	Structural Analysis II
8	55000307	Mechanical Installations

55001094 - APPLIED MATHEMATICS

CREDITS:	4.5 ECTS
DEPARTMENT:	Industrial and Applied Mathematics (MAT)
COURSE COORDINATOR:	Luis Sanz Lorenzo
TYPE:	Common
YEAR AND SEMESTER:	3rd Year / Spring

LIST OF TOPICS

MODULE 1. Direct Stiffness Method in some engineering problems

- Systems of springs. Static and Dynamic analysis.
- Systems of articulated bars.

MODULE 2. Interpolation

- Polynomial interpolation.
- Nodal Basis functions
- Interpolation using other families of functions.

MODULE 3. Numerical integration and differentiation

- Quadature formulae.
- Newton-Cotes formulae
- Gaussian quadrature.
- Numeric differentiation.

MODULE 4. Numerical solution of Linear Systems

- Direct methods.
- Iterative methods.

MODULE 5. Roots of nonlinear equations and systems of nonlinear equations

- Scalar case.
- Systems of equations.
- Pseudosolutions and equation solving through minimization.

MODULE 6. Approximation of Data

- General Least squares problems.
- Linear least squares.

MODULE 7. Numerical Solution of initial value problems in Ordinary Differential Equations

- Euler implicit and explicit methods.
- Runge-Kutta methods.
- Some notions about stability of schemes.

MODULE 8. The Finite Element Method

- Weak formulation
- Galerkin method
- FEM in 1D problems
- The local approach

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES: Algebra (55000002), Calculus 1 (55000001), Calculus 2 (55000008), Differential equations (55000011), Fundamentals of programming (55000007), Materials Resistance (55000027)

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Basic concepts of elasticity: displacements, strain and stress.
- Basic mathematics: Calculus, algebra and differential equations.
- Fundamentals of programming.

SPECIFIC OUTCOMES FOR THE COURSE

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

- Programming in Matlab environment.
- Application of numerical methods to problems of mechanical engineering.

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, analyze 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

Class notes, and collection of solved problems available to students through Moodle platform.

55001069 – Structural Analysis and Simulation

CREDITS:	6 ECTS
DEPARTMENT:	Mechanical Engineering (MEC)
COURSE COORDINATOR:	Ricardo Perera Velamazán
TYPE:	Track (Smart Systems and Structures)
YEAR AND SEMESTER:	3rd Year / Spring

LIST OF TOPICS

MODULE 1. TYPES OF STRUCTURE AND COMPUTATIONAL MODELS

MODULE 2. FUNDAMENTALS OF STRUCTURAL ANALYSIS

MODULE 3. FINITE ELEMENT MODELING AND SIMULATION OF TRUSSES AND BEAM STRUCTURES

MODULE 4. BUCKLING

MODULE 5. OPTIMAL DESIGN OF STRUCTURES

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE: STRENGTH OF MATERIALS AND ADVANCED STRENGTH OF MATERIALS

TOPIC: ALL THE TOPICS COVERED IN BOTH COURSES

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Basic math. Skill for the management of the concepts of algebra and differential equations

SPECIFIC OUTCOMES FOR THE COURSE

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

- Modelling of structural problems of bars and beams using computational and mathematical tools.
- Knowledge of the numerical problems in engineering, and the advantages and limitations of resolution methods studied in the course
- Ability to use media computations to implement, adjust and validate mathematical models of reality.

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 for 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

CHANDRUPATLA, T.R. Y BELEGUNDU, A.D. Introduction to Finite Elements in Engineering. Prentice-Hall, 2011.

CONNOR, J.J. y FARAJI, S. Fundamentals of Structural Engineering. Springer, 2016

FEODOSIEV, V.I. Resistencia de Materiales. Editorial Mir, 1980

GORDON, J.E. Estructuras o por qué las cosas no se caen. Editorial Celeste, 1999

LOGAN, D.L. A First Course in the Finite Element Method. CL Engineering 2016.

MACLEOD, I.A. Modern Structural Analysis. Thomas Telford, 2005.

NORRIS, CHARLES H. y WILBUR, J. B. Análisis elemental de Estructuras. Editorial McGraw-Hill, 1973

OCHSNER, A. y MERKEL, M. One-dimensional Finite Elements: An Introduction to the FE Method. Springer Berlin Heidelberg, 2014.

PERERA, R. y GÓMEZ LERA, Mª S. Problemas de Estructuras Articuladas. Editorial Sección Publicaciones ETSII, 1996

PERERA, R. Introducción al Método de Elementos Finitos. Sección de Publicaciones de la ETSII, 2000.

POPOV, E. Mecánica de Sólidos, Pearson, 2000.

REDDY, J.N. An Introduction to the Finite Element Method. New York: McGraw-Hill, 2005

TIMOSHENKO, S. Resistencia de Materiales. Editorial Espasa Calpe, 1976

TIMOSHENKO, S.P. y YOUNG, D.H. Teoría de las Estructuras. Editorial Urmo, 1976

YEOMANS, D. How Structures Work. Wiley-Blackwell, 2009

OTHER MATERIALS

ANSYS SOFTWARE

55000302 - CIVIL ENGINEERING GRAPHICS

CREDITS:	3 ECTS
DEPARTMENT:	Mechanical Engineering (MEC)
COURSE COORDINATOR:	Antonio Carretero Diaz
TYPE:	Track (Construction Engineering)
YEAR AND SEMESTER:	4th Year / Fall

LIST OF TOPICS

MODULE 1. Land representation. Orthographic projection.

• Fundamentals of orthographic projection. Point, line and plane representation. Slope and interval. Graduation straight. Relative positions between straight lines. The drawing: representation, marking. Intersections: straight-plane and plane-plane. Topographic drawing.

MODULE 2. Basic concepts and rules of construction drawing.

• Special drawing and construction standards. Drawings to use in the construction drawing. The topographical drawing and its symbology. • The design of metal construction. • The design of concrete and masonry. • Industrial facilities drawing • Electrical and fluids facilities.

MODULE 3. Introduction to topography.

• Basis •Surveying instruments. •Planimetric, altimetric and stadia surveying. • Stakeout.

MODULE 4. IT tools in the sector.

• BIM methodologies. •Terrain modeling.

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE: 1º

TOPIC: Calculus, Industrial drawing

COURSE: 2º

TOPIC: Statistic

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Knowledge of: representation systems, standardization, scale.
- Handling skills for drawing.
- Basic statistics.
- Basic calculation.
- Useability of technical tools.

SPECIFIC OUTCOMES FOR THE COURSE

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

- Interpretation, development and use of structural elements drawings used in the construction industry, and its facilities
- Incorporate the appropriate use of technical terms in language.
- Knowledge of the basics of the tools used to measure terrain and readiness tasks.
- Using the above tools.
- Introduction to specific software.
- Problem solving graphically.
- Interpretation, development and use of topographic maps.

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

BIBLIOGRAPHY

TEXT BOOKS

Nombre	Tipo	Observaciones
Topografía General y Aplicada	Bibliografía	Domínguez García-Tejero, F. Editorial Mundi-Prensa. 1998. ISBN: 9788471147219
Aplicación del sistema de planos acotados a la resolución de problemas	Bibliografía	Moreno Garcia, D Editorial ETSI Agrónomos
Ejercicios de topografía.	Bibliografía	Santamaría Peña, J.; "Ejercicios de topografía"; Univ. La Rioja; Logroño 2002. ISBN: 84-88713-98-3
Cálculo y normativa básica de las instalaciones en los edificios	Bibliografía	Arizmendi Barnes, L.J; "Cálculo y normativa básica de las instalaciones en los edificios"; Ed. EUNSA; Pamplona 2003. ISBN: 9788431320614

OTHER MATERIALS

Nombre	Tipo	Observaciones
Documentos CTE	Recurso web	En esta página se pueden descargar los documentos aprobados que configuran el marco regulatorio del CTE, así como los documentos de apoyo http://www.codigotecnico.org/index.php/menu-documentoscte
Normas UNE sobre dibujo.	Recurso web	AENOR - Normas UNE on-line https://portal.aenormas.aenor.com/aenor/Suscripciones/Personal/pagina_per_sus.asp
MOODLE asignatura	Plataforma online de la asignatura	Recursos propios, exámenes y material adicional: Curso: Sistemas de Representación en Construcción (upm.es) https://moodle.upm.es/titulaciones/oficiales/course/view.php?id=5133

55000303 – INDUSTRIAL ARCHITECTURE AND CONSTRUCTION

CREDITS:	6 ECTS
DEPARTMENT:	Mechanical Engineering
COURSE COORDINATOR:	R. Álvarez
TYPE:	Track (Construction Engineering)
YEAR AND SEMESTER:	4th year / Fall

LIST OF TOPICS

MODULE 1. The construction sector (4 h)
1) Importance of the construction sector in Europe and in Spain. Subsectors. Diversification and concentration (2 h)
2) Philosophy of industrial architecture. The basic technical project (2h)

MODULE 2. Basic industrial project planning (10 h)
3) Project design and industrial building (6 h)
4) Mandatory rules (4 h)

MODULE 3. Materials and components used in industrial buildings (8 h)
5) Materials used in construction. (6 h)
6) Stamps and marks of quality materials and construction systems (2h)

MODULE 4. Structural system (14 h)
7) Retaining structures and foundations (4 h)
8) Structural types (6 h)
9) Forged (4 h)

MODULE 5. The envelope of the building (14 h)
10) Thermal and acoustic (4 h)
11) Enclosures (6 h)
12) Covers (4 h)

MODULE 6. Partitions and internal finishes (6h)
13) Partitioning for industrial buildings (4 h)
14) Vertical surfaces coverings (1 h)
15) Flooring (1 h)

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Basic math. Skill for the management of the concepts of calculus, algebra and differential equations.
- Familiarity with the basics of programming (best in Matlab)
- Graphics systems management representation.
- Search and analysis of technical documentation.
- Write and present technical solutions.

SPECIFIC OUTCOMES FOR THE COURSE

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

- Relate and analyze needs and technical solutions.
- Application of the methodology of implementation to a case.
- Selection criteria, assessment of alternatives and justification for constructive solutions.

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 for 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

OTHER MATERIALS

Own resources: In Aula Web the students have the following documentation: Reduced syllabus Basic bibliography and Extended bibliography (recommended by subject) Presentations used in the classroom Mandatory normative documents compliance Articles related to the different Topics. Exams Other complementary exercises.

55000304-STRUCTURAL ANALYSIS I

CREDITS:	6 ECTS
DEPARTMENT:	Mechanical Engineering (MEC)
COURSE COORDINATOR:	R. Perera
TYPE:	Track (Construction Engineering)

LIST OF TOPICS

MODULE 1. Introduction

- Introduction
- Structural typologies

MODULE 2. Truss structures

- Governing equations of a bar
- Principle of virtual work
- Finite element approximation
- Assembly: From a bar to a truss

MODULE 3. Frame structures

- Governing equations
- Principle of virtual work
- Finite element approximation
- Assembly: From a beam to a frame
- Buckling

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES: STRENGTH OF MATERIALS and ADVANCED STRENGTH OF MATE

COURSE: TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Understanding of the mechanical behavior of isostatic beams and drawing and dimensioning diagrams efforts of these structural elements

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
- 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

V.I. FEODOSIEV: "Resistencia de Materiales", URSS, 1997

EGOR P. POPOV: "Mecánica de Sólidos", Pearson, 2000.

C.H. NORRIS, J.B. WILBUR: "Análisis elemental de Estructuras", Editorial McGraw-Hill, 1973

R. PERERA, Mª S. GÓMEZ LERA: "Problemas de Estructuras Articuladas", Editorial Sección Publicaciones ETSII, 1996

R. PERERA: "Introducción al Método de Elementos Finitos", Editorial Sección Publicaciones ETSII, 2000

OTHER MATERIALS

55000305 - MATRIX METHODS AND STRUCTURAL DYNAMICS

CREDITS:	4.5 ECTS
DEPARTMENT:	Mechanical Engineering (MEC)
COURSE COORDINATOR:	A. Benavent
TYPE:	Track (Construction Engineering)
YEAR AND SEMESTER:	4th Year / Spring

LIST OF TOPICS

MODULE 1. Introduction

- 1) Structural analysis. Limit states. Hypothesis for the analysis of linear structures. The Principle of Virtual Work in frame structures.

MODULE 2. Matrix analysis of structures

- 2) Flexibility and stiffness matrices. Degree of freedom in local and global coordinates. Transformation of coordinates. Methods for synthesizing the global stiffness matrix and the load vector. Initial stresses and deformations. Calculation of displacements. Calculation of stresses and reactions.

MODULE 3. Dynamic analysis of structures

- 3) Dynamic loads (wind, earthquake, explosion, traffic, etc.). Systems of one degree of freedom. Mass and damping matrices. Natural frequencies and modes of vibration. Modal analysis of systems with N degrees of freedom. Seismic response. Modal spectral analysis. Step by step methods. Response in the frequency domain.

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE: Strength of materials

TOPIC: Material properties, strength of material. Tension/compression. Flexion. Buckling.

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Analytical skills. Computer tools. Critical spirit.

SPECIFIC OUTCOMES FOR THE COURSE

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

- Analyze the stresses and deflections developed in a frame structure when it is subjected to an arbitrary static or dynamic loading. Understand the Principle of Virtual Work as a genenal approach that allows to formulate the equations of equilibrium and compatibility and to unify the treatment of both static and dynamic problems. Understand the systematization of the stiffness method and its implementation in computers. Understand the bases and methods to obtain the dynamic response of a structure.

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 economicfactors
- ABET_3. An ability to communicate effectively with a range ofaudiences
- 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

CÁLCULO MATRICIAL DE ESTRUCTURAS
E. Alarcón, R. Álvarez, Mª S. Gómez Editorial REVERTÉ, 1990

FINITE ELEMENT PROCEDURES IN ENGINEERING ANALYSIS
Klaus-Jürgen Bathe Editorial Prentice – Hall, 1982

MATRIX STRUCTURAL ANALYSIS
W. McGuire & R.H. Gallagher Editorial Wiley, 1979

DYNAMICS OF STRUCTURES
R. W. Clough & J. Penzien Editorial R. W. Clough & J. Penzien, 1982

OTHER MATERIALS

Solved problems. Written material. AulaWeb.

55000306 - STRUCTURAL ANALYSIS II

CREDITS:	4.5 ECTS
DEPARTMENT:	Mechanical Engineering (MEC)
COURSE COORDINATOR:	R. Perera
TYPE:	Track (Construction Engineering)

LIST OF TOPICS

MODULE 1. Introduction

- 1) Grids, plates and thin plates
- 2) Membranes
- 3) Shells

MODULE 2. Plates

- 4) Governing equation. Boundary conditions
- 5) Solution methods
- 6) Buckling

MODULE 3. Shells

- 7) Overview
- 8) Membrane theory
- 9) Bending theory

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES: STRUCTURAL ANALYSIS I

COURSE: TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Capacity to analyse
- Critical spirit
- Use of informatic tools

SPECIFIC OUTCOMES FOR THE COURSE

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

- Use of numerical methods, with emphasis on the Finite Element Method, for solving structural problems. Emphasis is made on the use

of commercial software

- Use of the compatibility, equilibrium and constitutive relationships in plates, membranes and shells
- Distinction of different structural typologies for structural modeling

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

Stresses in plates and shells
A.C. Ugural Editorial McGraw-Hill

Introducción al método de elementos finitos
R. Perera Editorial Servicio de Publicaciones de la ETSI Industriales

Theory and analysis of elastic plates and shells
Reddy Editorial CRC press

Theory of plates and shells
Timoshenko and Woinowsky-Krieger Editorial McGraw-Hill

Estática elemental de las cáscaras
Pflüger Editorial De Eudeba

Theories and application of plates and shells
Szilard Editorial John Wiley and Sons

The behavior of plates and shells
Vinson Editorial John Wiley and Sons

OTHER MATERIALS

55000307 - MECHANICAL INSTALLATIONS

CREDITS:	6 ECTS
DEPARTMENT:	Mechanical Engineering (MEC)
COURSE COORDINATOR:	I. Del Rey
TYPE:	Track (Construction Engineering)
YEAR AND SEMESTER:	4th Year / Spring

LIST OF TOPICS

MODULE 1. Collection, supply and distribution of water

- 1) Study of needs; general approach
- 2) Study the possibilities of acquisition and supply
- 3) Design supply and distribution system: Alternative
- 4) Technological solutions. Regulation (regulation tanks, piping, pumps and other components)

MODULE 2. Sanitation and Drainage

- 5) Alternatives. Unit, separative and semiseparativo systems
- 6) Forced lifting systems
- 7) Technological solutions. Regulation (Components disposal facilities: Materials for pipes, manholes, ventilation networks, pressure groups, connections to the sewer).
- 8) Technological solutions. Regulation (Components disposal facilities: Materials for pipes, manholes, ventilation networks, pressure groups, connections to the sewer).

MODULE 3. Generating hot water and superheated steam

- 9) Definitions and basic concepts
- 10) Fuels for energy generation sources. Solid, liquid and gaseous fuels
- 11) Procurement, supply, transportation and storage of fuels.
- 12) Renewable energy sources for power generation. Regulatory and technological solutions.
- 13) Systems generating hot water and superheated steam (boilers and other systems)

MODULE 4. Distribution and applications of hot water and superheated steam

- 14) Definitions and main applications • 15) Thermal Fluid transport
- 16) Technological solutions. Regulation (Dimensioning and installation of pipes. Networks of hot water, superheated water and steam)

MODULE 5. Air conditioning

- 17) Definitions and Fundamentals (Psychrometry and Comfort)
- 18) Needs Analysis
- 19) Equipment and Technology Solutions

MODULE 6. Ventilation and smoke extraction

- 20) Basics moving hot gases
- 21) Design criteria and needs analysis
- 22) Technological solutions and applicable regulations

MODULE 7. Compressed air

- 23) Fundamentals of Compressed Air
- 24) General criteria for calculation and design
- 25) Preparation of compressed air. Distribution networks
- 26) Technological solutions, regulation and applications (compressors and other components of compressed air installations)

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Analyzing, and select basic components as part of complex systems.

SPECIFIC OUTCOMES FOR THE COURSE

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

- Analyze the needs of water intake and discharge, heat and compressed air from an industrial or business either, which are exerted on the relevant building activity.
- Relate these needs with different technological alternatives as appropriate responses to the needs expressed.
- Resolution of case studies of facilities and distribution of water supplies; generation facilities and distribution of heat and compressed air as well as water drainage in buildings.

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_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

Arquitectura y Urbanismo Industrial
Rafael de Heredia Editorial ETSII, 1981

Real Decreto 1027/2007, por el que se aprueba el RITE, 2007
Código Técnico de la Edificacion
RD 314/2006 del 17 de marzo de 2006 , 2006

Industrial ventilation Design Handbook
H. Goodfellow; E. Tähti Editorial Academic Press, 2001

Calculo y normativa básica de las instalaciones en los edificios
L. Jesus Arizmendi Barnes Editorial Universidad de Navarra, 1995

Fans & Ventilation A practical Guide
WTW Cory Editorial ELSEVIER, 2005

Redes industriales de ubería Bombas para agua ventiladores y
Antoni Luszczewski Editorial Reverté editores, 1999

OTHER MATERIALS: • Transparencias o apuntes con el contenido de la asignatura