



COURSE DESCRIPTIONS

Bachelor's Degree in Technical Architecture

➤ 1st year

6435 PHYSICS I: MECHANICS

I SYSTEMS OF FORCES

Topic 1. Systems of forces.

Introduction.

- 1.1.- Moment of a force with respect to a point.
- 1.2.- Moment of a force with respect to an axis.
- 1.3.- Characteristics of force systems.
 - 1.3.1.- Resultant and resultant moment.
 - 1.3.2.- System Invariants.
 - 1.3.3.- Minimum moment and central axis.
- 1.4.- Types of systems of forces.
 - 1.4.1.- Pair of forces.
 - 1.4.2.- Concurrent forces. Varignon's theorem.
 - 1.4.3.- Parallel forces.
 - 1.4.4.- Coplanar forces.
- 1.5.- Equivalent force systems.
- 1.6.- Reduction of force systems.

II. MASS GEOMETRY

Topic 2. Centres of gravity

Introduction

- 2.1.- Centre of gravity of bodies.
- 2.2.- Static momentum of surfaces.
- 2.3.- Guldin-Pappus Theorem.
- 2.4.- Application: Distributed loads

Topic 3. Momentum of Inertia

Introduction

- 3.1.- Momentum of Surface Inertia.



- 3.2.- Product of Surface Inertia.
- 3.3.- Steiner's Theorem. Translation of Axes.
- 3.4.- Momentum of Inertia with respect to rotated axes. Main axes of inertia.
- 3.4.1.- Momentum of Inertia with respect to a rotated axis.
- 3.4.2.- Main axes of inertia.

III. APPLIED STATIC

4. Static of Rigid Bodies

Introduction

- 4.1.- Rigid Body Concept.
- 4.2.- Degrees of freedom. Diminished degrees of freedom.
- 4.3.- Ligatures. Mechanical effects.
- 4.4.- Equilibrium of rigid bodies.

5. Rigid system static

Introduction

- 5.1.- Equilibrium of various solids.
- 5.2.- Articulated Structures. Spatial and flat.
- 5.3.- Flat Articulated Structures.
- 5.3.1.- External, internal and overall equilibrium.
- 5.3.2.- Analytical methods of resolution.

6. Friction

Introduction

- 6.1.- Mutual actions of contact between solids.
- 6.2.- Sliding friction.

IV. NOTIONS OF ELASTICITY

7. Internal forces in solids

Introduction

- 7.1.- Internal forces in a solid in equilibrium.
- 7.2.- Transversal section requirements.
- 7.3.- Internal forces in a flat beam.
- 7.3.1.- Indication convention.
- 7.3.2.- Equilibrium of a slice.
- 7.3.3.- Solicitation diagrams.
- 7.4.- Study of beams.

8. Fundamentals of elasticity

Introduction

- 8.1.- Elastic bodies. Hooke's Law.
- 8.2.- Longitudinal stresses.



8.2.1.- Traction and compression.

8.2.2.- Pure bending.

8.2.3.- Complex Bending.

6436 APPLIED MATHEMATICS I

Real functions of a real variable

LIMITS AND CONTINUITY

Basic definitions. Limits. Continuity. Properties and theorems.

DERIVATION. GRAPHICAL REPRESENTATION OF FUNCTIONS

Concept of derivative and geometric interpretation. Applications.

INDEFINITE INTEGRAL

Antiderivative of a function. Indefinite integral. Properties. General integration procedures

Defined integral.

APPLICATIONS

Definition and properties. Applications.

MULTI-VARIABLE FUNCTIONS

Real function of two variables. Definitions. Limits and continuity. Derivation and differentiation.

Applications. Concept of double and triple integral. Properties.

Geometric interpretation. Applications.

6437 FUNDAMENTALS OF MATERIALES

Thematic Unit 1. INTRODUCTION TO THE STUDY OF MATERIALS AND TESTS

Topic 1. Concept of material, material, and construction material.

Topic 2. Classification of materials.

Topic 3. Factors that influence the choice of materials.

Topic 4. Characteristics or properties of building materials.

Topic 5. Tests: Definition and Types.

Thematic Unit 2. CHEMICAL AND BIOLOGICAL PROPERTIES OF MATERIALS

Topic 1. Preliminary Concepts.

Topic 2. Structure and state of matter.

Topic 3. Chemical bonding.



Topic 4. Chemical reactions.

Topic 5. Durability of materials.

Topic 6. Biological properties.

Thematic Unit 3. ORGANOLEPTIC PROPERTIES AND THE PHYSICS OF MATERIALS

Topic 1. Organoleptic properties and tests.

Topic 2. Physical properties and tests.

Topic 3. Thermal behaviour and reaction to fire.

Topic 4. Acoustic properties.

Topic 5. Optical properties.

Topic 6. Electrical properties.

Thematic Unit 4. MECHANICAL PROPERTIES OF MATERIALS

Topic 1. Properties or Mechanical characteristics.

Topic 2. Mechanical solicitations (stress/strain).

Thematic Unit 5. REGULATIONS APPLICABLE TO CONSTRUCTION MATERIALS

Topic 1. Standardization and norms. Certification and certificates.

Topic 2. UNE Spanish standards and International standards.

Topic 3. DIT and DITE.

Topic 4. Compulsory compliance laws.

Spanish regulations: LOE, CTE and CE.

Topic 5. Other regulations.

Thematic Unit 6. GEOLOGICAL CHARACTERISTICS OF MATERIALS

Topic 1. General information on Rocks and minerals.

Topic 2. Formation of rocks: Terrestrial Erosive Cycle.

Topic 3. Classification of rocks.

Topic 4. Property of rocks.

Topic 5. Classification criteria of commercial rocks.

Commercial rocks of igneous origin.

Commercial rocks of sedimentary origin.

Commercial rocks of metamorphic origin.

Cutting and commercial forms of rocks: Finishes.

Topic 6. Aggregates for mortars.

Aggregate regulations and concept.

Classification of aggregates.

Specifications of aggregates for mortars.

Topic 7. General information on Lands.

Geological origin, basic components and structures.

Topic 8. Classification of lands according to the CTE.



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Topic 9. Physical properties of lands.

Atterberg densities, porosities, moisture, consistency and limits.

Topic 10. Granulometry of lands: classification according to Casagrande.

Topic 11. Mechanical characteristics of lands: Compressibility.

Topic 12. Chemical characteristics of lands.

Thematic Unit 7. ENVIRONMENTAL IMPACT, WASTE MANAGEMENT AND RECYCLING

Topic 1. Environmental impact.

Topic 2. Waste management.

Topic 3. Recycling and reuse of materials.

TEST PROBLEMS.

LAND PROBLEMS.

LABORATORY PRACTICES.

OTHER ACTIVITIES.

Conferences programmed by the teaching team for the study unit.

6438 CONSTRUCTION I

INTRODUCTION TO CONSTRUCTION

CONSTRUCTION OF A BUILDING

1.1. Introduction. Knowledge of construction. Its impact on the project.

1.2. Elements, function, types according to use.

1.3. Man as a unit of measurement. Proportions.

1.4. Dimensions of spaces and their interconnection.

1.5. The door.

1.6. The staircase.

1.7. Building safety.

1.8. Regulations for the construction of a building.

APPROPRIATE STRUCTURAL SUPPORT. INTRODUCTION TO STRUCTURES

2.1. Purpose and requirements.

2.2. Actions and efforts.

2.3. Construction systems. Operations.

2.4. Materials for the construction of structures.

2.5. Types of buildings. Tall buildings.

2.6. Roofing structures.

THE ENCLOSURES

3.1. Thermal insulation.

3.2. Acoustic insulation.



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- 3.3. Clean air. Ventilation.
- 3.4. The window. Glazing.
- 3.5. Usual types of enclosures.

WATER IN A BUILDING

- 4.1. Clean water.
- 4.2. The evacuation of water.
- 4.3 Humidity.

ENERGY NEEDS IN A BUILDING.

- 5.1. Energy diversity.
- 5.2. Electricity.
- 5.3. Other types of energy.

WASTE IN A BUILDING

- 6.1. Evacuation of liquid waste.
- 6.2. Evacuation of solid waste.
- 6.3. Waste recycling.

QUALITY

- 7.1. Quality.
- 7.2. Quality in construction.
- 7.3. Quality control.

THE PROJECT

- 8.1. The Preliminary Project.
- 8.2. The basic project. Documents.
- 8.3. The execution project. Documents.
- 8.4. Project control.
- 8.5. The project according to the CTE.

THE TERRAIN AND FOUNDATIONS

INTRODUCTION AND GENERAL CONCEPTS

- 1.1. General concepts. Program. Bibliography and regulations.
- 1.2. General construction concepts.
- 1.3. Construction elements.

THE TERRAIN

- 2.1. Lands. Properties. Execution incidence.
- 2.2. Lands. Classification and regulations.
- 2.3. Lands. Geotechnical surveys.
- 2.4. Earth movements. Definition and general information. Execution and safety conditions.



2.5. Earth movements. Excavations. Ditches and wells.

2.6. Earth movements. Fillers. Compacting. Slopes.

THE FOUNDATION

3.1. Structural elements and historical evolution.

3.2. Foundation. Actions and loads. Types.

3.3. Foundation. Shallow foundations.

3.3.1. Footings. Types and execution.

3.3.2. Slab. Types and execution.

3.4. Foundation. Deep Foundations.

3.4.1. Wells. Types and execution.

3.4.2. Piles. Types and execution.

3.5. Foundation. Consolidation systems.

CONTAINMENT SYSTEMS

4.1. Containment systems Types.

4.2. Containment systems. Executed after excavation.

4.2.1. Retaining walls.

4.2.2. Reinforced earth.

4.3 Containment systems. Executed prior to excavation.

4.3.1. Screen walls.

4.3.2. Pile walls.

4.4. Containment systems. Executed with the excavation.

4.4.1. Sheet pilings.

4.4.2. Shorings.

4.5. Containment systems. Drainage. Drainage.

PROJECTS AND AUXILIARY ELEMENTS

5.1. Reframing Alignments and flushings. Execution.

5.2. Auxiliary constructions. Scaffolding.

5.3. Auxiliary constructions. Formwork Types. Execution.

WORKSHOP PRACTICES

1 Land reconnaissance. Properties.

2 Execution of shallow foundation.

3 Execution of containment systems. Screen wall. Pile wall.

4 Shorings. Sizing.

5 Reframing of shallow foundation. Aligning boundaries.



6439 DESCRIPTIVE GEOMETRY

Two-dimensional system concept

Manipulation of two-dimensional format

Graphical digital tools.

Introduction to CAD.

Two-dimensional objects

Exceptional objects.

Linear objects.

Superficial objects.

Parametric objects.

Properties of two-dimensional objects

General properties.

Geometric properties.

Parametric properties.

Three-dimensional system concept

Manipulation of three-dimensional space

Graphical digital tools.

Introduction to Sketchup.

Three-dimensional objects

Exceptional objects.

Linear objects.

Surface objects.

Polyhedral objects.

Solid objects.

Geometric construction of three-dimensional objects

Extrusion.

Scanning.

Union.

Subtraction.

Revolution.

Mesh.

Properties of three-dimensional objects

General properties.

Geometric properties.

Parametric properties.

Introduction to modelling

Modelling and representation of elementary geometries

Orthogonal cylindrical projection.



Corner applications.

Parallel perspectives.

Shadows as a representation tool.

Modelling and representation of complex geometries

Conical cylindrical projection.

Perspective applications.

Movement as a representation tool.

6440 PHYSICS II: FUNDAMENTALS OF INSTALLATIONS

I. FLUID MECHANICS

1. Fluid Static

- 1.1. Nature and Properties of fluids.
- 1.2. Fundamental Law of Hydrostatics.
- 1.3. Applications of the fundamental law of hydrostatics.
- 1.4. Pressure forces on flat surfaces.
- 1.5. Archimedes' Principle.

2. Perfect fluid dynamics

- 2.1. Introduction.
- 2.2. Stationary movement of a fluid.
- 2.3. Continuity Equation.
- 2.4. Bernoulli's theorem for ideal fluids.
- 2.5. Applications of Bernoulli's theorem.
- 2.6. Pumps and turbines.

3. Real fluid dynamics.

- 3.1. Real fluids. Dynamic and kinematic viscosity.
- 3.2. Arrangements in real fluids.
- 3.3. Laminar flow in a pipe. Poiseuille Formula.
- 3.4. Pressure losses in pipelines.

II. THERMOLOGY

4. Temperature and heat

- 4.1. Introduction.
- 4.2. Zeroth law of thermodynamics. Concept of temperature.
- 4.3 Temperature measurement.
- 4.4. Thermal expansion in solids.
- 4.5. Expansion in liquids and gases.
- 4.6. Heat.



5. Heat propagation mechanisms

- 5.1. Heat transmission by conduction. Fourier's Law.
- 5.2. Heat transmission by convection.
- 5.3. Radiation heat transmission.

6. First and second principles of the thermodynamics

- 6.1. Work in thermodynamics.
- 6.2. First principle of thermodynamics.
- 6.3. Thermodynamic processes.
- 6.4. Second principle of thermodynamics.

7. Fundamentals of hygrometry

- 7.1. Air Characteristics.
- 7.2. Measurement of the relative humidity. Hygrometers.
- 7.3. Psychrometric diagram.
- 7.4. Air conditioning.

III. ELECTRICAL CIRCUITS

8. Direct Current Circuits

Review of the electric field.

- 8.1. Electric current.
- 8.2. Ohm's Law. Electrical resistance.
- 8.3. The Joule effect.
- 8.4. Electromotive force.
- 8.5. Analysis of Direct Current Circuits.
- 8.6. Capacity and Capacitors.

9. Alternating Current Circuits

Review of the magnetic field.

- 9.1. Alternating electromotive force.
- 9.2. Elements of an alternating current circuit.
- 9.3. RLC Circuit in series. Phasor representation.
- 9.4. Effective values.
- 9.5. Power in alternating current circuits.
- 9.6. Complex representation in alternating current circuits.
- 9.7. Transformers.

IV. ACOUSTICS

10. Introduction to acoustics.

- 10.1. Introduction.
- 10.2. Sound waves.
- 10.3. Objective measurement of sound. Sound pressure and intensity.



10.4. Subjective measurement of sound. Sonority.

10.5. Enclosure acoustics.

6441 APPLIED MATHEMATICS II

Basic notions

1.-Systems, matrices and determinants

Linear systems.

Matrices.

Determinants.

Rank of a matrix.

Vector spaces.

2.-Vector spaces

Real vector space.

Subspaces.

Bases and dimension.

Space of the rows of a matrix.

Coordinates and base changes.

3.-Euclidean vectoral space

Inner product.

Standard and distance.

Angles and orthogonality.

Orthonormal base changes.

Orthogonal matrices.

Linear applications.

4.-Linear applications

Concept of linear application and properties.

Image and nucleus of a linear map.

Matrix and equations of a linear map.

Similarity of matrices.

5.-Diagonalization

Eigenvalues and Eigenvectors.

Characteristic polynomial, characteristic subspace.

Diagonalization.

Orthogonal diagonalization.

Geometric places in the plane and in space.



6.-Geometric loci on the plane and in space

Geometric loci on the plane

Reduction and classification of conics.

Quadrants.

6442 MATERIALS I

Thematic Unit 1. CERAMIC PRODUCTS

Topic 1. General information and manufacture of ceramic products

Topic 2. Fired clay ceramic pieces for brickwork masonry.

Topic 3. Ceramic vaults for framing.

Topic 4. Ceramic tiles.

Topic 5. Domestic sanitary ceramics.

Topic 6. Ceramic pavers.

Thematic Unit 2. GLASSES

Topic 1. General information on glasses.

Topic 2. Glass manufacturing and finishing processes.

Topic 3. Commercial glass.

Thematic Unit 3. PLASTERS

Topic 1. General information on plasters and their manufacture.

Topic 2. Characteristics and properties of plasters.

Topic 3. Types of commercial plasters and prefabricated plaster products.

Thematic Unit 4. AERATED LIME AND HYDRAULIC LIME

Topic 1. General information on aerated lime and hydraulic lime and their manufacture.

Topic 2. Characteristics and properties of aerated lime and hydraulic lime.

Topic 3. Types of commercial lime.

Thematic Unit 5. CEMENTS

Topic 1. General information, manufacture and properties of cements.

Topic 2. Composition of cements.

Topic 3. Types of cements according to RC-16.

Topic 4. Types of cements according to RD 1313.

Topic 5. Over-sulfated cements.

Thematic Unit 6. MASONRY MORTARS AND ADHESIVES

Topic 1. General information on mortars and raw materials of mortars.



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Topic 2. Dosing, kneading and properties of mortars.

Topic 3. Adhesives: Concept and properties.

PLASTER PROBLEMS.

CEMENT PROBLEMS.

PARTICLE SIZE PROBLEMS.

MORTAR DOSING PROBLEMS.

LABORATORY PRACTICES.

OTHER MATERIAL ACTIVITIES I.

Study of the EC marking of construction products.

Study of the reception of materials on-site according to CTE.

Conferences programmed by the subject teaching team.

6443 CONSTRUCTION II

MASONRY

MASONRY AND ITS MATERIALS

1.1. Fundamental concepts.

1.2. Scope.

1.3. Materials used.

1.3.1. Groups of parts.

1.3.2. Terminology.

1.3.3. Characteristics of bricks.

1.3.4. Mortars.

1.3.5. Pastes.

1.3.6. Concrete.

BRICKWORK AND WALLS

2.1. Scope of application of CTE DB SE-F.

2.2. General information.

2.3. Types of walls by their constructive organization.

2.3.1. Single-wythe walls.

2.3.2. Stretcher bond walls (off-set joint pattern).

2.3.3. Double-wythe walls.

2.3.4. Mixed masonry wall.

2.3.5. Cavity walls.

2.3.6. Cladding walls.

2.3.7. Reinforced walls.

2.4. Structural criteria.

2.4.1. Compressive strength.

2.5. Links between walls and framing.



- 2.5.1. General information.
- 2.5.2. Link by connectors.
- 2.5.3. Link by friction.
- 2.6. Movement joints.
- 2.6.1. Installation of movement joints.

PRE-FABRICATED BRICK WALLS

- 3.1. General information.
- 3.2. Types of courses.
- 3.3. Type of joints.
- 3.4. Brick laying.
- 3.5. Bonding rules for high-strength masonry walls.
- 3.6. Bonds.
- 3.7. Types of bonds.
 - 3.7.1. Stretcher bonds.
 - 3.7.2. Heading bond.
 - 3.7.3. English bond.
 - 3.7.4. Belgian bond.
 - 3.7.5. Dutch bond.
 - 3.7.6. Flemish bond.
- 3.8. Practical rules for the insertion of ties in bonded walls.
- 3.9. Solution of wall junctions.
 - 3.9.1. Stretcher bonds.
 - 3.9.2. Heading bond.
 - 3.9.3. English bond.
 - 3.9.4. Belgian bond.
 - 3.9.5. Dutch bond.
 - 3.9.6. Flemish bond.
- 3.10. Columns.
 - 3.10.1. Square columns.
 - 3.10.2. Rectangular columns.
 - 3.10.3. Columns in the form of a cross or cruciform.
 - 3.10.4. Corner columns.
- 3.11. Layout of walls made of brick masonry

CONDITIONS AND SUPERVISION OF MASONRY WALL CONSTRUCTIONS

- 4.1. Construction of walls.
 - 4.1.1. Levelling the ground for the wall foundation.
 - 4.1.2. Laying out the wall.
 - 4.1.3. Humidification.
 - 4.1.4. Placement of parts.
 - 4.1.5. Filling of joints.



- 4.1.6. Raising the wall.
- 4.1.7. Masonry bonds.
- 4.1.8. Channels and protrusions.
- 4.1.9. Layout of reinforcement mesh.
- 4.2. Supervision of construction.
 - 4.2.1. Reception of materials.
- 4.3 Brickwork Control.
 - 4.3.1. Categories of implementation.
- 4.4. Working tolerances.
- 4.5. Mortars and filler concretes.
- 4.6. Reinforcement meshes.
- 4.7. Protection of masonry under construction.

CONCRETE BLOCK WALLS

- 5.1. Definition.
- 5.2. Classification of blocks.
- 5.3. Types of parts.
- 5.4. Masonry bonds for concrete blocks.
- 5.5. Conditions for construction.
- 5.6. Construction details.

WALLS OF LIGHTENED CERAMIC BLOCK

- 6.1. Definition.
- 6.2. Technical characteristics.
- 6.3. Part types.
- 6.4. Masonry bond for ceramic block.
- 6.5. Conditions for construction.
- 6.6. Construction details.

MASONRY REINFORCED BY MORTAR COATING

- 7.1. Introduction.
- 7.2. Meshes.
 - 7.2.1. Control and reception of meshes.
- 7.3. Incorporation of mortar coating on meshwork.
 - 7.3.1. Placement of the mesh.
 - 7.3.2. Anchorage and overlap.
 - 7.3.3. Bond between walls.
- 7.4. Fields of application.

BRICKWORK LINTELS AND ARCHES

- 8.1. Definition.
- 8.2. Nomenclature.



8.3. Classification by constructive organization.

8.3.1. Bonded.

8.3.2. Arch ring.

8.3.3. Lintel arches

8.4. Threshold arches.

8.4.1. Types.

8.4.2. Execution process.

8.4.3. False lintel arch.

8.5. Semi-circular arch. Construction process.

8.6. Overhanging eaves.

8.7. Rupture of arches.

8.8. Laying out arches and brick lintels.

BONDING AND CONSTRUCTION OF BRICK VAULTS

9.1. Definition.

9.2. Nomenclature.

9.3. Classification by constructive organization.

9.3.1. Bonding.

9.3.2. Ring arches.

9.3.3. Ribbed.

9.3.4. Brickwork vaults.

9.4. Execution of brickwork vaults.

9.5. Brickwork stairs.

INTERIOR PARTITION WALLS AND PARTITIONS

10.1. Definition.

10.2. Ceramic brick partition walls.

10.3. Plate and panel partition walls.

10.4. Panelled Partition walls or with framework.

10.5. Reinforced partition walls.

10.6. Glass or translucent partition walls.

10.7. Execution systems.

10.8. Coatings and finishes in partition walls.

ROOFS

11.1. Definitions and Nomenclature.

11.2. Elements that make it up.

11.3. Execution systems.

11.4. Masonry finishes.

11.5. Lay out and outline of roofs.



WORKSHOP PRACTICES

1. Part types according to CTE (Código Técnico de Edificación) [Technical Building Code].
2. Type of walls according to CTE.
3. Brickwork reinforced by mortar coating.
4. Links I.
5. Links II.
6. Conditions for the construction of walls and arches.
7. Breeze block walls.
8. Roofs.
9. Pre-frames.
10. Partition walls and cladding.

HISTORY OF CONSTRUCTION

INTRODUCTION. ARCHITECTURE AND CONSTRUCTION, GENERAL CONCEPTS, BUILDING TYPOLOGIES.

CONSTRUCTION SYSTEMS. GENERAL CONCEPTS.

CLASSIFICATION.

- 2.1. Lintel system.
- 2.2. Vaulted system.

EXTRAORDINARY SUPPORTS. CONCEPTS, TYPOLOGIES, CLASSIFICATION.

- 3.1. Pillars, columns and pilasters.
- 3.2. Stylistic, typological and constructive characteristics.

CONTINUOUS SUPPORTS. CONCEPTS, TYPOLOGIES, CLASSIFICATION.

- 4.1. According to the type of material.
- 4.2. According to its composition.
- 4.3 Construction typologies, historical evolution.

CEILINGS. CONCEPTS, TYPOLOGIES, CLASSIFICATION.

- 5.1. Lintel system.
- 5.2. Vaulted system.

ROOFS. GENERAL CONCEPTS, TYPOLOGIES, EVOLUTION.

- 6.1. Structural elements, concepts, typologies, structural forms, classification and evolution.
- 6.2. Coverage elements, concept, typologies and evolution.

MORTARS, COATINGS, FLOORS. CONCEPTS, TYPES, EVOLUTION

HISTORICAL RELATIONSHIP OF THE DIFFERENT ARCHITECTURAL STYLES.



6444 ARCHITECTURAL DRAWING I

UNIT 1

SKETCHING

Freehand drawing.

Architectural sketches. Development process. Dimensioning.

UNIT 2

DRAWING UP OF PLANS

Scales. Concept and application.

Architectural survey. Planimetric interpretation and representation.

UNIT 3

APPLICATION OF REPRESENTATION SYSTEMS

Application of the Dihedral system in the architectural interpretation and representation.

Application of perspective systems in visualization and representation.

UNIT 4

GRAPHIC TECHNIQUES

General information on standardization, symbology and representative conventionalisms.

Importance in architectural plans.

Manual procedures and application of digital tools: AutoCAD, Sketchup and

Revit at beginner level.

6445 STATISTICS

Descriptive Statistics and Probability

One-dimensional and two-dimensional data analysis

1.-Introduction: Sample. Statistical variable. 2.- Presentation and representation of data.

3.- Characteristic measures: parameters of position, dispersion, asymmetry.

4.- Two-dimensional data analysis. Linear regression.

Probability and Combinatorics

1. Introduction. 2. Event space. 3. Axiomatic definition of probability.

4. Conditional probability. 5. Bayes theorem. 6. Appendix: Combinatorial.

Probability Distributions

Random variables: Measurements of position, dispersion, asymmetry and kurtosis

1.- Introduction. 2.- Random variable. 3.- Probability distributions in random discrete variables.

4.- Probability distributions in random continuous variables.



5.- Characteristic measures. 6.- Independence of variables.

Discrete Probability Distributions Continuous Probability Distributions

1.- Introduction. Discrete distributions. 2.- Uniform. 3.- Bernoulli 4.- Binomial.

5.- Poisson. 6.- Approximation of Binomial to Poisson. 7.- Introduction. Continuous

8.- Uniform. 9.- Normal distribution. 10.- Central limit theorem: Approximations to normal.

Sampling Distributions

Distributions associated with normal distribution

1.- Distribution associated to the normal: Pearson, Student, Fisher-Snedecor.

2.- Appendix: Other distributions

Sample distribution of a proportion, an average and sample variance

1.- Introduction. 2.- Random and Statistical Samples. 3.- Specific estimation. 4.- Distribution of the sample average. 5.- Distribution of the sampling variance. 6.- Specific statistical distributions. 7.- Distribution of the difference of two 8.- Distribution of the ratio of sampling variances. 9.- Statistics in proportions.

Estimation

Specific estimation. Estimation by Confidence Intervals

Confidence

1.- Introduction. 2.- Intervals for a population. 3.- Intervals for two populations

Statistical hypothesis testing

Parametric Contrasts

1.- Introduction. 2.- Elements of a contrast. 3.- Contrasts for a population. 4.- Contrasts for two populations. 5.- Confidence intervals and hypothesis contrasts.

➤ 2nd year

6446 MATERIALS II

Thematic Unit 1. GRANULOMETRY

Topic 1. CLASSIFICATION OF AGGREGATES.

Introduction. Classification and designation of aggregates. Aggregates for concrete.

Particle size (granulometry) problems.

Thematic Unit 2. MATERIALS USED IN THE MANUFACTURING OF CONGLOMERATES

Topic 1. CONGLOMERATES

Introduction. Cements.



Topic 2. WATER

Introduction. Characteristics of water for use in conglomerates. Mix water. Curing water. Water for washing aggregates.

Topic 3. ADDITIVES

Introduction. Classification. Plasticizers. Superplasticizers. Aerators. Modifiers for setting and hardening. Mass water-repellent. Gas generators. Foam generators. Colorants. Additions

Thematic Unit 3. CONGLOMERATES. CONCRETE

Topic 1. INTRODUCTION TO CONCRETE

Introduction. History of Portland concrete.

Topic 2. CEMENTS FOR CONCRETES

Introduction. History of Portland cement. Composition of Portland cement.

Manufacture of Portland cement. Fineness of grinding. Loss to fire and insoluble hydration of Portland cement. Portland cement setting and Portland cement expansion. Cement shrinkage and stiffening. Cement resistance. Types of cements. Classification of cements according to RC-08. Usable cements according to EHE-08.

Topic 3. AGGREGATES FOR CONCRETE

Introduction. Nature and origin of aggregates. Designation of aggregates. Characteristics of aggregates. Granulometric study of aggregates.

Topic 4. FRESH CONCRETE

Introduction. Properties. Consistency. Measure of consistency. Docity. Homogeneity. Specific weight. Compactness.

Topic 5. DOSAGE OF CONCRETE

Introduction. General requirements. Fuller method. Bolomey method. De La Peña method.

Topic 6. MANUFACTURE, TRANSPORT AND PLACING OF CONCRETE

CONCRETE

Introduction. Concrete manufacture. Concrete transport. Designation and characteristics

Placing of concrete. Concrete consolidation.

Concrete joints. Precautions to be taken when placing concrete in cold or hot weather.

Topic 7. CURING AND PROTECTION OF CONCRETE

Introduction. Fictitious age and degree of maturity. Concrete curing. Influence of curing on the

Types of curing. Concrete protection.

Topic 8. PHYSICAL CHARACTERISTICS OF HARDENED CONCRETE



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Introduction. Density. Elasticity. Resistance to compression. Resistance to traction.
Permeability. Shrinkage and stiffening. Fluency. Thermal properties.

Topic 9. DURABILITY

Introduction. Classes of types of environments. Strategy for durability. Concrete dosage
Concrete impermeability. Physical actions. Chemical attacks. Expansive attacks. Concrete cracking.

Topic 10. SPECIAL CONCRETE

Introduction. Lightweight concrete. Heavy concrete. Refractory concrete. Concrete reinforced with fibres.
Polymer-impregnated concrete. Sulphur-impregnated concrete. Concrete sealed with wax. Porous
concrete. Roller-compacted dry concrete. Concrete and sprayed mortar.
High resistance concrete. Self-compacting concrete. Recycled concrete.

Topic 11. CONCRETE QUALITY CONTROL

General control criteria. Quality control levels. Conditions for compliance. Documentation and follow-up.
Control of execution. Levels of guarantee and seals of quality.

Topic 12. CONCRETE DOSING PROBLEMS

Topic 13. LABORATORY PRACTICES

Determination of the wear resistance of coarse aggregates. "Los Angeles" abrasion test. Particle size trial of
an aggregate. Determination of aggregate shape coefficient Determination of consistency. Abrams' cone
method. Manufacture of concrete specimens. Facing of specimens. Determination of resistance.
Determination of resistance to indirect traction
Non-destructive tests. Sclerometric methods. Determination of resistance to compression by ultrasound.

Thematic Unit 4. METALLIC PRODUCTS

Topic 1. GENERAL INFORMATION ON METALLIC MATERIALS

Introduction. Obtaining.

Topic 2. METALLIC MATERIAL PROPERTIES

Mechanical properties. Chemical properties. Thermal and electrical properties

Topic 3. METAL WORK

Types of work. Special treatments.

Topic 4. IRON AND STEEL

Metallurgy. Foundry: obtaining, composition and types. Steel: obtaining and FE-C diagrams. Phases.
Commercial forms of iron and steel. Stainless steel.

Topic 5. STEEL FOR PASSIVE ARMATURES (EHE-08)



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General information. Passive armatures. Weldable corrugated steel bars and rolls. Corrugated wire and smooth wire.

Topic 6. COPPER

General information. Properties. Uses. Copper tubes.

Topic 7. MAIN ALLOYS

Brass. Bronze.

Topic 8. ALUMINIUM

General information. Properties. Uses. Alloys.

Topic 9. ZINC

General information. Properties. Uses

Topic 10. GALVANIZED AND SHERARDIZED

General information. Types of galvanization. Commercial forms. Alloys.

Topic 11. LEAD

General information. Properties. Uses. Commercial forms. Alloys.

Topic 12. TESTS ON STEEL FOR CONCRETE

Sampling, identification and preparation of specimens for resistance to traction. Resistance to bending. Resistance to ungluing. Resistance to torsion. Resistance to penetration.

Thematic Unit 5. WOOD

Topic 1. GENERAL INFORMATION ON WOOD

Advantages and disadvantages. Nature of wood.

Topic 2. MAIN TYPES OF WOOD USED IN CONSTRUCTION

Conifer wood. Hardwood. Exotic wood.

Topic 3. PHYSICAL AND MECHANICAL PROPERTIES OF WOOD

Physical properties. Mechanical properties.

Topic 4. WOOD TESTS

Moisture determination. Shrinkage determination. Hardness determination. Determination of compressive strength. Determination of tensile strength. Determination of resistance to cutting. Determination of bending strength.

Topic 5. DEFECTS AND ALTERATIONS OF WOOD



Knots. Twisted fibre. Interlaced fibre. Other defects.

Topic 6. DESTRUCTION OF WOOD

General information. Causes of destruction. Biotic causes. Abiotic causes.

Topic 7. PROTECTION OF WOOD

Protection of wood. Wood treatment.

Topic 8. RECOGNITION OF WOOD

6447 INSTALLATIONS I

SUPPLY OF WATER

FUNDAMENTAL KNOWLEDGE

WATER. TREATMENT

Introduction.

The consumption of water.

Water Treatment.

WATER SUPPLIES

Mains network.

Distribution networks.

Connection and supply points.

WATER SUPPLY (Section HS 4)

Scope of application.

Verification Procedure.

CHARACTERIZATION AND QUANTIFICATION OF DEMAND

Installation Properties.

Signage.

Water saving.

MATERIALS USED IN INTERIOR DOMESTIC DRINKING WATER INSTALLATIONS.

General conditions of materials.

General conditions of water pipes.

Valves and faucets.

Incompatibility between materials.

Faucets, sanitary and domestic apparatus.

DESIGN AND REFRAMING OF INTERIOR INSTALLATIONS

General scheme of the installation.

Elements that compose the installations.

Protection against returns.



Separation from other facilities.

Signage.

Water saving.

CALCULATION AND DIMENSIONING OF INTERIOR FACILITIES

Reserve of space in the building.

8.2. Calculation and dimensioning of the main networks.

8.3. Calculation and dimensioning of the derivations to wet rooms and branches.

Calculation and dimensioning of the DHW networks.

Calculation of expansions.

Calculation and dimensioning of the equipment, elements and devices of the installation.

Calculation and dimensioning of the installations with flux meter.

CONSTRUCTION AND COMMISSIONING

General conditions of execution.

Installation tests.

MAINTENANCE AND CONSERVATION

Service Interruption.

Re-commissioning.

General maintenance conditions.

MINIMUM SOLAR CONTRIBUTION OF DOMESTIC HOT WATER

CHARACTERIZATION AND QUANTIFICATION OF DEMAND

Minimum solar contribution.

CALCULATION AND DIMENSIONING

Previous data.

General conditions of the installations.

General calculation criterion.

Components.

Orientation and tilt losses and shadows

MAINTENANCE

Monitoring and maintenance Plan

WATER EVACUATION

CHARACTERIZATION AND QUANTIFICATION OF REQUIREMENTS

MATERIALS USED IN WATER EVACUATION INSTALLATIONS

General characteristics of the materials.

Pipeline materials and collection points.

Conditions of accessory materials.

DESIGN AND LAYOUT OF WATER EVACUATION INSTALLATIONS

General evacuation conditions.

General conditions of evacuation systems.



Elements that compose evacuation installations.

CALCULATION AND DIMENSIONING OF EVACUATION INSTALLATIONS

Sizing of the sewage network.

Sizing of the rainwater network.

Sizing of mixed type collectors.

Sizing of ventilation grids.

Sizing of pumping and elevation systems.

WORKSHOP AND LABORATORY PRACTICES

Water consumption apparatuses: toilets and domestic appliances.

Metal pipes and fittings.

Plastic pipes and fittings.

Valves, mechanisms and accessories.

Pressure groups. Pressure reducing valve.

Inner installations: impermeability tests.

Heat generators for DHW production.

Pipes and accessories for evacuation and ventilation network.

Domestic sanitary devices and taps.

6448 CONSTRUCTION III

REINFORCED CONCRETE

CHAPTER 1 - STRUCTURAL SYSTEMS

- 1.- Introduction.
- 2.- Vaulted system.
3. - Diaphragm System.
4. – Portal System.
5. - Structural Configuration and topology of joints.
6. - Basic structural safety documentation.

CHAPTER 2 - REINFORCED CONCRETE. ARMATURES

- 1.- Introduction.
2. - Adhesion between concrete and steel.
- 3.- Durability.
3. - Reinforced concrete components.
 - 3.1. – Concrete.
 - 3.2. – Reinforcement meshes: main and secondary meshes.
 - 3.2.1. - Active and passive meshes.
 - 3.2.2. - Supply and storage.



- 3.2.3. - Manipulation. Bending and cutting.
- 3.2.4. - Anchoring and splicing.
- 3.2.5. - Execution of steel reinforcement.
- 3.2.6. - Placement on-site.

CHAPTER 3 - REINFORCED CONCRETE FOUNDATIONS

- 1.- Introduction.
- 2.- Classification.
 - 2.1. - According to depth.
 - 2.2. - According to the edge-leaf relationship.
- 3. - Superficial or Direct Foundations.
 - 3.1.- Insulated footings.
 - 3.2. - Combined and continuous footings.
 - 3.3. – Shaft foundations.
 - 3.3. – Slatted bed foundation.
 - 3.4.- Foundation slabs.
- 4.- Deep Foundations.
 - 4.1. – Piles.
 - 4.2. - Pile caps.
- 5. - Girder beams.
- 6. - Constructive Recommendations.
 - 6.1. - Constructive Recommendations.
 - 6.2. - Layout of separators.
- 7. – On-site placement of reinforcement meshes.
 - 7.1. – Footings.
 - 7.2. - Piles and pile caps.
 - 7.3. – Mesh operations.
- 8.- Execution processes.
 - 8.1. – Layout.
 - 8..2. – Formwork.
 - 8..3. – Placement.
 - 8..4. – Verification.
 - 8..5. – Concreting.
 - 8..6. – Curing.
 - 8.7 – Stripping.

CHAPTER 4 - REINFORCED CONCRETE WALLS

- 1.- Introduction.
- 2. – Topology.
 - 2.1. – Load-bearing walls
 - 2.2. – Partition walls.
- 2.3. – On-site placement of reinforcement meshes.



- 2.4. –Execution process.
- 3.- Retaining walls.
- 4.- Gravity retaining walls.
- 5.- Cantilever retaining walls.
- 6. – Counterfort retaining walls.
- 7. – Laterally reinforced retaining walls.
- 8. – Basement walls.
- 9.- Screen walls.
- 10. - Bearing Walls
- 11.- Execution processes

CHAPTER 5 – REINFORCED CONCRETE MESH FRAMEWORK REINFORCEMENT

- 1.- Introduction.
- 2. - Conditions of application.
- 3. – Columns.
 - 3.1. - Shape and dimensions.
 - 3.2. - Reinforcing bars.
 - 3.3.- Construction details.
- 4. – Beams.
 - 4.1. - Minimum edges.
 - 4.2. – Reinforcement meshes.
 - 4.3. – Formwork.
- 5. – Slabs.
 - 5.1. – Definition.
 - 5.2. – Functions.
 - 5.3.- Classification.
- 6. - Unidirectional slabs.
 - 6.1. – Definition.
 - 6.2.- Classification.
 - 6.3. - Constituent Elements.
 - 6.4. - Geometric Conditions.
 - 6.5. - Reinforcing bars.
 - 6.6. - Unions and supports.
 - 6.7. – Joints.
- 7. - Waffle slabs.
 - 7.1. – Definition.
 - 7.2. – Plates.
 - 7.3.- Classification.
 - 7.4. - Basic Geometries.
 - 7.5. – Ring beam.



- 7.6. - Reinforcing bars.
- 8.- Execution process.
- 8.1. – Layout.
- 8.2. – Formwork.
- 8.3. – Placement.
- 8.4. – Testing.
- 8.5. – Concreting.
- 8.6. – Curing.
- 8.7 – Formwork removal.
- 8.8. – Security Conditions

CHAPTER 6 – SHUTTERING, REMOVAL OF SHUTTERING

- 1.- Introduction.
- 2.- Shuttering – removal of shuttering.
- 3.- Shuttering – Re-shuttering.
- 4.- Shuttering over a slab.

CHAPTER 7 - REINFORCED CONCRETE ROOF STRUCTURES

- 1.- Introduction.
- 2.- Classification.
- 3. - Folded and Laminar Structures.
- 3.1. - Folded Structures.
- 3.1.1. - Shapes and dimensions.
- 3.1.2.- Construction systems.
- 3.2. - Laminar Structures.
- 3.2.1. - Simple curvature.
- 3.2.2.- Double curvature.
- 3.2.3.- Construction systems.

CHAPTER 8 - REINFORCED CONCRETE STAIRCASES

- 1.- Introduction.
- 2. - Concrete Stairs in situ.
- 2.1. - Straight Staircases.
- 2.2. - Curved Staircases.
- 2.3.- Construction details.

CHAPTER 9 - WALL-BASED STRUCTURES

- 1.- Introduction.
- 2.- Materials.
- 3. – Execution.
- 3.1. - Table formwork.
- 3.2. - Tunnel formwork.



- 4.- Constructive process.
- 5. - Facade enclosures executed with tunnel formwork.
- 6. - Links with the slabs. Chained.

CHAPTER 10 - JOINTS IN CONCRETE CONSTRUCTIONS REINFORCEMENT

- 1.- Introduction.
- 2. – Typology.
 - 2.1. – Working joints.
 - 2.2. - Contraction or retraction joint.
 - 2.3. – Expansion joint.
 - 2.4. – Weight-bearing joint.
- 3. - Joints in walls.
 - 3.1.- Retaining walls.
 - 3.2. - Basement walls.
- 4. - Joints in pavements and edging.
- 5. - Joints in building structures.

CHAPTER 11 – STRUCTURAL ARTICULATIONS

- 1.- Introduction.
- 2. - Reinforced concrete articulations.
 - 2.1. – Articulations.
 - 2.2. - Semi-articulations.
 - 2.3. – Pendulums.
- 3. - Metallic Joints.
 - 3.1. – Fixed.
 - 3.2. - Mobile or sliding.
- 4. - Elastomeric material supports.

CHAPTER 12 - PREFABRICATED STRUCTURES

- 1. - Introduction and classification.
- 2. - Prefabricated concrete framework constructions.
 - 2.1. - Typology and classification.
 - 2.2. - Constituent Elements.
 - 2.2.1. – Columns.
 - 2.2.2. – Beams.
 - 2.2.3. – Slabs.
 - 2.2.4. – Staircases.
 - 2.2.5. – Handling and assembly.
- 3. - Prefabricated roof structures.
 - 3.1. – Beam-based structures.



- 3.2. – Portal-based structures.
- 3.3. - Folded and laminar structures.
- 4. – Joints.
 - 4.1.- Introduction.
 - 4.2. - Support-foundation joints
 - 4.3. - Joints between supports.
 - 4.4. - Beam-support joints.
 - 4.5.- Beam-beam joints.
- 5. - Prefabricated concrete wall constructions.
- 6. - Panel-based construction.
 - 6.1.- Classification.
 - 6.2. - Facade Panels.
 - 6.3. – Joints.
 - 6.4.- Construction details.
 - 6.5. - Handling and assembly.
- 7. - Three-dimensional Modules.

CHAPTER 13 - CONTROL OF REINFORCED CONCRETE CONSTRUCTION WORK

- 1.- Concrete quality control.
- 2. - Concrete strength control.
- 3. - Statistical control of concrete.
- 4. - Complementary concrete tests.
- 7. - Quality control of reinforcements.
- 8.- Control of execution.
- 9. - Execution tolerances according to EHE.

6449 LEGAL ASPECTS OF BUILDING

THEORY, UNIT 1: FUNCTIONING OF THE ADMINISTRATION

TOPIC 1. GOVERNING PRINCIPLES OF ADMINISTRATION

* Legality Principle.

- Administration Privileges.
- Administration Duties.

TOPIC 2. THE ADMINISTRATIVE ACT

- Elements.
- Effectiveness.
- Administrative silence.

TOPIC 3. THE ADMINISTRATIVE PROCEDURE



- General principles.
- Interested parties.
- Structure.
- Deadlines.

TOPIC 4. ADMINISTRATIVE RESOURCES

- Concept and Principles.
- Types.

TOPIC 5. ADMINISTRATION GOODS

- Classification.
- Acquisition.
- Transmission.
- Self-protection.
- Exemption from seizure.

PRACTICE UNIT 1

TOPIC 1. LEGAL REGIME OF THE PUBLIC DOMAIN

- * Highway Law.
- * Water law.
- * Coastal Law.
- * Practical assumption of limitations to building in areas near the publicly owned land.

TOPIC 2. FORCED EXPROPRIATION

- Causa Expropiandi.
- Subjects.
- Procedure.
- Reversion.
- . Practical case of forced expropriation.

TOPIC 3. ADMINISTRATIVE PROCEDURE

Practical case of administrative procedure and administrative appeals.

THEORY, UNIT 2: BUILDING WORKS

TOPIC 6. LEGAL STATUS OF THE AGENTS INVOLVED IN THE BUILDING WORK

- *Types of Building Work.
- *Applicable Regulations.
- *Functions and Obligations of Agents.



TOPIC 7. CONTRACTING IN PRIVATE CONSTRUCTION WORK

*Work Contract.

- Service Contract.

TOPIC 8. PUBLIC PROCUREMENT

. Legal regulation

- Contract Requirements.
- Contracting Procedure.
- Execution.
- Irregularities.
- Extinction.

TOPIC 9. AGENT RESPONSIBILITIES

> Civil liability.

- Contractual.
- Extracontractual.

> Criminal liability.

> Administrative liability.

PRACTICE UNIT 2. THE BUILDING SITE

TOPIC 10. STEPS TO BE TAKEN ON-SITE

> Previous.

> For the Beginning of the Work.

> During the work.

- Daily.
- Monthly.
- Other Contingencies.

> Final managements.

> Later.

TOPIC 11. THE WORK PROGRAM AND THE BUILDING BOOK

. Guidelines and examples of a work program and its possible modification during the course of the project.

. Guidelines and example of the Building Records Book.

TOPIC 12. EASEMENTS.

> Introduction.

> Concept.

> Legal system.

> Legal easements.

- Necessary thoroughfare.
- Lights and Views.



- Centre islands.
- Others.

6450 ENTERPRISE ECONOMY

Applied economics

I. Part:

1. - ECONOMICS AND ECONOMIC ANALYSIS

Concept of economics. Scarcity and choice.

Economic activity.

The circular flow of income.

The frontier of production possibilities.

2. - BUSINESS AND THE MARKET

The market.

Demand.

Supply.

Market equilibrium.

Supply and demand curves.

Calculation of the demand curve.

Displacements of the demand curve.

Changes in prices and the elasticity of demand.

3. - COST ANALYSIS

Cost Accounting.

Cost and types of costs.

Cost Model - volume – profit.

Fundamental phases in cost analysis.

Personnel costs.

Material Costs.

Indirect costs.

4. - VALUATION OF INVESTMENTS

Investment and financing.

Types of investments.

Investment Valuation.

Timeless criteria.

- Net cash Flow per committed monetary unit.
- Average annual net cash flow.
- Pay-back period.

Time criteria.



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- Net present Value (NPV).
- Internal rate of return (IRR).
- Relationship between the NPV and the IRR criteria.

5.- FUNCTIONS OF BUSINESS ADMINISTRATION

Planning.

Organization. Organizational charts of the company.

Directing.

Personnel Integration.

Supervising.

6. - THE CONSTRUCTION SECTOR

The construction sector. Economic magnitudes of the sector.

7. - STEPS TO CREATE A COMPANY

Administrative steps.

Plan of company.

PART II:

6. - ACCOUNTING

Accounting.

The balance.

The books.

Economic and Financial structure.

Expenses and Income.

Profit and loss account.

General accounting plan. Accounting principles and standards.

VAT.

Stocks and adjustments.

Weighted Average price.

FIFO.

LIFO.

Depreciation of assets.

Linear.

Tables.

Diminishing depreciation with constant depreciation.

Diminishing depreciation of sum of digits.

Activity-based.

Wages and salaries.

Differences from the General Construction Accounting Plan.

Construction work accounting.

Construction work executed by us for us.



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Construction work executed by others for us.
Construction work executed by us to sell.
Executed work units at the established prices.
Construction work executed based on costs
Fulfilled contract Method.
Loan repayment.
American.
French.
Constant quotas.
Balance sheet analysis.
Distribution of profits.
Losses.
Ratios. Profitability, liquidity and activity.

6451 ARCHITECTURAL DRAWING II

UNIT 1

SKETCHES AND SUBSEQUENT REPRESENTATION ON A SCALE OF SOLUTIONS, ELEMENTS AND DETAILS OF ARCHITECTURE.

Analyses and graphical expression applied to perception, knowledge and the representation of spaces, forms and architectural elements. Drawing up of plans. Sketching, data acquisition and drawing to scale. Application of representation systems.

UNIT 2

BASIC GRAPHICAL DOCUMENTATION OF THE ARCHITECTURAL PROJECT.

Graphical analysis of the architectural project at basic level. Project sketches. Elaboration of the graphic documentation of the project at basic level. Volumetric studies.

UNIT 3

REPRESENTATION PROCEDURES AND TECHNIQUES.

Standardization, symbology and representative conventionalisms. Graphic techniques and means of representation. Manual procedures and application of digital tools: AutoCAD, Sketchup and BIM-Revit environment.



6452 TOPOGRAPHY AND LAND SURVEYING

Topic 1

Definition. Applications. Relationship of Topography with other sciences. Geodesy. Geoid and reference ellipsoid. Geodetic vertices and geodetic networks. Cartography. Maps and plans. Classification of cartographic projections. UTM Projection. UTM Coordinates. GPS global positioning system. Influences of Mean error.

Topic 2

Units of measure. Measurement of angles. Courses. Azimuths. Orientation of a Vertical angles. Scale. Visual perception limit. Contour lines. Characteristics. Equidistance. Obtaining plans with contour lines.

Topic 3

Ways to avoid the effect of the errors. Errors in the direct measurement of distances. Measurement of lots.

Topic 4

Essential elements of the surveying apparatus. Accessories.

Topic 5

Basis for the stadia measurement of distances. Calculation of the unevenness in lines of vision. Calculation of coordinates in tachymetry. Total Station. Electronic distance measurement. Total station correction. Characteristics of the total station.

Topic 6

Planimetric methods. Radiation. Itinerary. Triangulation. Calculation of areas.

Topic 7

Earthwork in Projects. Disassembly and filling. Work units that Profiles and calculation of earthworks in linear construction work.

Topic 8

Lay outs. Definition. Laying out of points. Laying out of buildings.

6453 INSTALLATIONS II

BLOCK 1 AIR CONDITIONING

FUNDAMENTAL CONCEPTS OF THERMODYNAMICS

Heat and temperature.

Thermometric scales.

Latent heat and sensible heat.



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Heat Propagation: conduction, convection and radiation.

Air Characteristics.

AIR CONDITIONING FACILITIES

General information.

Types of air conditioning systems.

Comfort Parameters: hydrothermal well-being indices.

CALCULATION OF THERMAL TRANSMITTANCE

Thermal conductivity Coefficient.

Most used Materials and their characteristics.

Internal thermal resistance.

Superficial thermal resistance.

Total thermal resistance.

Thermal transmittance.

CALCULATION OF THE CHARACTERISTIC PARAMETERS OF DEMAND

Thermal transmittance of enclosures in contact with the outside.

Thermal transmittance of soil in contact with the ground.

Thermal transmittance of walls in contact with the ground.

Thermal transmittance of buried roofs.

Thermal transmittance of inner partitions.

Thermal transmittance of sanitary chambers.

Thermal transmittance of openings and skylights.

Solar factor of openings and skylights.

SURFACE AND INTERSTITIAL CONDENSATION

Conditions for the calculation of condensation.

Calculation of surface condensation.

Checking interstitial condensation.

Calculation of interstitial condensation.

Temperature Distribution.

Saturation steam pressure distribution

Steam pressure distribution

LIMITATION OF ENERGY DEMAND

General information.

Characterization and quantification of requirements.

Calculation and dimensioning.

Construction products.

Construction.

JUSTIFICATION SHEETS FOR THE SIMPLIFIED OPTION



Sheet 1- Calculation of the average characteristic mean parameters.

Sheet 2- Energy demand conformance.

Sheet 3- Condensation conformance.

DESIGN AND CALCULATION OF AIR CONDITIONING FACILITIES BY VENTILATION

Indoor air quality in homes (HS3).

Air quality in the tertiary sector (HE2-RITE).

THERMAL LOADS (HEATING)

Inner and outer calculation conditions.

Heat load by transmission.

Heat load by ventilation.

Calculation table of the total thermal load and of each property.

THERMAL LOADS (REFRIGERATION)

Internal and external calculation conditions.

Heat load by transmission and solar radiation.

Ventilation heat load.

Internal load per person, illumination etc.

Calculation table of the total thermal load and of each property.

DESIGN AND CALCULATION OF SUMMER AIR CONDITIONING INSTALLATIONS (COOLING)

Classification of air conditioning systems in summer.

Air distribution networks.

Terminal elements.

Hydraulic circuits.

Calculation of cooling plant elements.

Schemes. Regulation and control.

Operation and implementation.

RADIANT HEATING AND COOLING FLOORS

Characteristics of the installation.

Calculation and design.

Regulation and control.

Implementation.

BLOCK 2 WORKSHOP AND LABORATORY PRACTICES



6454 CONSTRUCTION IV

CHAPTER 1 - STRUCTURES WITH STONE MATERIALS (QUARRYING)

TOPIC 1 - QUARRYING

- 1.1. – Definition.
- 1.2. - Extraction of the stone.
- 1.3. - Bonding and union materials.
- 1.4. - Tools, equipment and auxiliary means.
- 1.5. - Joints, repointing and reworking.
- 1.6. - Stone finishes.
- 1.7. - Classification of quarry pieces.
 - 1.7.1. - Masonry construction work.
 - 1.7.2. - Ashlar construction work.
 - 1.7.3. - Ashlar masonry construction work.
 - 1.7.4. - Platings or coatings.
 - 1.7.5. - Tiles or pavers.

TOPIC 2 – MASONRY AND ASHLAR CONSTRUCTION WORK

- 2.1. - Definition
- 2.2.- Classification.
 - 2.2.1. - Ordinary stonework.
 - 2.2.2. - Ashlar masonry.
- 2.3. - Masonry with pebbles.
- 2.4. - Gravel Masonry.
- 2.5. – Rubble Masonry.
- 2.6. - Masonry with irregular courses.
- 2.7. - Masonry with regular courses or ashlar.
- 2.8. - Polygonal masonry.
- 2.9.- Construction details
- 2.10. - Mixed masonry.

TOPIC 3 - ASHLAR MASONRY CONSTRUCTION WORK

- 3.1.- Definition and general information.
- 3.2. - Classification of ashlar.
- 3.3. - Types of ashlar masonry.
- 3.4. - Division of the work.
- 3.5. - Obtaining ashlar blocks. Cutting ashlar blocks.
- 3.6. – Bedding ashlar.
 - 3.6.1. – On-site casting of bonds.
 - 3.6.2. – Fully bonded footing.
- 3.7 – Bonding.



- 3.7.1. – Racked.
- 3.7.2. – Junction.
- 3.7.3. – Circular.

TOPIC 4 - STONE STAIRCASES

- 4.1.- Classification.
- 4.2. - Straight self-supporting staircases.
- 4.3. - Curved self-supporting staircases.
- 4.4. - Helicoidal or spiral staircases.

TOPIC 5 - ARCHES

- 5.1. - Constituent Elements.
- 5.2. - Surfaces relative to the arch.
- 5.3. - Linear Dimensions.
- 5.4. - Execution of an arch in natural stone.
 - 5.4.1. – Working the jambs.
 - 5.4.2. - Layout of the arch mount.
 - 5.4.3. – Forming the voussoirs.
 - 5.4.4. - Placing the jambs.
 - 5.4.5. - Shoring systems and trusses.
 - 5.4.6. - Assembly process.

TOPIC 6 - LINTELS, GUTTERS AND COPINGS

- 6.1. - Lintels by means of segments.
- 6.2. - Lintels by means of whole stones.
- 6.3. – Gutters.
- 6.4. – Copings.

CHAPTER 2 - WOODEN STRUCTURES (CARPENTRY TO ASSEMBLE)

TOPIC 1 - CARPENTRY TO ASSEMBLE

- 1.1.- Introduction.
- 1.2. - Classification of carpentry work.
- 1.3.- Materials.
- 1.4. - Microscopic Structure of the wood.
- 1.5. - Properties of wood.
 - 1.5.1. - Anisotropic material.
 - 1.5.2. - Mechanical characteristics.
 - 1.5.3. - Humidity of wood.
- 1.6. - Pathology and protection.
 - 1.6.1. - Destructive Agents.



- 1.6.2. - Preventive and curative actions.
- 1.6.3. - Constructive protection measures.
- 1.6.4. - Replacement and rehabilitation of wooden structures.
- 1.7. - Fire in wooden structures.
 - 1.7.1. - Behaviour of wood against fire.
 - 1.7.2. - Fire protection.
- 1.8. - Tools and machinery.

TOPIC 2 - JOINTS

- 2.1.- Introduction.
- 2.2.- Classification.
 - 2.3. - Traditional or carpenters' joints.
 - 2.3.1. – Lap joints.
 - 2.3.2. – Couplings.
 - 2.3.3. – Assemblies.
 - 2.3.4. - Auxiliary elements for joining wood.
 - 2.3. - Modern Joints.
 - 2.3.1. – Pegged joints.
 - 2.3.2. – Connector joints.
- 2.4. - Glued joints.
- 2.5. - Auxiliary elements.
- 2.6. – On-site placement and installation.

TOPIC 3 - WOOD PRODUCTS

- 3.1.- Introduction.
- 3.2. - Laminated Wood.
 - 3.2.1. – Glues.
 - 3.2.2. – Wood.
 - 3.2.3. - Joints of sheets.
 - 3.2.4. - Manufacture of glued beams.
- 3.3. - Boards
 - 3.3.1. - Solid wood Board.
 - 3.3.2. - Plywood Board.
 - 3.3.3. - Laminated core board.
 - 3.3.4. - Particle Board.
 - 3.3.5. – Fibreboard.
 - 3.3.6. - Complex Board.
 - 3.3.7. - Honeycombed Board.
 - 3.3.8. - Physical characteristics.
 - 3.3.9. - Mechanical characteristics.
 - 3.3.10. - Rules of implementation.



TOPIC 4 - SOLID WOOD CONSTRUCTIONS

- 4.1. - Constructions with logs or timber.
 - 4.1.1. – Characteristics.
 - 4.1.2. – Foundations.
 - 4.1.3. – Walls.
 - 4.1.4. – Divisions.
- 4.2. - Vertical Latticework.
 - 4.2.1. – Characteristics.
 - 4.2.2.- Classification.
 - 4.2.3.- Execution process.
 - 4.2.4.- Construction details.
- 4.3. - Horizontal truss work.
 - 4.3.1. – Characteristics.
 - 4.3.2.- Construction details.
- 4.4. - Inclined truss work.
 - 4.4.1. – Characteristics.
 - 4.4.2. – Lean-to roof.
 - 4.4.3. – Ridge loaded roof.
 - 4.4.4. – Couple roof.
 - 4.4.5. – Ridge loaded roof with braced purlins and king post.
 - 4.4.6. – Roof frames with posts.
 - 4.4.7. – Purlin roof frames.
 - 4.4.8. – Mansard roof.
 - 4.4.9. – Roof with a garret.
 - 4.4.10. - Sawtooth roof or shed.
 - 4.4.11. - Tower and pavilion roofs.
 - 4.4.12. - Intersection and penetration of roofs.
 - 4.4.13. – Attics.
 - 4.4.14. - Single-pitched roofs.
- 4.5. - Wooden Staircases.
 - 4.5.1. – Ladder stairs.
 - 4.5.2. - Fitted or assembled Staircases.
 - 4.5.3. - Supported Staircases.
 - 4.5.4. - Curved Staircases.

TOPIC 5 - LIGHT-FRAME CONSTRUCTIONS

- 5.1.- Introduction.
- 5.2. - Structural Elements.
 - 5.2.1. – Foundations.
 - 5.2.2. – Facades.
 - 5.2.2.1. – Framework by storeys.



- 5.2.2.2. - Framework with continuous straight footings.
- 5.2.2.3. - Overlaps, corners and openings.
- 5.2.2.4. - Exterior cladding.
- 5.2.3. – Slabs.
- 5.2.4. - Interior Partitions.
- 5.2.5. – Roofs.
- 5.2.6. - Interior finishes.
- 5.2.7. – Facilities.
- 5.3.- Constructive process.

TOPIC 6 - SPECIAL WOODEN CONSTRUCTIONS

- 6.1. - Solid core structures.
- 6.2.1. - Hollow Beams.
- 6.2.2. - Beams with double T section.
- 6.2.3. - Web plate beams.
- 6.2.4. – Beams with web openings.
- 6.2. – Structures with bar frameworks.
- 6.2.1. - Beams with wooden bars.
- 6.2.2. - Triangular reinforcement.
- 6.2.3. - Parallel cord lattice beams
- 6.3. - Portals
- 6.3.1. - Lattice frame portals
- 6.3.2. - Hollow core and double-T frame portals.
- 6.3.3. - Laminated wood frames.
- 6.4. – Arches.
- 6.5. - Laminated wooden Structures.
- 6.5.1.- Introduction.
- 6.5.2. - Constituent elements.
- 6.5.3. - Structural typology.
- 6.5.4.- Fields of application.

TOPIC 7 - EXECUTION

- 7.1.- General principles.
- 7.2.- Construction details.
- 7.3. – Tolerances.
- 7.4. – Control.

CHAPTER 3 - METALLIC STRUCTURES

TOPIC 1 - METAL CONSTRUCTIONS

- 1.1.- Introduction.
- 1.2. - Advantages and disadvantages of metallic structures.



- 1.3. – Structural steel.
- 1.4. - Steel in the Technical Code.
- 1.5. - Specifications of qualities and grades.
- 1.6. - Applications for the different types of steel.
- 1.7. – Profiles.
- 1.8. - Other products.
- 1.9. – Applications.
- 1.10. - Manufacturing Process.
- 1.11. - Typology of structures.
- 1.12. - Basic document of Steel structures.

TOPIC 2 – TYPES OF JOINT

- 2.1.- INTRODUCTION.
- 2.2. – RIVETS.
- 2.3. - ORDINARY AND CALIBRATED SCREWS.
- 2.4. - HIGH RESISTANCE SCREWS.
- 2.5. - PREPARATION OF HOLES.
- 2.6. - CONSTRUCTION ARRANGEMENTS.
- 2.7. – EXECUTION.
- 2.8. – WELDING.
 - 2.8.1. - Fusion welding.
 - 2.8.2. - Electric Arc welding.
 - 2.8.3. - Electric resistance welding.
 - 2.8.4. - Deformations and residual stresses.
 - 2.8.5. - Classification of welds.
 - 2.8.6. - Instructions for welding.
 - 2.8.7. - Imperfections in welded joints.
 - 2.8.8. - Sources of energy for welding.
 - 2.8.9. - Welding accessories.
 - 2.8.10. – Tools.
 - 2.8.11. - Work Clothes.
 - 2.8.12. - Safety and hygiene.

TOPIC 3 - STEEL CUTTING

- 3.1. - CUTTING WITH GASES
 - 3.1.1. – Fundamentals.
 - 3.1.2. - The blowtorch.
 - 3.1.3. – Defects.
- 3.2. - CUTTING WITH THE ELECTRIC ARC
 - 3.2.1. - With hollow electrode.
 - 3.2.2. - With carbon electrode.



- 3.2.3. - Under protective gas.
- 3.1. - CUTTING WITH PLASMA.
- 3.3.1. – Foundation.
- 3.3.2. – Modalities.
- 3.3.3. – Applications.
- 3.3.4. – Defects.
- 3.4. - CUTTING WITH LASER.
- 3.5. - OTHER PROCEDURES.

TOPIC 4 - METAL LATTICE FRAMEWORK CONSTRUCTIONS

- 4.1.- Introduction.
- 4.2. - Structural Configuration.
 - 4.2.1. – Configuration.
 - 4.2.2. - Interaction with soil.
 - 4.2.3. - Typology of ties.
- 4.3. - Structural Elements.
 - 4.3.1. – Columns.
 - 4.3.2. – Girders.
 - 4.3.3. – Cross braces.
- 4.4.- Construction details. Joints.
 - 4.4.1. - Column-foundation joint.
 - 4.4.2. - Girder-column joint.
 - 4.4.3. - Column-column joint.
 - 4.4.4. - Girder-girder joint.
 - 4.4.5. - Masonry supports.
 - 4.4.6. – Girder-slab joint.
 - 4.4.7. - General Cross bracing.
 - 4.4.8. - Profile joints.
- 4.5.- Execution process.

TOPIC 5 - LARGE SPAN METAL CONSTRUCTIONS

- 5.1.- Introduction.
- 5.2. - Structural Typology.
 - 5.2.1. - Flat reinforcement Structures.
 - 5.2.1.1. – Framework structures.
 - 5.2.1.2. – Portal frames.
 - 5.2.1.3. – Arches.
 - 5.2.2. - Tubular Profiles.
 - 5.2.2.1.- Introduction.
 - 5.2.2.2.- Advantages and disadvantages.
 - 5.2.2.3. – Applications.
 - 5.2.2.4. – Joints.



5.2.2.5. – Pathologies.

5.2.3. - Spatial Structures.

5.2.3.1. – Composition.

5.2.3.2. – Bar joints.

5.2.3.3. – Support.

5.3.- Execution process.

TOPIC 6 - METAL STAIRCASES

6.1. - General information.

6.2. - All-metal Staircases.

6.3. - Mixed steel-concrete staircases.

TOPIC 7 - STEEL AND CONCRETE STRUCTURES

7.1.- Introduction.

7.2. - Metallic Supports for reinforced concrete slabs.

7.3. - Mixed steel-concrete structures.

7.3.1. – Supports.

7.3.2. – Girders.

7.3.3.- Construction details.

7.4. – Pre-stressed steel beams.

7.5. - Collaborative slabs.

TOPIC 8 - METAL CONSTRUCTION PROTECTION

8.1.- Introduction.

8.2. – Corrosion.

8.2.1.- Introduction.

8.2.2. - Protection Systems.

8.2.1.1. - Concrete coating.

8.2.1.2. – Metallic plating.

8.2.1.3. - Paint Systems. Reference standards.

8.2.1.4. – Other.

8.3. – Fire resistance.

8.3.1. - Steel exposed to fire.

8.3.2. - Fire safety.

8.3.3. - Protection systems.

8.3.4- Reference standards.

TOPIC 9 - TOLERANCES AND CONTROL OF METAL CONSTRUCTIONS

9.1.- Introduction.

9.2. - Manufacturing tolerances.

9.3. – On-site placement tolerances.



TOPIC 10 - CONTROL OF METAL CONSTRUCTIONS. INSPECTION AND MAINTENANCE

- 10.1.- Introduction.
- 10.2. - Quality Control of the project.
- 10.3. - Control of materials.
- 10.4. - Control of completed work.
- 10.4.1. - Control of the work executed in the workshop and on-site.
- 10.4.2. - Inspection of metal constructions.
- 10.4.3. - Inspection of welds.
- 10.4.3.1. - Visual Inspection.
- 10.4.3.2. - Inspection by penetrating liquids.
- 10.4.3.3. - Irradiation Procedures.
- 10.4.3.4. - Ultrasound tests.
- 10.4.3.5. - Figuration tests.
- 10.5. - Inspection and maintenance.

6455 FUNDAMENTALS OF STRUCTURES

1. Laws of forces in Isostatic structures,

1. - INTRODUCTION AND GENERAL REVIEW

Centres of gravity. - * Static Moment. - * Moments of Inertia. - * Steiner Theorem
. - * Other concepts

2.-ACTIONS AND EFFORTS

* General information. - * Concept of forces. - * Forces acting on a prismatic piece:
Axial, Shear, Bending Moments and torque. - * System of connections and
movements. -* Isostatic and hyperstatic states.

3.- LAW OF FORCES IN ISOSTATIC STRUCTURES.

* Support reactions and laws of forces on cantilevers. - * Support Reactions and
Laws of forces on isostatic beams. - * Gerber Beams. -

2. Stress Analysis on flat sections.

2.1. - ELASTICITY THEORY.

*Introduction The elastic solid. - * Concept of Stress. - * Stress state around a single point: internal
equilibrium equations and boundary equilibrium equations. - * generalized Hooke's Law. - *
Relationship between landslides and Compatibility Equations. - * General approach to the problem
of the elastic body.



2.2. - INTRODUCTION TO MATERIAL STRENGTHS.

* Definitions. - * Simplifying Hypotheses of the Elasticity Theory. The strength of materials. - * Concept of Safety Coefficient. - * Calculation hypothesis. - * Hooke's law. - * Compatibility conditions. - * Rethinking the elastic body problem.

2.3. – STRESS STATE: AXIAL STRESS.

* General definition: Traction and compression. - * Internal equilibrium Equation and compatibility in deformations. - * Modulus of elasticity. - * Distribution of stress due to axial exertion.

2.4. - STATE OF TENSION: PURE FLEXION.

* General definition. Bending moment. - * Single-component bending moment. - * Equations of equilibrium and compatibility in deformations. - * Distribution of Deflected flexion. Distribution of voltages. - * Resistant Moment.

2.5. – STRESS STATE: COMPLEX FLEXION.

* General definition. Overlapping of effects. - * Distribution of tensions. Fibre compound tension or compression; compound flexion. - * Central core.

2.6. – STRESS STATE: SIMPLE FLEXION.

* General definition. - * Relationship between bending Moment and shear force. - * Tangential stresses. Stress distribution.

2.7. – STRESS STATE: TORSION.

* The concept of the twisting moment. - * Stress distribution produced by a twisting moment. - * Analogy of the membrane. - * Torsion in thin sections: open profiles without branching, open branching profiles, closed profiles of one or more cells.

2.8. - GENERAL STRESS STATE

* Statement of the problem. - * Composition of stresses.

3. Deformations in Isostatic Structures.

3.1. - DEFORMATION OF AN ELEMENTARY SLICE

*General information: Superposition Principle. - * Generalization of Hooke's Law. - * Elementary deformation produced by axial forces. - * elemental Deformation produced by bending moment. - * elemental Deformation produced by cutting stress . - * elemental Deformation produced by thermal stress.

3.2.- Mohr's Theorems.

*Deformation of the prismatic piece subjected to axial stress. - * Deformation of prismatic piece subjected to bending moment. - * First theorem of Mohr. - * Second theorem of Mohr. - * Deformation in brackets. - * Deformation in isostatic beams. - * Third theorem of Mohr. - Theorem of the conjugated beam.



3.3. - ELASTIC EQUATION.

* Deformation Equation. -

3.4. - DEFORMATION ENERGY.

* General concept of deformation energy. - * Energy of deformation by axial effort. - * deformation Energy per bending moment. - * deformation Energy by shear stress. - * Castigliano's Theorem.

CRITERIA OF PLASTIFICATION AND BREAKAGE

Criteria of plastification and breakage. Tresca Criterion. Criterion of Von Mises. Criterion of the maximum normal effort. Mohr Criterion.

EXPERIMENTAL TECHNIQUES

Measurement Chain. Measurement Transducers. Measurement of Forces. Measurement of movements. Measurement of deformations. Statistical techniques of measurement. Structural trial Configuration.

4. Hyperstatic structures.

4.1. - HIPERESTATICAS STRUCTURES.

* General concepts. - * General Method of resolution of hyperstatic structures. -

4.2. - CONTINUOUS BEAMS.

* General method of resolution. - * Theorem of the three moments.

MULTI-AXIAL LOAD

Multi-axial load. Generalized Hooke's Law. Volumetric modulus of elasticity. Multiaxial stress state. First concept of principal stresses and main directions. General stress state. Unitary deformations under shear.

DEFORMATION ENERGY

Deformation Energy for multi-axial states. deformation Energy associated with Castigliano's Theorem. Calculation of deformations with Castigliano's Theorem.

PLASTIFICATION AND RESIDUAL STRESSES

Plastification under traction-compression. Residual stresses in traction-compression.

5. Indirect actions: Reductions in support and thermal stress

5.1.- INDIRECT ACTIONS: REDUCTIONS IN SUPPORT.

* Indirect actions: Reduction in supports, supports and elastic embedding.

5.2.- INDIRECT ACTIONS: THERMAL STRESSES

* Thermal Efforts. * Constant temperature variation along the edge. - * Linear temperature Variation along the edge. * Deformation in cantilevers: Turns and slides. - * Deformation in bi-supported: Rotation at the ends.



6456 ARCHITECTURAL DRAWING III

1-BASIC GRAPHICAL DOCUMENTATION AND EXECUTION OF THE ARCHITECTURAL PROJECT.

Planimetric project documentation.

General information and development.

Scales and architectonic detail.

Detail, scales and degrees of definition.

The scale in coherence with the need of the tectonic model and its adjustment to the degree of scalar definition.

Representation procedures and techniques.

Methodology and Manual graphical procedures and application of AutoCAD, Sketchup and Revit digital tools.

2- ELEMENTARY ARCHITECTONIC FACT AND TECTONIC DEVELOPMENT.

Planimetry of execution of elementary architectonic unit.

Planimetric development of execution of elementary architectonic unit.

Detail of simple architectural unit.

Detail development of elementary architectural unit.

Representation procedures and techniques.

Methodology and Manual graphical procedures and application of AutoCAD, Sketchup and Revit software.

3- COMPLEX ARCHITECTONIC FACT AND TECTONIC DEVELOPMENT.

Planimetry of complex architectural unit

Development of the actual planimetry a complex architectural unit.

Detail of complex architectural unit.

Detail development of complex architectural unit.

Representation procedures and techniques.

Methodology and Manual graphical procedures and rendering programs compatible with the digital tools developed in the previous subjects taught in the area or 3D Max.

4-IDEATION AND ARCHITECTURAL DETAIL.

Architectural Ideation and planimetry

Development of planimetry in the ideation of architecture

Ideation and architectural detail.

Development of architectural detail in the ideation of architecture.

Representation Procedures and techniques

Methodology and Manual graphical procedures and rendering programs compatible with the digital tools developed in the previous subjects taught in the area or 3D Max.



➤ 3rd year

6457 CONSTRUCTION V

First Part. The skin of the building.

1. Introduction and general concepts.
 - 1.1. General concepts. Program. Bibliography and regulations.
 - 1.2. General Concepts of building enclosures.
 - 1.2.1. External actions that affect the building.
 - 1.2.2. User requirements
 - 1.2.3. Classification of enclosures.

Second part. The Roof of the building.

2. The Roof. General concepts.
 - 2.1. Definition and components of a roof.
 - 2.2. Roof requirements.
 - 2.2.1. Environmental.
 - 2.2.2. Safety.
 - 2.2.3. Aesthetics.
 - 2.2.4. Durability.
 - 2.3. Classification of roofs
3. Flat roofs.
 - 3.1. Types of flat roofs.
 - 3.1.1. Non-transitable roof.
 - 3.1.1. Transitable roof.
 - 3.1.3. Landscaped roof.
 - 3.1.4. Roof for road traffic.
 - 3.1.5. Water roof.
 - 3.2. The inverted roof.
 - 3.2.1. Formation of slopes
 - 3.2.2. Waterproofing.
 - 3.2.3. Thermal insulation.
 - 3.2.4. Separating layers.
 - 3.2.5. Protective layers.
 - 3.2.6. Water evacuation.
 - 3.3. Execution of singular points.
4. Sloping roofs.
 - 4.1. Introduction. Types.
 - 4.2. Roof materials.
 - 4.2.1. Loose parts.
 - 4.2.2. Metallic sheets.



- 4.2.3. Plates.
- 4.2.4. Panels.
- 4.3. Thermal insulation.
- 4.4. Roof supports.
 - 4.4.1. Lineal.
 - 4.4.2. Surface.
- 4.5. Resistant structures.
- 4.6. Water drainage systems.
- 4.7. Constructive solutions for each type of roof.
- 4.8. Singular points.
- 5. Lighting on roofs.
 - 5.1. Constructive requirements.
 - 5.2. Skylights.
 - 5.3. Light wells.
 - 5.4. Composition Elements.
 - 5.4.1. Glass.
 - 5.4.2. Plastics.
 - 5.4.3. Carpentries.
 - 5.4.4. Joints and seals.
 - 5.5. Singular points.
- 6. Execution and control of roofs.

Third part. The facade.

- 7. Conventional brickwork facades.
- 8. Ventilated facade.
- 9. Facade cladding.
 - 9.1. Natural stone cladding
 - 9.2. Ceramic tile cladding.
 - 9.3. Continuous coatings
 - 9.3.1. Rendering.
 - 9.3.2. Stucco.
 - 9.3.3. Complementary decorative work.
- 10. Lightweight facade panels.
 - 10.1. GRC Panels.
 - 10.2. Simple plate panels.
 - 10.3. Sandwich Panels.
- 11. Heavy facade panels.
 - 11.1. Concrete panels.
 - 11.2. Glass. Curtain Wall.
- 12. Carpentries.
 - 12.1. Wood.



12.2. Light alloys.

12.3. Plastics.

13. Defences.

13.1. Railings.

13.2. Closures.

13.3. Blinds.

13.4. Lattice blinds.

14. Glasswork.

14.1. Plans.

14.2. Tempered.

14.3. Special.

Fourth part. Partitions.

15. Partition walls.

15.1. Brick.

15.2. Plates and panels.

16. Carpentry.

16.1. Wood.

16.2. Metals

16.3. Glass.

Fifth part. Coatings.

17. Walls.

17.1. Plasters

17.2. Trimmings and plaster.

17.3. Stucco.

17.4. Tiling.

17.5. Veneers.

17.6. Flexible.

17.7. Lightweight.

17.8. Flexible.

17.9. Fabrics.

17.10. Paints.

18. Floors.

18.1. Floor tiles.

18.2. Hardwood floors.

18.3. Industrial.

18.4. Laminates.

18.5. Carpeting.

18.6. Stones.



18.7. Wall-plates.

18.8. Terrazzo.

19. Ceilings.

19.1. Continuous.

19.2. Plates.

6458 STRUCTURES ANALYSIS AND REINFORCED CONCRETE FUNDAMENTALS

ANALYSIS OF STRUCTURES

1. Hyperstatic structures.
2. Flat systems.
3. Method of forces or flexibility.
4. Symmetry and anti-symmetry.
5. Mixed structures (rigid ties - articulated ties).
6. Seats, temperature variations, manufacturing errors.
7. Calculation Programs - CYPE Metal 3D, Tricalc by Arktec and/or others.
8. Introduction to rigidity and displacement methods.

FUNDAMENTALS OF REINFORCED CONCRETE

1. General principles.

Project Bases. Safety Criteria and calculation bases. Actions, materials and Analysis of structures. Technological Properties of Materials.
Durability.

2. Calculation.

Material Data for the project. Calculations relating to the Last State Limits.
Equilibrium Limit State.

3. Fatigue Limit State vs. Normal solicitations (I).

General calculation principles. Calculation of reinforcement of sections subjected to simple bending in beam elements.

4. Fatigue Limit State vs. Normal solicitations (II).

Calculation of ultimate moments in cases of simple flexion.

5. Fatigue Limit State vs. Normal solicitations (III).

Calculation of reinforcement of sections subjected to simple bending in beam and column elements.

6. Fatigue Limit State vs. Shear stress.

Calculation of reinforcement in sections subjected to compound flexion in beam and column elements.



7. Instability Limit State.

Verification of isolated supports.

8. Deformation Limit State.

Simplified method.

9. CYPECAD. and/or Tricalc by Arktec.

6459 QUANTITY SURVEYING I

1. - Building project. Documents.

2. - Structure of the budget.

3. - Measurements and valuations of work.

3.1. Groundwork.

3.2. Foundations.

3.3. Structures.

3.4. Masonry.

6460 WORKPLACE ACCIDENT PREVENTION AND SAFETY

Thematic unit 1. - Basic Concepts of Prevention and Safety

TOPIC I INTRODUCTION TO THE STUDY OF PREVENTION AND SAFETY IN CONSTRUCTION

- Prevention and safety in labour relations. Collective bargaining.
- Prevention as collective work in the Construction Sector.
- Professional risks and damages.

TOPIC II THE ACCIDENT AT WORK

- The concept of workplace accident. Risk and danger at work.
- The causes of the work accident. Concurrence of causes.
- Circumstances affecting safety: Acts and unsafe conditions.
- Immediate Consequences of accidents at work.
- Classification of occupational accidents.
- Occupational incapacities in the National Health System.
- Medical Classification of the accident.

TOPIC III STUDY OF OCCUPATIONAL ACCIDENTS

- Introduction.
- The work accident report.
- Accident Registry.
- Statistical Indices of accidents.



- Prevention Statistics and indicators.

TOPIC IV LIABILITIES ARISING FROM ACCIDENTS AT WORK

- Criminal liability.
- Civil liability.
- Administrative liability.

Thematic unit 2. - Risk Prevention and Safety Regulations applicable to the Construction Sector.

TOPIC V HEALTH AND SAFETY REGULATIONS

- Regulatory References on occupational health and safety.
 - Law 31/95 on the prevention of occupational risks and amendments.
 - The objectives of Law 31/95 on the prevention of occupational risks.
 - Prevention policy.
 - Right and obligations of employers.
 - Obligations of workers with regard to risk prevention.
 - The occupational risk prevention management system: Prevention services.
- The risk prevention plan.
- Obligations of the manufacturers, importers and suppliers.

TOPIC VI THE ROYAL DECREE 1627/97. THE HEALTH AND SAFETY PLAN

- Background.
- Scope of application.
- Definition of concepts.
- The Study of Health and Safety in the Royal Decree 1627/97.
- The Basic Health and Safety Study.
- The Health and Safety Plan at Work.
- General Principles applicable to the preparation phase of the work project.
- General Principles applicable to the execution phase of the project on-site.
- Obligations of contractors and subcontractors.
- Obligations of the self-employed workers.
- The Incident Report Book.
- The work stoppage.
- Information to the workers.
- Consultation and participation of workers.
- Project viewing.
- Advance notice.

TOPIC VII ORGANIZATIONS INVOLVED IN SAFETY AND PREVENTION

- National bodies involved in occupational health, safety and risk prevention.
- International bodies involved in occupational health, safety and risk prevention.



TOPIC VIII THE EVALUATION OF WORKPLACE RISKS

- Introduction.
- Procedures to evaluate the risks at work.
- General Method of Risk Assessment.

Thematic unit 3. - Risks and their protection.

TOPIC IX PROTECTION AT WORK

- Protection at work: Collective protection: Nets, stairs, railings, canopy nets, decking.
- Protection at work: Individual protection: protection of the skull, respiratory tract, ears, eyes, skin, feet. Protective equipment against falls.

TOPIC X RISKS IN THE CONSTRUCTION PROCESS

- Electrical Risks: Use of temporary electrical systems on site. Direct and indirect contacts. Grounding of auxiliary equipment. Tensions and safe distances.
- Risk of falls to a different level: Scaffolds and work platforms. Types of Scaffolding and regulations.
- Risks arising from the manipulation of loads: Identification of risks and characteristics of auxiliary materials used: slings, cables, chains and Position for load balancing.
- Fire Risk: Triggers leading to fire initiation and propagation. Extinguishing equipment and typology based on the type of fire. Prevention in the storage of combustible products on site.
- Risks associated with the handling of auxiliary equipment and machines tools: Identification of the risks and preventive measures. Machinery Regulations.
- Risks in the construction process: description of the risks that arise in Identification of risks and correction measures.
- Risks in demolition processes and deconstruction of buildings: Singularities of the demolition process. Previous analysis of the constructive typology of the building. Planning of the deconstruction process. Risks and preventive measures.
- Risks in the building maintenance process: The inspection of buildings. Preventive measures in the planning and programming of maintenance work. Compatibility of building maintenance and residential activities.

Thematic unit 4. - Appendices

TOPIC XI BASIC DOCUMENTATION OF OCCUPATIONAL SAFETY AND HEALTH AT CONSTRUCTION SITES

- Introduction.
- Prior notice.
- Work Centre Opening.



- Appointment of Health and Safety Coordinators.
- Preparation of the Health and Safety Plan.
- Appointment of the person in charge of prevention.
- Designation of Prevention Delegates.
- Information, consultation and participation of workers.
- Training of workers.
- Health monitoring.
- Delivery of individual protection equipment.
- Coordination of prevention with subcontractors.
- Appointment of Preventive resources.
- Obligations of self-employed workers.

6461 CONSTRUCTION EQUIPMENT AND AUXILIARY MEANS

U.D.1. - SITE PLANNING FOR WORK EQUIPMENT AND AUXILIARY MEANS

L.1. - CLASSIFICATION OF WORK EQUIPMENT

This lesson has as its objective the planning and placement of the different equipment and auxiliary means, differentiating the different elements that must be considered, in order to have the basic services before beginning construction or rehabilitation of any job.

L.2. – CONSIDERATION OF WORK EQUIPMENT

Within this lesson, the students will have as their objective to become familiar with the basic documentation of an architectural project as well as the study of the location of the equipment on-site. This is because the construction process of any building is justified to develop in detail all the specific requirements of barriers with their typologies and administrative processes. On the other hand, the job's progressive occupation must be carried out in accordance with its characteristics and even the slopes towards its access points. Eventually, the student must be able to develop a working method for each construction site, learning about the constraints that each one has.

U.D2. - PROVISIONAL GENERAL CONSTRUCTION SITE FACILITIES

L.3. - PROVISIONAL FACILITIES FOR WATER SUPPLY, SANITATION AND EVACUATION ON SITE

L.4. - PROVISIONAL FACILITIES FOR ELECTRICITY ON SITE

U.D.3. - AUXILIARY MEANS OF CONTAINMENT: SHORING, INDUSTRIALIZED SHORING SYSTEMS, SCAFFOLDING, ELEMENTS AND MEANS OF CONSOLIDATION

L.5. - SHORING AS AN AUXILIARY MEANS. WOODEN SHORING ELEMENTS



L.6. - INDUSTRIALIZED SHORING SYSTEMS. SCAFFOLDING

L.7. - SCAFFOLDING ACCESSORIES. ELEMENTS AND MEANS OF CONSOLIDATION

U.D.4. - PRODUCTION AND TRANSMISSION OF ENERGY ON JOBS

L.8. - SOURCES AND ENERGIES

L.9. - COMBUSTION ENGINES

L.10. - ELECTRIC MOTORS AND PUMPS

L.11. - GENERATOR SETS AND PUMPS

6462 INSTALLATIONS III

BLOCK 1: ELECTRICAL INSTALLATIONS

1. INTRODUCTION TO ELECTRICAL SYSTEMS

1.1. Magnitudes and Fundamental concepts.

2. MATERIALS.

2.1. Cables, protection Tubes and protection gutter.

2.2. Protective Boxes.

2.3. Protection Mechanisms.

2.4. Control and protection mechanisms.

2.5. Control mechanisms.

3. DISTRIBUTION NETWORKS

3.1. Aerial networks.

3.2. Underground networks.

4. LOAD FORECAST

4.1. Classification of consumption points.

4.2. Degree of electrification

4.3 Total load corresponding to a building preferably intended for housing.

4.4. Total load corresponding to commercial, office and mixed buildings.

5. SUPPLIES

5.1. Definition.

5.2. Types of supplies.

6. LIAISON FACILITIES

6.1. General protection box

6.2. General power line



- 6.3. Individual derivation
- 6.4. Meters: location and installation systems
- 6.5. General and individual device control and protection board.

7. INSTALLATION OF EARTHING

- 7.1. Purpose
- 7.2. Earthing or ground connection. Definition
- 7.3. Earthing connections.

8. INTERIOR OR RECEPTOR INSTALLATIONS

- 8.1. General requirements.
- 8.2. Installation systems.
- 8.3. Protective tubes and conduits.
- 8.4. Overcurrent protection.
- 8.5. Surge protection.
- 8.6. Protection against direct and indirect contacts.
- 8.7. Number of circuits and characteristics.
- 8.8. General installation requirements.
Premises containing a bathtub or shower.

9. INSTALLATION IN PREMISES OF PUBLIC ATTENDENCE

- 9.1. Scope of application.
- 9.2. Power for security systems.
- 9.3. Emergency lighting.

10. INSTALLATIONS IN PREMISES WITH RISK OF FIRE OR EXPLOSION

- 10.1. Scope of application.
- 10.2. Site classification.

11. SINGLE-LINE DIAGRAMS

- 11.1. Learn the standardized electrical symbology of single-line diagrams.
- 11.2. Graphic representation and Application of electrical symbology in single-line diagrams.

12. RECEPTOR INSTALLATION

- 12.1. Types of receivers.

BLOCK 2: INTERIOR ILLUMINATION

13. PHOTOMETRY

- 13.1. Concepts.
- 13.2. Magnitudes and foundations.



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14. LAMPS AND LIGHTS

- 14.1. Incandescent lamps.
- 14.2. Discharge lamps.
- 14.3. Other light sources.
- 14.4. Lights and their classification.

15. INTERIOR LIGHTING

- 15.1. Glare.
- 15.2. Colour.
- 15.3. Lighting systems.
- 15.4. Recommended lighting levels.

16. CALCULATION AND DESIGN

- 16.1. Starting data.
- 16.2. Number of lights and their location.
- 16.3. Calculation of installed power.

ENERGY EFFICIENCY OF LIGHTING FACILITIES (DB HE3)

- 17.1. General information.
- 17.2. Characterization and quantification of demand.
- 17.3. Construction products.
- 17.4. Maintenance and conservation.

18. DOMOTIC AND AUTOMATION SYSTEMS

- 18.1. Home automation and its advantages.

BLOCK 3: TELECOMMUNICATIONS

19. COMMON TELECOMMUNICATION INFRASTRUCTURES

- 19.1. Definition of the network.
- 19.2. Design Considerations.

20. ENCLOSURES AND CONDUITS.

- 20.1. Input boxes and link registers.
- 20.2. Telecommunications facilities enclosures.
- 20.3. Main, secondary and internal user conduits and their registers.

BLOCK 4: WORKSHOP AND LABORATORY PRACTICES

- Electric material.
- Cables, tubes and junction boxes.
- Elements of Link Installation.

Command mechanisms, control mechanisms and protection.

Lamps and lights.

Measurement switchgear.

6463 TECHNOLOGY OF BUILDING STRUCTURES

Movement in Buildings

CTE DB AE

1 General information.

1.1 Scope of application.

2 Permanent movement.

2.1 Own weight.

2.2 Prestressing.

2.3 Terrain movement.

3 Variable movement.

3.1 Overload of use.

3.2 Actions on railings and Dividing elements.

3.3 Wind.

3.4 Thermal actions

3.5 Snow.

4 Accidental movement

4.1 Earthquake.

4.2 Fire.

4.3 Impact.

Annex A. Terminology.

Annex B. Notations and units.

B.1 Notations.

B.3 Units.

Annex C. Handbook of Weight and internal friction coefficients.

Annex D. Wind Action.

D.1 Dynamic pressure.

D.2 Exposure Coefficient.

D.3 External pressure Coefficients.

Annex E. Climatic data.



Direct foundations

4 DIRECT FOUNDATIONS.

4.1 Typology.

4.1.1 Insulated footings.

4.1.2. Combined and continuous footings.

4.1.3. Foundation shafts.

4.1.4 Gratings.

4.1.5 Slabs.

4.2 Analysis and dimensioning.

4.2.1 Basic criteria.

4.2.1.1 Concept of sinking.

4.2.1.2 Relative terrain-structure rigidity Forces on foundations elements.

4.2.1.3 Models of interaction. Ballast module.

4.2.2 Verifications.

4.2.2.1 Ultimate limit states.

4.2.2.1.1 Sinking.

4.2.2.1.2 Sliding.

4.2.2.1.3 Overturning.

4.2.2.1.4 Overall Stability.

4.2.2.1.5 Structural Capacity of the foundation.

4.2.2.2 Service limit states.

4.2.2.3 Other additional checks.

4.2.3 Basic variables and terrain parameters.

4.2.3.1 Ultimate limit states.

4.2.3.2 Service limit states.

Design and calculation of structural elements and floor structures

Floor framing

1. PRESENTATION

1.1. Introduction.

1.2. Floors.

1.3. Function of floors.

1.4. Conditioning factors.

1.3. Most common typologies.

1.4. Premises for the choice of slab system.

1.5. History and evolution of slabbed floors.

2. TYPES OF FLOOR SLABS

2.1. Introduction.

2.2. Prefabricated slabs.

2.2.1. Hollow core slabs.

2.2.1.1. Characteristics.



- 2.2.1.2. Application.
- 2.2.1.3. On-site placement.
- 2.2.1.4. Advantages.
- 2.2.2. Pre-slabs.
 - 2.2.2.1. Characteristics.
 - 2.2.2.2. Application.
 - 2.2.2.3. On-site placement.
 - 2.2.2.4. Advantages.
- 2.2.3. Metallic slab (collaborating sheet metal).
 - 2.2.3.1. Characteristics.
 - 2.2.3.2. Application.
 - 2.2.3.3. On-site placement.
 - 2.2.3.4. Advantages.
- 2.3. Implementation on site.
 - 2.3.1. Characteristics.
 - 2.3.2. Application.
 - 2.3.3. On-site placement.
 - 2.3.4. Advantages.

3. COMPARATIVE

3.1. Introduction

Previous considerations: cost and deadline

Durability, Seismic Actions and Fire Safety of Building Structures

6464 TECHNICAL PROJECTS I

- A) Design concept of building engineering.
- B) Regulations on design actions of building engineering.
- C) Design and Project methodology.
- D) Building and renovation projects.
- E) Project phases.
 - E.1) Previous studies.
 - E.2) Preliminary draft.
 - E.3) Basic project.
 - E.4) Execution project.



F) Detail of the phases of the construction project.

F.1) Previous studies.

1 Expository record.

2 Sketch.

3 Cost estimates.

F.2) Preliminary draft.

1 Justifying report.

2 Floor Plans, section and elevation.

3 Advance budget.

F.3) Basic project.

1 Justifying report.

2 General Plans to scale of location, site location, urban justification, floor plans, sections and elevations.

3 Estimated budget by chapters.

Note: up to this point it would be strictly the program of the subject Projects I, nevertheless, and taking into account the importance that the basic project has for the later drafting of the execution project, the following documents that would complete a basic project for obtaining the execution project are included.

F.4) Execution project.

I. Report on the execution project.

1. Descriptive report.

2. Constructive report.

3. CTE compliance.

3.1 Structural safety.

3.1.1 Structural safety.

3.1.2 Actions in Building.

3.1.3 Foundations.

3.1.4 Seismic action.

3.1.5 EHE compliance.

3.1.6 Characteristics of the floor.

3.1.7 Steel structure.

3.2 Fire safety.

3.3 Safety of use.

3.4 Health.

3.4.1 HS1 Protection against moisture.

3.4.2 HS2 Waste collection and disposal.

3.4.3 HS3 Indoor air quality.

3.4.4 HS4 Water supply.

3.4.5 HS5 Waste water disposal.

3.5 Protection against noise.

3.6 Energy saving.

3.6.1 HE1 Energy demand limitation.



- 3.6.2 HE2 Efficiency of Thermal installations.
- 3.6.3 HE3 Energy efficiency in lighting installations.
- 3.6.4 HE4 Minimum solar contribution to DHW production.
- 3.6.5 HE5 Minimum photovoltaic contribution of electrical energy.
- 4. Compliance with other regulations.
- 5. Report appendices.
- 5.1 Geotechnical information.
- 5.2 Structure calculation.
- 5.3 Fire protection.
- 5.4 Facilities.
- 5.5 Energy efficiency.
- 5.6 Quality control plan.
- 5.7 Health and Safety Study (BASIC).

II. Plans

- The project will contain as many plans as necessary for the detailed definition of the job.
- In the case of renovation works, the building plans will be included before the intervention. Those of the basic project with the modifications that are pertinent in accordance with the report or reports issued by the technical experts from the relevant administration/s. Graphic and dimensional description of the entire structural system (foundation, load/bearing structure and horizontal structure).

In those relating to the foundation, its relationship with the immediate environment and the whole of the job will also be included.

Plans of facilities. Graphic and dimensional description of the networks of each installation, plants, sections and details.

Plans of constructive definition. Graphic documentation of constructive details.

Graphic reports. Indication of concrete solutions and singular elements: carpentry, locksmith, etc.

OTHER

III. Specification of conditions

IV. Measurements.

V. Budget.

6465 QUANTITY SURVEYING II

Thematic block I.- measurements and valuations of building work. ii

Criteria of measurement and valuation of roofs

**Criteria of measurement and valuation of pavements
and Coatings**



6466 CONSTRUCTION MANAGEMENT

TOPIC 1. GENERAL CONCEPTS

1. GENERAL CONCEPTS

- 1.1. Historical summary.
- 1.2. Factors that determine the organization.
- 1.3. 1.3. Stages or phases of organization.
- 1.4. Types of organization.

TOPIC 2. STUDY of WORK. STANDARDIZATION - STANDARDIZATION

2. STUDY OF MOVEMENTS AND TIMES.

- 2.1. Diagram of process operations.
- 2.2. Diagram of process analysis. Symbols used.
- 2.3. Graph of activities in the workplace. Diagrams.
- 2.4. Plant distribution.
- 2.5. Principles.

3. FACTORS THAT DETERMINE PRODUCTION

- 3.1. Concepts:
 - 3.1.1. Demand, Profitability, Competitiveness, Market Research.
- 3.2. Workloads.
- 3.3. Deadlines and delivery dates.
- 3.4. Levels of information.

TOPIC 3. STATISTICS APPLIED TO PLANNING - GRAPHICAL SUPPORT

4. GRAPHICS:

- 4.1. Characteristics and types.
- 4.2. Organization charts, characteristics.

5. MATHEMATICS AND TECHNIQUES APPLIED TO CONSTRUCTION PLANNING

- 5.1. Concepts:
 - 5.1.1. Centralization Parameters and dispersion parameters.
 - 5.1.2. Normal and standard curve.
 - 5.1.3. Graphic adjustment.
 - 5.1.4. Probability of compliance with scheduled dates.
 - 5.1.5. Band or level of confidence.

6. SAMPLING

- 6.1. Method of instantaneous observations.



6.2. Stages.

6.2.1. Data collection.

6.2.2. Calculation number of measurements required.

6.2.3. Forms.

6.2.4. Upper and lower control limits.

7. TIMING

7.1. Basic concepts:

7.1.1. Clock time.

7.1.2. Rhythm factor.

7.1.3. Normal time.

7.1.4. Type time.

7.2. Scales.

8. CONTROL OF STOCKS

8.1. Basic principles.

8.2. Stock curves.

8.3. Order and replacement point.

8.4. Value of items.

8.5. ABC systems.

TOPIC 4. CONSTRUCTION COMPANY. ORGANIZATION - ECONOMIC STUDY OF WORK

9. THE CONSTRUCTION COMPANY

9.1. Characteristics.

9.2. Classification.

9.3. Business organization chart.

9.4. Departments or Areas of activity.

9.5. Functions.

9.6. Mission of the Building Engineer.

10. ECONOMIC STUDY OF A JOB

10.1. Capital investments and profitability.

10.2. Maximum capital, minimum capital.

10.3. Chart and economic calendar of job.

TOPIC 5. PLANNING A WORK

11. JOB PLANNING

11.1. Project activity worksheets

11.1.1. Allocated Resources (personnel, machinery,...) and calculation of the planned duration.

11.1.2. Conversion of the necessary work days into calendar days.

11.1.3. Links between the activities of a job



TOPIC 6. SYSTEMS OF JOB PROGRAMMING

12. GANTT BAR DIAGRAM

- 12.1. Representation of Activities in the GANTT Diagram.
- 12.2. Personnel Curves.
- 12.3. Curves of Partial and Accumulated job valuations.

13. CPM SYSTEM

- 13.1. Normal and Fictitious Activities.
 - 13.1.1. Numbering of events.
- 13.2. Time calculations in Activities.
- 13.3. Total, Free and Independent Clearances. Graphic representation.
- 13.4. Critical events and activities.
- 13.5. Roads or Critical Roads.

14. PERT SYSTEM

- 14.1. Concepts of Normal and Fictitious Activities, Events.
 - 14.1.1. Interdependence between Activities.
- 14.2. Estimation of the time in the PERT.
 - 14.2.1. PERT final expected time (Network Calculation).
- 14.3. Clearances (Total, Free and Independent).
 - 14.3.1. Representation of Clearances.
- 14.4. Critical Activity and Critical Events.
- 14.5. Roads in the PERT.
 - 14.5.1. Road or critical roads in the PERT.
- 14.6. Probability of finishing the job in the desired time.

15. ROY SYSTEM

- 15.1. Representation of Activities.
- 15.2. Ligatures.
- 15.3. Calculation of the ROY Network.
- 15.4. Calculation of Clearances
 - 15.4.1. Calculation of total clearance and free clearance.
- 15.5. Critical activities.
- 15.6. Critical path or paths.

16. PRECEDENCE SYSTEM

- 16.1. Activities, Sequentiality and Duration.
- 16.2. Ligatures and Conditions.
- 16.3. Graphic representation of the system
- 16.4. Calculation of Total Clearances.



17. RELATIONSHIP BETWEEN THE PERT, CPM, ROY AND THE GANTT DIAGRAM

17.1. Improved GANTT

17.2. Total clearances in the GANTT diagram.

TOPIC 7. SHORTENING WORK DEADLINES

18. STUDY OF WORK COSTS

18.1. Direct costs. Indirect costs. Total costs

18.2. Cost/time ratio. Normal and accelerated cost curves

18.3. Increasing cost over time

19. SHORTENING OF DEADLINES

19.1. Advisable activities to be shortened, based on criticality and costs.

19.2. Selective shortening in the PERT, CPM and ROY systems.

6467 TECHNIQUES FOR WORKPLACE ACCIDENT PREVENTION

Thematic Unit 1

Prevention of Occupational Risks - Specialties

- Basic concepts.
- Safety at Work. Main Risks.
- Industrial Hygiene. Main Risks.
- The Physical Burden at Work. Detection and Prevention. Design of Posts.
- Environmental Conditions.
- The Mental Burden. Detection and Prevention. Psychosocial Risks.

Prevention Techniques

- Risk Assessment. Main Methods. WT Fine Method.
- Accident Notification.
- Statistical Analysis of Accidents. Main Indices.

Prevention Audits

- Legal audits in the field of Occupational Risk Prevention.
- Obligatory Compliance Regulations.
- Technical Guides.
- Prevention Technical Notes.

Accidentality in Spain

- Sectors of Activity.
- Other Variables.



➤ 4th year

6468 TECHNICAL PROJECTS II

- A) Design concept of building engineering.
- B) Regulations on design actions of building engineering.
- C) Design and Project methodology.
- D) Building and urbanization projects and civil jobs.
- E) Phases of the building project.
 - E.1) Previous studies.
 - E.2) Preliminary draft.
 - E.3) Basic project.
 - E.4) Execution project.
- F) Phases of the urbanization project and civil jobs.
 - F.1) Preliminary draft.
 - F.2) Execution project.
- G) Detail of the phases of the building project.
 - G.1) Previous studies.
 - 1 Expository record.
 - 2 Sketch.
 - 3 Cost estimate.
 - G.2) PRELIMINARY DRAFT
 - 1 Justifying report.
 - 2 Floor Plans, elevations and sections.
 - 3 Budget advance.
 - G.3) BASIC PROJECT
 - 1 Descriptive report.
 - 2 General Plans to scale of Floors, elevations and sections.
 - 3 Budget by chapter, trade or technology.
 - G.4) EXECUTION PROJECT
- I. REPORT ON THE EXECUTION PROJECT
 - 1. Descriptive report.
 - 2. Constructive report.



3. CTE compliance.
 - 3.1 Structural safety.
 - 3.1.1 Structural safety.
 - 3.1.2 Actions in Building.
 - 3.1.3 Foundations.
 - 3.1.4 Seismic action.
 - 3.1.5 EHE compliance.
 - 3.1.6 Characteristics of the floor.
 - 3.1.7 Steel structure.
 - 3.2 Fire safety.
 - 3.3 Safety of use.
 - 3.4 Health.
 - 3.4.1 HS1 Protection against moisture.
 - 3.4.2 HS2 Waste collection and disposal.
 - 3.4.3 HS3 Indoor air quality.
 - 3.4.4 HS4 Water supply.
 - 3.4.5 HS5 Waste water disposal.
 - 3.5 Protection against noise.
 - 3.6 Energy saving.
 - 3.6.1 HE1 Energy demand limitation.
 - 3.6.2 HE2 Efficiency of Thermal installations.
 - 3.6.3 HE3 Energy efficiency in lighting installations.
 - 3.6.4 HE4 Minimum solar contribution to DHW production.
 - 3.6.5 HE5 Minimum photovoltaic contribution of electrical energy.
4. Compliance with other regulations.
5. Report appendices.
 - 5.1 GEOTECHNICAL INFORMATION.
 - 5.2 STRUCTURAL CALCULATION.
 - 5.3 FIRE PROTECTION
 - 5.4 BUILDING INSTALLATIONS.
 - 5.5 ENERGY EFFICIENCY.
 - 5.6 ENVIRONMENTAL IMPACT STUDY.
 - 5.6 QUALITY CONTROL PLAN.
 - 5.8 SAFETY AND HEALTH STUDY OR BASIC STUDY, IF APPLICABLE.

II PLANS

- The project will contain as many plans as necessary for the detailed definition of the job.
- In the case of renovation jobs, the building plans will be included before the intervention.

SITUATION PLAN * Refers to current planning, with reference to localizable points and with indication of the geographic north.



EMPLOYMENT PLAN* Urban justification, alignments, setbacks, etc.

URBANIZATION PLAN*. Road network, connections, etc.

GENERAL FLOORS*. Dimensioned, with an indication of scale and uses, reflecting fixtures and fittings, where necessary for the purpose of verifying the conformity of the functionality of spaces.

ROOF PLANS*. Slopes, water collection points, etc.

Elevations and sections*. Dimensioned, with indication of scale and height of plants, forging thicknesses, total heights, to check compliance with urbanistic and functional requirements.

STRUCTURE PLANS. Graphic and dimensional description of the entire structural system
In those relating to the foundation, its relationship with the immediate environment and the whole of the job will also be included.

INSTALLATION PLANS. Graphic and dimensional description of the networks of each installation, floors, sections and details.

Plans of constructive definition. Graphic documentation of constructive details.

Graphic reports. Indication of concrete solutions and singular elements: carpentry, locksmith, etc.

OTHER

III SPECIFICATION OF CONDITIONS.

- ADMINISTRATIVE CLAUSE SPECIFICATION.
- GENERAL PROVISIONS.
- OPTIONAL PROVISIONS.
- ECONOMIC PROVISIONS.
- SPECIAL TECHNICAL SPECIFICATIONS.
- MATERIAL REQUIREMENTS.

Minimum technical characteristics to be met by products, equipment and systems to be incorporated into the job, as well as its supply conditions, reception and conservation, storage and handling, quality assurance and quality control reception to be carried out, including sampling of the product, tests to be carried out acceptance and rejection criteria, and the actions to be taken and the criteria to be adopted of use, conservation and maintenance.

These specifications can be made by reference to general specifications that are of application, Recognized Documents or others that are valid at the discretion of the designer.

- PRESCRIPTIONS REGARDING EXECUTION BY WORK UNITS.

Technical characteristics of each work unit indicating its execution process,



implementing rules, preconditions to be fulfilled before its implementation, permissible tolerances, conditions of termination, conservation and maintenance, performance control, trials and tests, quality assurance, criteria of acceptance and rejection, measurement criteria and evaluation of units, etc. Measurements will be needed to ensure compatibility between the different products, elements and construction systems.

- PRESCRIPTIONS ON VERIFICATIONS IN THE FINISHED BUILDING.

The verifications and service tests to be carried out shall be indicated to check the final performance of the building.

IV MEASUREMENTS.

Development by headings, grouped in chapters, containing all the technical descriptions necessary for its specification and valuation.

V. BUDGET.

- APPROXIMATE BUDGET*

Approximate valuation, detailed by chapter, of the material execution of the job.

- DETAILED BUDGET.

Price table grouped by chapters.

Summary by chapters, with expression of the final value of execution and contract.

It will include the quality control budget.

Health and Safety Study Budget.

VI. WORK MANAGEMENT.

1 WORK ORDERS, GRAPHICAL AND WRITTEN.

2 WORK CERTIFICATION.

VII. LIQUIDATION AND RECEPTION OF JOB.

1 FINAL FINANCIAL STATEMENT OF JOB.

2 CERTIFICATE OF PROVISIONAL RECEIPT, GUARANTEE AND FINAL RECEIPT.

H) DETAILS OF THE PHASES OF THE URBANISATION PROJECTS AND CIVIL WORKS.

G.1) PRELIMINARY DRAFT.

1 Justifying report.

2 Floor Plans, elevations and sections.

3 Budget advance.

G.2) EXECUTION PROJECT

3 Descriptive record OF THE Specific Urbanization Projects and Civil jobs, containing:



- a. General report.
 - b. Report appendices.
 - c. Specification of conditions.
 - d. General Budget Summary.
 - 4 Specific projects, containing:
 - a. Descriptive report.
 - b. Report appendices. Characteristics and calculations.
 - c. Floor Plans, elevations, profiles, sections, etc.
 - d. Specification of conditions.
 - e. Budget, with Measurements, price charts. Partial Budgets and General Budget.
 - 5 Works management, graphical and written, with Dimension Plans
 - 6 Final settlement and hand-over of works.
 - a. Final financial statement of works.
 - b. Certificate of provisional hand-over, guarantee and final receipt.
- I) DEMOLITION PROJECTS. OTHER PROJECTS.

6469 PATHOLOGY AND REHABILITATION

BLOCK 1 PATHOLOGY AND REHABILITATION

CHAPTER 1 INTRODUCTION AND TYPES OF INJURIES

- Safety threshold.
- Pathological process.
- Injury-cause.
- Classification of injuries.
- Physical injuries.
- Mechanical injuries.
- Chemical injuries.
- Direct and indirect causes.

CHAPTER 2 GENERAL METHODOLOGY, INSPECTIONS, INSTRUMENTATION

- Pre-diagnosis.
- Previous studies/diagnosis.
- Final report, final diagnosis/conclusion.
- Classifications of inspections.
- Data collection.
- Fieldwork.
- Inspections of seats, shifts and instrumentation.
- Inspection of structural movements.



Instrumentation.

Humidity Inspections.

Other inspections.

CHAPTER 3 COMPATIBILITY OF MATERIALS

Introduction.

Compatibility Types.

Physical Compatibility.

Chemical Compatibility.

CHAPTER 4 PATHOLOGY OF FOUNDATIONS

Causes of foundation-related problems.

Symptomatology of foundation failures.

Footing.

Cracks and fissures.

Incidence of footings on structural buildings.

Framework.

Incidence of footings on structural buildings.

Resistant Wall strength.

Foundation reinforcements.

Building rehabilitation.

CHAPTER 5 PATHOLOGIES OF BUILDINGS BASED ON THE STRUCTURE OF

Resistant Walls.

General concepts.

Pathology of adobe and rammed earth resistance walls.

Physical Injuries Mechanical Injuries and Chemical Injuries.

Pathology of buildings based on the structure of stone walls.

Physical, chemical and mechanical injuries.

Wall-based building rehabilitation.

CHAPTER 6 PATHOLOGY OF CONCRETE

Introduction.

Damage of hydrothermal origin.

Damage due to the action of burdens.

Damage due to girder and pillar lattice structures.

Damage to wall-based structures.

Damage to slabs.

Damage to slab-based forgings and/or slabs.

Lightened and / or masses.

Damage to one-way slabs in situ.



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Damage to prefabricated slabs.
Fire Damage.
Chemical Damage in concrete.
Damage caused by carbonation (co₂).
Damage caused by sulphate attack.
Damage caused by corrosion of the reinforcement meshes.
Concrete reinforcements.

CHAPTER 7 PATHOLOGIES IN METAL STRUCTURES

Definitions and typologies.
Pathologies due to the project phase.
Pathologies due to the manufacturing phase.
Pathologies due to the assembly phase.
Pathologies attributable to the service phase.
Rehabilitation systems and structural reinforcement.

CHAPTER 8 PATHOLOGY OF WOODEN STRUCTURES

Definition and typologies.
Degradation of wood.
Abiotic degradation.
Biotic degradation.
Protection of wood.
Reinforcement of wooden structures.
Traditional reinforcements.
Wood-based reinforcements.
Metal reinforcements.
Modern reinforcements.
Beta system.
Carbon fibre-based system.

CHAPTER 9 FACADE PATHOLOGY

Humidity in facades.
Pathology of enclosures based on exposed bricks.
Pathology of enclosure based on elemental finishes.
Pathology of veneers.
Pathology of cladding.
Pathology of finishes with wall tiles.
Pathology of facades based on prefabricated elements.
Oxidation and corrosion of metal facade elements.
Pathology of facades based on decorations and rendering.
Rehabilitation of facades.



CHAPTER 10 ROOF PATHOLOGY

Pathology of flat roofs.

Pathologies of sloped roofs.

CHAPTER 11 TECHNICAL INSPECTIONS OF BUILDINGS

PHOTOGRAMMETRY

I PART: ORTHOGONAL AND OBLIQUE AXONOMETRY - PERSPECTIVES

Topic 1. GENERAL CONCEPTS OF AXONOMETRY

- Fundamentals of the system.
- Folding and deactivation of a flat figure.
- Perpendicularity and distances.
- Angles.
- Representation of figures and shadows.
- Application of axonometric perspectives to drawing.
- Oblique Axonometry. Concepts. Rotation, perpendicularity and distances, angles. Representation of figures and shadows.

PART II. CONICAL PROJECTION SYSTEM - CONICAL PERSPECTIVE

Topic 2. CONIC OR LINEAR PERSPECTIVE

- General information. Representation of the point, straight line and plane.
- Intersections.
- Parallelism.
- Rotations.
- Perpendicularity and distances.
- Angles. Circle and measuring point. Perspective coordinates of the point.
- Representation of figures.
- Perspective of curved lines and surfaces.
- Perspective methods.
- Perspective of inclined picture.
- Prospective restitutions.
- Reflections and shadows. Practical perspective.
- Fundamental elements of the conical perspective.
- Types of perspective as a function of the position of the plane of the frame.
- Types of perspective depending on the position of the point of view.
- Vertical frame perspective.
- Metric points. Measurement of distances on a line.

PART III. PHOTOGRAMMETRY

Topic 3. INTRODUCTION TO PHOTOGRAMMETRY



- General concepts and historical origins. Background of classical and stereoscopic photography.
- Laussedat Method and Terrero-Hauk Theorem
- Stereoscopic Photogrammetry. Fundamentals and antecedents.
- Metric cameras and stills.

Fundamentals of the stereoscopic method.

- Metric cameras and stills.
- Orientation of a pair (or multiple) stills.
- Restorative devices.
- Stereoscopic restitution.

Topic 4. HOMOGRAPHS IN GRAPHIC EXPRESSION AND ITS APPLICATIONS TO PHOTOGRAMMETRY

- Homographs, the graphic expression.
- Application of homographs to the survey of flat architectural walls.
- Application of homographs to the simplified layout of architectural perspectives.
- Installation and fundamentals of the "Homograph. F1" computer program
- Field Practices.
- Laboratory Practices.

6470 SURVEYS AND VALUATIONS

Thematic Unit 1.- PERITATIONS

Chapter 1. LEGAL FRAMEWORK

- 1.1. Rules governing the exercise of professional activities.

2. CHAPTER 2. INTRODUCTION

- 2.1. General concepts.
- 2.2. Conditions to be an expert.

3. CHAPTER 3. CLASSIFICATION OF THE EXPERT'S REPORT

- 3.1. Depending on the issuer of the order.
- 3.2. Depending on jurisdiction.
- 3.3. Depending on the subject matter of the expertise.

4. CHAPTER 4. PREPARATION OF THE REPORT

- 4.1. Previous data. Acceptance of the order.
- 4.2. Collection of information.
- 4.3 Investigation of the facts.



- 4.4. Results.
- 4.5. Writing the report.
- 4.6. Importance of language.
- 4.7. Ethics and deontology.

5. CHAPTER 5. CONTENTS OF THE REPORT

- 5.1. Preamble.
- 5.2. Table of contents.
- 5.3. Author(s) of the report.
- 5.4. Background information.
- 5.5. Purpose of the report.
- 5.6. Documentation used
- 5.7. Inspections carried out. Methodology.
- 5.8. Description of observations, checks, findings.
- 5.9. Results according to the object of the expertise. Justification of the results.
- 5.10. Proposals for action. Justification of the proposals.
- 5.11. Assessment of the repair system. Justification of the method used.
- 5.12. Conclusions.
- 5.13. Annexes.

6. CHAPTER 6. OBLIGATIONS AND RIGHTS OF THE EXPERT

- 6.1. Liability of experts.
- 6.2. Appointment of the judicial expert.
- 6.3. Experts' fees.
- 6.4. Conditions for experts.
- 6.5. Disqualifications of the experts.
- 6.6. Issuance and ratification of the opinion.

7. CHAPTER 7. INTERVENTION OF THE EXPERT IN THE ACT OF THE TRIAL OR HEARING

- 7.1. False testimony.
- 7.2. The expert opinion.

Thematic Unit 2. APPRAISALS

8. CHAPTER 8. INTRODUCTION TO THE REAL ESTATE VALUATION

- 8.1. Definition, concept, variables and types. Application and principles.
- 8.2. General structure of valuation reports.
- 8.3. Valuation methods according to their purpose.

9. CHAPTER 9. COST METHOD AND VALUATION METHOD BY COMPARISON

- 9.1. Gross (crb) and net (crn) replacement value.
- 9.2. Concept of depreciation.
- 9.3. The real estate market.



10. CHAPTER 10. RESIDUAL METHOD OF SOIL VALUE

- 10.1. Basic concepts of financial mathematics. Technique of cash flow, IRR and NPV.
- 10.2. The market value of the land. Land impact value.
- 10.3. Static and dynamic residual method.

11. CHAPTER 11. UPDATING METHOD

- 11.1. Updating of expected income. Capitalization of current income.
- 11.2. Valuation of buildings linked to economic exploitation.

12. CHAPTER 12. WARRANTY ASSESSMENTS

- 12.1. The mortgage market.
- 12.2. Mortgage appraisals. Regulations and legal framework.
- 12.3. Appraisal procedures.

6471 ECONOMIC AND URBAN MANAGEMENT

TOPIC 1 URBAN MANAGEMENT

1. URBANISM.

- 1.1. Historical evolution.
- 1.2. Urban planning legislation:
 - 1.2.1. State Law 2/2008 Consolidated Text of the Land Law.
 - 1.2.2. Castilla y León Urban Development Law.
- 1.3. Principles informing urban planning.
- 1.4. Soil classification.
- 1.5. Urban law of land ownership.

2. URBAN PLANNING

- 2.1. Concepts and objectives of urban planning.
- 2.2. Urban planning:
 - 2.2.1. General planning.
 - 2.2.2. Development planning.
- 2.3. Elaboration and approval of urban plans.

3. URBAN MANAGEMENT

- 3.1. Urban management: isolated and integrated actions:
 - 3.1.1. Consensus system.
 - 3.1.2. Cooperation system.
 - 3.1.3. Compensation system.
 - 3.1.4. Expropriation system.
 - 3.1.5. Concurrence system.
- 3.2. Action project.



- 3.2.1. Urban agents.
- 3.2.2. Subdivision Project.
- 3.2.3. Urbanization project.

4. URBAN DISCIPLINE. THE MUNICIPAL ASSESSOR:

- 4.1. Intervention in use.
 - 4.1.1. Urban license.
 - Major building permit.
 - Minor building permit.
 - First Occupancy License.
 - Environmental license.
(Opening License)
 - 4.2. Sectoral Regulations.
 - 4.2.1. Heritage.
 - 4.2.2. Accessibility.
 - 4.2.3. Highways.
 - 4.2.4. Environmental Prevention Act.
 - 4.2.5. Hydrographic Confederation.
 - 4.2.6. Municipal Ordinances.
 - 4.3 Conservation and rehabilitation.
 - 4.3.1. Execution orders.
 - 4.3.2. Declaration of ruin.
 - 4.4. Protection of legality.

TOPIC 2. ECONOMIC MANAGEMENT

- 5. ECONOMIC STUDY OF A JOB.
 - 5.1. Capital investments and profitability.
 - 5.2. Maximum capital, minimum capital.
 - 5.3. Chart and economic calendar of job.

- 6. CALCULATION OF THE VIABILITY OF REAL ESTATE DEVELOPMENTS.

6472 SUSTAINABLE CONSTRUCTION

TOPIC 1. SUSTAINABLE CONSTRUCTION INTRODUCTION

- 1. What is sustainability?
- 2. Why should we introduce the concept of sustainability in construction?
- 3. Current Situation.
- 4. Sustainable construction.
 - 4.1. Integration with the environmental characteristics of the environment.



- 4.2. Not more economically expensive.
- 4.3 Saves resources.
- 4.4. Saves energy.
- 4.5. Waste management.
- 4.6. Increases user comfort.
- 5. Sustainable buildings.
- 6. Legislative framework.

TOPIC 2. SUSTAINABLE URBANISM

- 1. Brief historical note
 - 1.1. The modern city of movement
- 2. Consequences of urbanization on the territory. The ecological footprint
 - 2.1. Consequences of urbanization for the territory
 - 2.2. The ecological footprint.
- 3. Sustainable urbanism.
 - 3.1. Sustainable urban planning.

TOPIC 3. SUSTAINABLE ARCHITECTURE AND CONSTRUCTION

- 1. Sustainable architecture.
 - 1.1. Main building design guidelines.
- 2. Study of the building environment.
 - 2.1. Orientation. Sun exposure.
 - 2.2. Location.
- 3. Active and passive systems.
- 4. Passive systems for winter conditions.
 - 4.1. Solar capture systems.
 - 4.2. Energy accumulation and distribution.
- 5. Passive systems for summer conditions.
 - 5.1. Passive cooling systems.
- 6. Life Cycle Analysis.
 - 6.1. Introduction.
 - 6.2. LCA. Definition and objectives.
 - 6.3. Regulations.
 - 6.4. Methodology.
- 7. Sustainable construction materials.
 - 7.1. Types of materials.
- 8. Sustainable building systems.
- 9. Rehabilitation of existing buildings.
- 10. Tools for environmental assessment of buildings.

TOPIC 4. RENEWABLE ENERGIES IN CONSTRUCTION

- 1. Use of renewable energies.



- Biomass.
- Hydraulics.
- Wind.
- Solar.
- Geothermal.

6473 TOTAL QUALITY, SAFETY AND ENVIRONMENTAL MANAGEMENT

1.- Introduction. Concept of Quality; Safety and Environment.

1.1.- Introduction. Concept of Quality; Safety and Environment

2.- Evolution to Total Quality. Parallelism with Security.

2.1.- History of Quality.

2.2.- Evolution of the Quality Concept.

2.3.- Evolution of the Company's Organization Charts.

3.- Approaches, Principles and Definitions of Total Quality Management.

4.- Justification or Quality Object.

4.1.- Deming Chain Reaction.

5.- Standardization Structure and Quality Seals.

5.1.- International and national standardization bodies.

5.2.- Certification and product quality seals, systems and people.

5.3.- ISO 9001. Parallelism with ISO 14000 and ISO 8900.

5.4.- Audits.

6.- Models.

6.1.- Circles.

6.2.- EFQM.

6.3.- "Pillars".

6.3.1.- G.C.T. and Customer Satisfaction

6.3.2.- G.C.T. and Cost (waste). Costs of Quality and no quality. Analysis of the nonconformities in the construction company.

6.3.3.- G.C.T. and the Human Factor

6.3.4.- G.C.T. and Continuous Improvement (Kaizen)

7.- Quality tools.

7.1.- Preventive tools in development.

- QFD.
- AMFEC.



- SMED.

7.2.- Production control.

- Control charts by attributes.
- Control charts by variables.
- Process capability studies.
- Sampling Plans.

7.3.- Quality management.

- Troubleshooting.
- Quality Costs.
- Quality systems.

7.4.- Basics.

- Brainstorming.
- Data collection.
- 7.5 Why?
- Cause-Effect Diagram.
- Verification and data collection.
- Diagram of evolution or situation.
- Pareto Diagram.
- Frequency distributions. Histograms.
- Scatter diagrams.
- Flow, process, activity, etc. diagrams.
- Tree Diagrams.
- Relationship diagrams.
- Matrix diagrams.
- Reports

8.- Quality in building in the Project and on site.

8.1.- The architectural project: minimum contents.

8.2. - Quality Control of the project: EHE and EAE.

8.3.- Supervision of the Project in the Law of Contracts of the Public Sector

8.4.- Work Quality Control Planning: CTE, PAC and PPI.

8.5.- Quality Control in execution phase.

8.6.- On-site reception control.

8.7.- Control by means of tests.

8.8.- Control of the finished work.

8.9.- Quality seals, marks and logos.

8.10.- CE Marking, Construction Products Regulations.

9.- Safety Management: Risk Assessment in construction jobs.

9.1.- Risk Assessment related to the work positions, type of specific machinery.

9.2.- PRL measures.



6474 ENERGETIC EFFICIENCY

ENERGY EFFICIENCY OF THE THERMAL ENCLOSURE

GENERAL CONCEPTS

Objectives for energy efficiency in buildings.

Basic energy concepts.

EFFICIENCY CHARACTERISTICS IN BUILDINGS

Location.

Site.

Orientation.

Form.

HERMAL ENCLOSURE: ENERGY CONSERVATION

Coefficient of heat transmission.

Thermal insulation: insulating materials.

The thermal inertia of opaque enclosures.

Carpentry (doors and windows).

WINTER CONDITIONS: EFFICIENT HEAT COLLECTION

Passive energy utilization systems.

Energy accumulation and distribution.

Greenhouse effect.

Distribution and location of openings.

SUMMER CONDITIONS: COOLING / EFFICIENT VENTILATION

Overheating.

Action against overheating.

Ventilation as a strategy against overheating.

Direct cooling actions.

ASSESSMENT OF THE ENERGY PERFORMANCE OF A BUILDING

CE3X reference software. Application example.

ENERGY EFFICIENCY ANALYSIS AND MEASUREMENT EQUIPMENT

Thermographic analysis.

Thermal flow analysis.

Analysis of infiltrations.

ENERGY EFFICIENCY OF AIR CONDITIONING

AND DOMESTIC HOT WATER

HEAT AND COLD GENERATORS

General information.

Generator energy efficiency. Standard, low temperature and condensation boilers. Heat pumps.

Coefficients of P.O.P. and E.E.R. energy efficiency.

Power fractionation in heat and cold production plants.

DISTRIBUTION OF HEAT AND COLD

General information.



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Thermal insulation of pipe and duct networks.

Minimum thicknesses.

Sealing of duct networks.

Equipment for the transport of fluids. Pressure drops in components. Efficiency of electric motors.

REGULATION AND CONTROL

General information.

Control of air-conditioning installations in generation and distribution.

Control of thermo-hygrometric conditions.

Control of indoor air quality in air-conditioning systems.

Control of domestic hot water preparation facilities.

CONSUMPTION ACCOUNTING

General information.

Breakdown of energy costs in buildings.

ENERGY RECOVERY

General information.

Free outside air cooling. Free-cooling.

Energy recovery from exhaust air.

USE OF RENEWABLE ENERGIES

General information.

Solar contribution for the production of A.C.S.

Solar contribution for the heating of covered swimming pools.

Limitation on the use of conventional energy.

Directive 2009/28/EC on the promotion of the use of energy from renewable sources.

GEOTHERMAL ENERGY IN BUILDINGS

Geothermal deposits.

Very low temperature geothermal energy.

Geothermal exchangers.

Geothermal heat pumps.

Applications of geothermal energy in buildings.

WATER REUSE IN BUILDINGS.

General information.

Waste water reuse.

Reuse of rainwater.

ENERGY EFFICIENCY IN LIGHTING INSTALLATIONS

GENERAL INFORMATION

Light sources.

Lamps.

Lighting.

Level of interior illumination.

PERFORMANCE OF LIGHTING SYSTEMS

Calculation of the energy efficiency value of installations (VEEI) in each area.

Control systems.



6477 SPECIAL INSTALLATIONS

1. FIRE PROTECTION INSTALLATIONS IN BUILDINGS

Fire protection installations

- 1.1. Classes of fire.
- 1.2. Extinguishers.
- 1.3. Equipped fire hydrants (BIES).
- 1.4. Fire hydrants.
- 1.5. Dry column.
- 1.6. Automatic sprinklers.
- 1.7. Automatic detection systems.
- 1.8. Fire-fighting water supply. Pressure groups.
- 1.9. Regulations.

2. GAS INSTALLATIONS

Gas installations.

- 2.1. Installations of piped natural gas in buildings.
- 2.2. Installations of piped propane gas in buildings.
- 2.3. Propane gas installations with fixed tanks.
- 2.4. Regulations.

3. THERMAL SOLAR ENERGY INSTALLATIONS

Installations of thermal solar energy.

- 3.1. Components of a solar thermal installation. Collectors, accumulators, exchangers, pumps, expansion vessels, control system.
- 3.2. Location of solar collectors. Orientation and tilt and shadows.
- 3.3. Facilities for the production of sanitary hot water in the building.
Centralized, individualized or mixed accumulation. Type schemes.
- 3.4. Applications for pool heating and underfloor heating.
- 3.5. Dimensioning of solar thermal installations. Calculation software.
- 3.6. Prevention of legionella in domestic hot water production installations.
- 3.7. Regulations.

4. PHOTOVOLTIC SOLAR ENERGY INSTALLATIONS

Photovoltaic solar energy Installations.

- 4.1. Components. Photovoltaic modules, batteries, regulators, inverters, devices of automatic orientation.
- 4.2. Isolated photovoltaic systems.
- 4.3 Grid-connected photovoltaic systems.
- 4.4. Regulations.

5. LIQUID FUEL INSTALLATIONS.

Liquid fuel installations

- 5.1. Oil tanks. Polyethylene, sheet steel and glass reinforced plastic. (GRP).

5.2. Surface, buried, semi-underground and pit deposits.

5.3. Pipeline supply installations in buildings. Horizontal networks and vertical networks capillary and column.

Oil pressure groups.

5.4. Regulations.

6. TRANSPORT OF PEOPLE.

Transport of people.

6.1. Electric lifts.

6.2. Hydraulic lifts.

6.3. Escalators.

6.4. Regulations.

6478 BUILDING INSPECTION AND MAINTENANCE

Thematic Unit 1.- Basic Concepts on Maintenance and Inspection of Buildings

TOPIC I Introduction to Building Maintenance and Inspection

1. Previous references on Maintenance and Inspection of Buildings.
2. Urban models and sustainability.
3. Reasons to conserve and maintain buildings. Legal references on built and renovated housing.
4. Energy consumption of buildings and sustainability.
5. Accessibility to buildings as a person's right.
6. Future strategies in the preservation of buildings.

TOPIC II The Duty to preserve Buildings

1. The duty of preservation: concept.
2. The useful life of the building.
3. Legal references on building preservation.
4. Preservation actions in the building: maintain, restore and rehabilitate.
5. Acceptance of the Duty to conserve buildings.
6. Characteristics of the Duty to conserve buildings.
7. Forms of accreditation of duty to conserve buildings.
8. Building conservation duty in jurisprudence: Levels and guarantees of conservation duties.
9. Basic aspects of the conservation duty and its dimension over time.
10. Limits of the building conservation duty: technical ruin, economic ruin and social interest.
11. Instrumental mechanisms to make building conservation duty effective.

TOPIC III Building maintenance

1. Maintenance of the building as a guarantee of the duty to conserve buildings.
2. Types of Maintenance: Corrective, Preventive and Predictive Maintenance.
3. Economic aspects of building maintenance: cost-effectiveness and safety.

Thematic Unit 2.- Study of the regulatory provisions underlying the Building Assessment Report

TOPIC IV The Building Assessment Report: the Technical Inspection of the Building

1. The Building Assessment Report. Concept of the Technical Inspection of the Building and Contents.
2. Nature and scope of the Technical Inspection of the Building. Legal References.
3. Formal content and material of the technical documents that may be issued by the Competent Technicians in the Building Assessment Report: the Certificate, the Report and the Opinion.
4. Procedure and contents of the Building Assessment Report: Report of the Technical Inspection of the Building, Accessibility Report and Energy Certification.
5. Study of the contents of Law 8/2013, on urban rehabilitation, regeneration and renewal.

TOPIC V The Building Assessment Report: The Building Accessibility Report

1. Concept of Universal Accessibility: the importance of accessibility and the Architecture of the future
2. The Technical Building Code and accessibility: The SUA Basic Document.
3. Buildings to which the SUA Basic Document of the Building Technical Code is applicable.
4. Building Accessibility Report Concept: Objectives and Purpose.
5. Concept of "accessible itinerary". Factors determining an accessible itinerary.
6. Criteria to follow in order to check whether there is accessibility in a constructed building.
7. Functional conditions of accessibility that are considered in the Building Evaluation Report.
8. Access from the outside to the inside of the building. Considerations to resolve the existing differences in levels.
9. Access between floors of the building: elevators and ramps.
10. Accesses on the floor of the building: a way of resolving horizontal differences in levels.
11. Technical and design aspects of accessible itineraries: corridors, doors, ramps, pavements...
12. Legal procedures for the suppression of architectural barriers: the Law of Horizontal Property and Law 15/1995 of 30 May 1995, on Domain Boundaries on buildings to remove architectural barriers to people with disabilities.
13. Concept of reasonable accommodation: actions to which it is restricted.

TOPIC VI The Building Assessment Report: the Certificate of Building Energy Efficiency

MAINTENANCE SERVICES MANAGEMENT

Thematic Unit 3.- Building Maintenance Management: Actions for correct building maintenance

TOPIC VII Structuring of Communities of Owners

TOPIC VIII Corrective Maintenance

1. Corrective Maintenance.
2. Preventive and Corrective Maintenance.
3. Maintenance of Opportunity.

TOPIC IX Preventive and Predictive Maintenance

1. Definition of Maintenance Management.
2. Goals. Scope, Sustainability, Methods.
3. Methodology. Planning, Management of resources, Control.
4. Diagnosis. Data and requirements, Methods of diagnosis.
5. Strategies. Construction Strategy. Maintenance Policy. Maintenance Strategy.

6. Maintenance Plan. Preparation, Realization, Control.

TOPIC X Development of a case study on Building Maintenance

1. Drafting a Building Maintenance Plan.

Thematic Unit 4.- The Building Evaluation Report: development of the building technical evaluation process for certification

TOPIC XI Actions in the Technical Inspection of the Building

1. Inspection and data collection of the building.
2. Identification and general building data.
3. State of conservation. Safety, health, public ornament and habitability, valuations.
4. Recommendations on the performance of the Technician responsible for the inspection.

TOPIC XII Building Accessibility Report

1. General data.
2. Regional legislation.
3. State regulations.
4. Final valuation.
5. Reasonable Accommodations.

TOPIC XIII Actions for the study of the Building Energy Certification



1. Energy performance certificate.
2. Energy rating of the building.
3. Partial qualification of the energy demand for heating and cooling.
4. Partial qualification of primary energy consumption.

TOPIC XV Development of a case study on the Building Evaluation Report

1. Preparation of a Building Evaluation Report with the program provided by Junta de Castilla y León.

6479 RENEWABLE ENERGIES FOR BUILDING: FUNDAMENTALS AND INSTALLATIONS

TOPIC 1: ENERGY OVERVIEW

Introduction.

- 1.1.- Limitation of fossil fuels and uranium.
- 1.2.- Contamination.
- 1.3.- Renewable energies.

TOPIC 2: SOLAR RADIATION

Introduction.

- 2.1.- Electromagnetic spectrum. Radiometric magnitudes.
- 2.2.- Sun-earth movement.
- 2.3.- Attenuation and radiation components.
- 2.4.- Solar spectrum. Mass of air N.
- 2.5.- Influence of orientation.
- 2.6.- Shadows and maps of trajectories.
- 2.7.- Instruments for measuring radiation.
- 2.8.- Map of solar radiation in Spain.

TOPIC 3: LOW TEMPERATURE CONVERSION - PASSIVE SYSTEMS

Introduction.

- 3.1.- Transparent and opaque walls.
- 3.2.- Storage, distribution and conservation.
- 3.3.- Types of passive solar buildings.
- 3.4.- Solariums, greenhouses, distillers, swimming pools and dryers.
- 3.5.- Passive cooling of buildings.

TOPIC 4: LOW TEMPERATURE CONVERSION - ACTIVE SYSTEMS

Introduction.

- 4.1.- Solar collector. Design parameters.



- 4.2.- Performance. Characteristic curve.
- 4.3.- Storage. Accumulator and exchanger.
- 4.4.- Degree of coverage. Thermal loads.
- 4.5.- Design schemes. Control.
- 4.6.- Refrigeration of buildings.

TOPIC 5: PHOTOVOLTAIC ENERGY

Introduction.

- 5.1.- Potential barrier and band theory.
- 5.2.- Impurified semiconductors.
- 5.3.- The P-N junction.
- 5.4.- Photogeneration of current.
- 5.5.- Photovoltaic effect.
- 5.6.- The solar cell.
- 5.7.- Photovoltaic module.
- 5.8.- Interconnection of modules.
- 5.9.- Practical aspects of generators.
- 5.10.- The lead-acid battery.
- 5.11.- Dimensioning of autonomous systems.

TOPIC 6: AEOLIAN ENERGY

Introduction.

- 6.1.- Origin of energy in the troposphere.
- 6.2.- General atmospheric circulation.
- 6.3.- Forces on a mass of air in horizontal movement.
- 6.4.- Global distribution of winds.
- 6.5.- External flow, drag and sustentation.
- 6.6.- Wind energy. Betz Efficiency.
- 6.8.- Wind machines.
- 6.9.- Aerodynamic performance or power factor.
- 6.10.- Design of wind power installations. Site selection.
- 6.11.- Dimensioning of a wind turbine.

TOPIC 7: HYDRAULIC POWER

Introduction.

- 7.1.- Elements of a hydroelectric plant.
- 7.2.- Types of plants.
- 7.3.- Load diagram.
- 7.4.- Hydraulic turbines.
- 7.5.- Power and efficiency of a turbine.
- 7.6.- Generation of hydroelectric energy.
- 7.7.- Characteristics of production and consumption.



TOPIC 8: OTHER RENEWABLE ENERGIES

8.1.- The energy of the sea.

- . - Types of tides.
- . - Potential energy of the tides.
- . - Study of existing plants.

8.2.- Geothermal energy at low temperatures.

- . - Introduction to geothermal energy.
- . - Heat pump.
- . - Applications to buildings with radiant floors.

TOPIC 9: SUSTAINABILITY - THE ECONOMICS OF HYDROGEN

9.1.- Concept of sustainability.

9.2.- The era of hydrogen.

9.3.- Hydrogen production: chemical methods and electrolysis.

9.4.- Hydrogen cells. Proton exchange membrane (PEM).

9.6.- Electrolyzers and PEM type batteries.

9.7.- Other types of cells.

9.8.- The hydrogen engine.

9.9.- Hydrogen plant with renewable sources.

9.10.- Environmental effects.

6459 COMPUTER GRAPHIC REPRESENTATION TECHNIQUES (1ST SEMESTER)

U.1 Introduction and background in 2D CAD

1.1 General information.

Introduction to the need for CAD systems in today's work.

1.2 Previous knowledge of CAD systems.

Brief review of the techniques already known in the computer field applied to Architecture.

U.2 Advanced drawing development through 2D CAD systems

2.1 Modification and editing of drawings.

2.2 Properties of drawing entities and their modification.

2.3 Advanced Editing Commands. Blocks. Shading.

2.4 Definition of plans through texts and attributes. Dimensioning.

U.3 Preparation and printing of project plans

3.1 Print settings.

3.2 Study work. Layout possibilities.

3.3 Necessary plans and external plotting.



U.4 Introduction and development of 3-D CAD techniques

- 4.1 3D environment, needs and applications.
- 4.2 Initial handling of specific programs.
- 4.3 Modelling and visualization of solids.
- 4.4 Introduction to photorealistic representations.

6481 INTERIOR DESIGN

INTERIOR DESIGN

The design of living spaces

Image and program.

The communication of the use

The program as a function of form.

The expression as image

The program as a form of function.

The ideation of the image

Drawing as a two-dimensional order.

The layout.

The sketch.

The embryonic representation.

The concretion of the image.

Drawing as a three-dimensional order.

Technical language.

Scale as reality.

Conventional representation.

6482 NEW MATERIALS IN CONSTRUCTION

Thematic Unit 1. GENERAL INTRODUCTION.

Thematic Unit 2. ADVANCED POLYMER MATERIALS.

Thematic Unit 3. THERMO-STABLE AND THERMOPLASTIC RESINS.

Thematic Unit 4. STRENGTHENING FIBRES.

Thematic Unit 5. COMPOSITE MATERIALS.

Thematic Unit 6. GEOTEXTILES.



Thematic Unit 7. INTELLIGENT GLASS.

Thematic Unit 8. ADVANCED CERAMIC MATERIALS.

Thematic Unit 9. NANOMATERIALS.

Thematic Unit 10. OTHER MATERIALS.

Bituminous, metallic, and magnetic materials.

Thematic Unit 11. BEHAVIOUR IN SERVICE OF MATERIALS.

Thematic Unit 12. APPLICATIONS OF NEW MATERIALS IN CONSTRUCTION.

PRACTICES.

6483 PREFABRICATION IN BUILDING

1. Introduction, Syllabus and Bibliography

- > Presentation, syllabus and evaluation of the subject.
- > Mandatory and recommended bibliography.
- > Regulations, CE Marking and quality marks.

2. Structural Systems in Building

Introduction Typology. Traditional and rational solutions.

- > Structures of: reinforced concrete, prefabricated, metallic.
- > Construction, retraction and expansion joints.
- * Practical applications.

3. Actions in Building

- > Transfer of actions in a structure.
- > General information and introduction to CTE regulations.
- > DB SE-AE of the CTE.
- * Practical applications.

4.- Pre-tensioning and post-tensioning

- > Introduction to pre-tensioning and post-tensioning.
- > Concept of pre-tensioned concrete. Preliminary and final tension.
- > Advantages.

5. Prefabrication

- > General concepts.



- > Advantages and disadvantages of using prefabricated products.
- > Prefabricated installations and prefabrication process.
- > Manufacturing control. CE marking of the product.

6. Prefabricated in building and industrial jobs

- > Typology and use in building.
- > Typology and use in industrial jobs.
- > Handling, transport and assembly.
- > Unions.

7. Introduction to design and calculation

- > Structural design with prefabricated elements.
- > Technical specifications: Interpretation.
- * Practical applications.

8. Floor framing

- > General information.
- > Typology: Unidirectional, bidirectional, mixed.
- > EHE Standard: Annexed slabs.
- * Practical application.

6484 FOUNDATION STRUCTURES

- TOPIC 1. Basic fundamentals for the calculation of foundations.
- TOPIC 2. Technical Building Code. Structural safety – foundations.
- TOPIC 3. Calculation of thrusts and containment structure.
- TOPIC 4. Typology, calculation and execution of foundations.
- TOPIC 5. Typology, calculation and execution of foundation.