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|-------|--------------------------------|------------------------------|
| Date: | <b>REGISTRATION OF COURSES</b> | RESPONSIBLE OF REGISTRATION: |
|-------|--------------------------------|------------------------------|

| AREA OF KNOWLEDGE                               | SUB-AREA            | UNDERGRADUATE | POSTGRADUATE |
|---|---------------------|---------------|--------------|
| <b>BASIC SCIENCES</b>                           |                     |               |              |
| ECONOMICS AND SOCIAL SCIENCES                   |                     |               |              |
| <b>HEALTH SCIENCES</b>                          |                     |               |              |
| <b>ENGINEERING, ARCHITECTURE AND TECHNOLOGY</b> | <b>Architecture</b> | <b>X</b>      |              |
| <b>EDUCATION SCIENCES</b>                       |                     |               |              |
| HUMANITIES AND ARTS                             |                     |               |              |
| <b>AGRICULTURAL AND SEA SCIENCES</b>            |                     |               |              |
| <b>MILITARY ARTS AND SCIENCES</b>               |                     |               |              |
| SAFETY AND CIVIL PROTECTION                     |                     |               |              |
| <b>INTERDISCIPLINARY</b>                        |                     |               |              |
| <b>OTHERS</b>                                   |                     |               |              |

**ADSCRIPTION OR BRANCH (ES):**

|            |                           |
|------------|---------------------------|
| FACULTY    | ARCHITECTURE AND URBANISM |
| SCHOOL     | ARCHITECTURE              |
| INSTITUTE  |                           |
| DEPARTMENT | TECHNOLOGY SECTOR         |
| OTHERS     |                           |

**COURSE:**

|                    |                                |
|--------------------|--------------------------------|
| NAME               | TECHNOLOGICAL APPLICATONS      |
| CODE               | 2066                           |
| EXECUTIVE UNIT     |                                |
| CLASSIFICATION     | Compulsory                     |
| APPROVAL DATE      |                                |
| UPDATE DATE        |                                |
| APPROVAL AUTHORITY |                                |
| CREDIT UNITS       | 3 (THREE)                      |
| HOURS/WEEK         | 4.5 (1.5 HOURS EACH AREA)      |
| REGIMEN            | SEMI-ANNUAL                    |
| ACADEMIC PERIODS   | REGULAR                        |
| REQUIREMENTS       | CONSTRUCTION 98 AND DESIGN 2.6 |
| PROFESSOR          | AREA PROFESSORS                |



## PURPOSES

Realize a complete project building reconciling interests and concepts of architectural design with structure and building services.

## LEARNING OBJECTIVES

At the end of the course the student will be able to:

Integrally coordinate a project, from the architectural, structural and services point of view.

### **BUILDING SERVICES:**

Pre-dimensioning of water tanks storage, drinkable water, wastewater, and rainwater pipes. Pumping systems calculations. Lighting and power outlets systems, air conditioning and wastewater systems, and fire fighting system. To make building systems plans. To make description memories, calculations and systems specifications.

### **STRUCTURES**

- 1) Analyse the resistant determinants associated with the load-bearing building system, in relation to the distinct technological variables and architectural design determinants.
- 2) Establish the suitable criteria for the resolution and design of structural details.
- 3) Development of structural details as case studies.

### **CONSTRUCTION:**

- 1) Analyse the non-constructive determinants of buildings, in relation to the distinct technological variables and architectural design determinants.
- 2) Establish the suitable criteria for the resolution and design of structural details.
- 3) Development of enclosures, envelopes and finishes details as case studies.



## CONTENTS

### STRUCTURES AREA:

#### TOPIC 1 SISMOLOGIC NOTIONS

- 1.1. Introduction. Fundamental concepts review, about: moments, shear stress, bending, dimensioning, etc.
- 1.2. Terminology. Earthquake causes. Soil type and acceleration influence. Equivalent static method. Displacements control. Building design and construction regulations. Building weight determination.
- 1.3. Centre of masses. Rigidities centre. Mezzanine rigidity notion. Displaceability. Generalities.
- 1.4. Structural plan symmetry. Plan configuration. Structural configuration of earthquake resistant buildings. Criteria. Floor shear stress. Basal shear force. Deformability estimative calculation.

#### TOPIC 2 STRUCTURAL ANALYSIS

- 2.1. Typologies of structures: beam-column, shear walls and cables. Tributary area. Pre-dimensioning of beams and columns in reinforced concrete and steel.
- 2.2. Rigidities symmetry in structural plan. Brief explanation of seismic effects. Rigidities centre.
- 2.3. Deformability. Deformation verification. Determination of floor shear.
- 2.4. Structural stability. Verticality.

#### TOPIC 3 MECHANICAL NOTIONS OF SOILS

- 3.1. 3.1. Introduction. Soil mechanics principles. Confined and non-confined compression efforts. Mörh's diagram. Granulometry. Influence of soils granulometry in shear resistance.
- 3.2. Cohesive soils. Granular soils. Settlements. Consolidation. Expansion. Soil's saturation grades influence.
- 3.3. Pressure variation with depth. Compaction, concept. Humidity influence. Problems and advantages. Types of compaction. Density concept. Humidity. Unitary weight.

#### TOPIC 4 WALLS

- 4.1. Introduction. Rankine's plastic Equilibrium states. Active and passive pressures.
- 4.2. Walls: of Gravity, Cantilever, Shear, Sheet pile; simplified calculation methods. Water influence in the pressure. Soil type influence in the pressure values.

#### TOPIC 5 FOUNDATIONS

- 5.1. Introduction. Foundations theory. Direct, isolated, continuous, combined, slab foundation, floating foundation.
- 5.2. Non-direct foundations. Piles theory. Piles types, Auger cast piles, driven piles. Calculation criteria. Example of each type of pile on function of soil type.
- 5.3. Normal penetration test (NPT). Interpretation. Soil pressure variation according to the depth of piles. Piles construction problems. Possible solutions. Examples.

### BUILDING SYSTEMS AREA:

1. INTRODUCTION: Course importance. Scope. Evaluation system. Classes attendance. Textbooks for Plumbing, Electrical, Mechanical and Fire fighting systems. What a project consists of?



- Plans
  - Book
  - Descriptive memory
  - Calculations
  - Specifications
  - Metric calculations
2. What a project consists of? Cont.  
Families that compose a project
- Architecture
  - Structures
  - Plumbing systems
  - Electrical systems
  - Mechanical systems
  - Fire Fighting systems
  - Special systems
- Scopes in technological applications. Difference with complementary courses. Scope of the project by each discipline. Assignment: AIRE CONDITIONING SYSTEMS
3. REVIEW. Potable water supply. Supply assignment.  
As of the fourth class is mandatory to bring to each class session the architecture project with the building services that are being incorporated throughout the course.
4. PROJECTS CORRECTION. General. Ducts and chutes projection. Building services spaces. Potable water correction.
5. Potable water project submission. Supply calculation. Project conception, floor plan drafting, vertical diagram, tank size, pumps room placement, interior design of pumps room.
6. REVIEW. Wastewater and rainwater. Project corrections: Wastewater and rainwater.
7. Wastewater and rainwater networks project submission. Conception of the project, floor plan drafting, vertical diagram, bilge pump room. No axonometric nor bathrooms details are required at 1:20 scale.
8. REVIEW. Electrical systems. Project correction: Lighting.
9. Lighting project submission. Project conception, floor plan drafting, vertical diagram, electrical room placement, electrical meter, distribution board, principal connections and derivations. Determination of lighting levels, and hence quantity and type of lamps.



10. REVIEW. Electrical systems. Project correction: Electrical outlet and force.
11. Electrical outlets and force project submission. Project conception, floor plan drafting, vertical diagram, electrical room placement, electrical meter, distribution board, principal connections and derivations.
12. REVIEW. Mechanical systems. Project correction: Forcer ventilation and air conditioning.
13. Mechanical systems project submission. Project conception, air conditioning system selection, floor plan drafting of pipes and ducts, vertical diagram, external and internal units, chillers and fans placement.
14. REVIEW. Fire fighting systems. Project correction: Detection, extinction, alarm and scape means.
15. Fire fighting systems project submission. Project conception, floor plan drafting of pipes and ducts, vertical diagram, fire fighting board placement, pressurizer of scape means.
16. Final project submission: Floor plans and books containing:
  - Descriptive memories
  - Calculations
  - Specifications
  - Metric calculations (Not required)

#### **CONSTRUCTION AREA:**

Case studies and development of details from the analysis of non-resistant constructive elements:

- 1) The constructive determinants derivate of non-resistant elements, their relation with the structural system and the building services networks.
- 2) Enclosures: Materials and architectural image of the building; durability; environmental adaptation.
- 3) Constructive details design: Enclosures, envelopes and finishes. Case studies.
- 4) The technical specification of the constructive process.



## INSTRUCTIONAL STRATEGIES

### **BUILDING SERVICES:**

Review of technics and skills acquired in other previous courses.

Reading and explanation of current regulations.

Assignments to encourage the contents.

Elaboration of a complete building systems services project.

## INSTRUCTIONAL MEDIA



## EVALUATION

### BUILDING SERVICES:

Assignments  
One project

## TEXTBOOKS (If possible, according to contents)

### BUILDING SERVICES:

1. MINISTERIOS DE SANIDAD Y ASISTENCIA SOCIAL Y DEL DESARROLLO URBANO. *Normas Sanitarias para Proyecto, Construcción, Reparación, Reforma y Mantenimiento de Edificaciones*. Gaceta Oficial de la República de Venezuela, N° 4.044 Extraordinario, Caracas 8/9/88.
2. NYERGES V., NICOLAS. *Instalaciones Sanitarias para Edificios*. Facultad de Arquitectura y Urbanismo. Universidad Central de Venezuela. Caracas 1966.
3. GILES V., RANALD. *Mecánica de los Fluidos e Hidráulica*. Schaum & Mc G-Hill.
4. MINISTERIO DE SANIDAD Y ASISTENCIA SOCIAL. *Normas Sanitarias para Proyecto, Construcción, Reparación y Reforma de Edificios*. Gaceta Oficial de la República de Venezuela, N° 752 Extraordinario, Caracas 26/2/62.
5. OLIVARES, ALBERTO. *Cálculo de Distribución de agua para edificios*. Caracas 1952.
6. TATÁ C., GUSTAVO A. *Aspectos fundamentales de Diseño y Cálculo en instalaciones de aguas blancas en edificios*. ULA, Mérida.
7. TATÁ C., GUSTAVO A. *Aspectos constructivos de Instalaciones de Aguas Blancas, Metodología de diseño y Cálculo en quintas bajo el sistema de suministro directo*. ULA, Mérida.
8. TATÁ C., GUSTAVO A. *Sistemas de distribución de agua potable en edificios. Diseño y Cálculo*. ULA, Mérida.
9. TATÁ C., GUSTAVO A. *Diseño y Cálculo de instalaciones de Aguas Servidas en edificios*. ULA, Mérida.
10. LOPEZ R., LUIS G. *AGUA, Instalaciones Sanitarias en los edificios*. Maracay 1.990.
11. COVENIN. *Normas de Prevención y Protección contra incendios*. Caracas. (Son varias normas)