INTRODUCTION

This course studies the physical, physiological and psychological principles of environmental conditioning. The behaviour of the building in relation to the light, thermal and acoustic environment is presented: general aspects, systems, and evaluation parameters.

OBJECTIVES

Conditioning I Servis I (Environmental Conditioning and Services Equipment) deals with the study of natural means, as well as the introduction of artificial means for environmental control and building services. The purpose is to provide the students with the knowledge and abilities needed to assess and plan architecture based on energy.

To attain this goal, the knowledge of the basic physical, physiological and psychological principles that regulate energy and environmental processes is needed. Some of the principles have already been introduced in other courses, be it in basic, intermediate education or at university. (Physics and chemistry per se however). Others have not been previously studied and can be new concepts for the students. In any case, a structural concept becomes necessary: top-down, not bottom-up. This is the purpose of the first part of the course.

In the second part, with an already acquired basis and language, the course will deal with the historical and cultural background on the topic, through the comprehension of the environmental phenomena that shape the architectural environment.

The third part comprises the environmental control techniques applied into architecture. The different techniques will be studied, from the more general, including those previously to the design of the building – such as the site – to the specific natural systems to solve and improve certain aspects of its environmental behaviour. This part is considered the core of the learning process, which allows the student to acquire the needed ability to address an architectural project from an energetic point of view.

COURSE DEVELOPMENT

Teaching will be theoretical and practical. Along the course, one theoretical lesson and two practical projects will be performed.

Project 1. Critical analysis of building facilities in a residential building in Barcelona or surroundings. It will be performed in groups of two students.

At the beginning of the course, the building to assess will be proposed. Teacher’s approval, through signature, will be needed to proceed.

1. Diagrams and comments on building facilities (geometry, operation, etc.)

2. Diagrams of transportation, space occupation and building facilities with their aesthetic repercussion.

Project 2. Design of the climate, light and acoustic natural aspects of an individual space for a hypothetical user that serve as a project task. The work will be developed in three main parts. The first one will be centered in the initial implantation study pre-existences and micro climate study, location and surroundings connection. The second one is focused on the development of the architectural solution. The third one involves a revision of the proposed design: lighting, acoustic and climate evaluation. At the end of the course, the student will handle a simplified version of the project together with the calculus of the energetic functioning results.

Project phases

1st phase: Definition of the relations between the exterior pre-existent microclimate and the project’s disposition, regarding its location, orientation and buildings spatial typology. A detailed study of exterior conditions that supports the decision of the location will be carried out. In addition, the corrections of the surroundings will be implemented in order to maximize the appropriate energetic performance.

2nd phase: The student will introduce the modifications suggested on the feedback with the professors and he will develop the shapes and components of the project. The natural conditioning elements (skins, protections, special systems, vegetation...) that suit better the user’s needs and environmental conditions will be implemented in the design. In this phase, the project will be detailed, considering dimensions, materials, colours, exterior and interior flooring, etc. The result will be studied in floorplans, sections and diagrams of the seasonal energetic functioning.

3rd phase: In this third part, the student will develop climate, lighting and acoustic calculus in order to optimize the adopted solution. Corrections on the design – such as shape, measures or materials - depending on the results of the calculations will be carried out.

COURSE STRUCTURE

INTRODUCTION. Environmental conditioning and service building equipment

1st PART. ENERGETIC ENVIRONMENT IN ARCHITECTURE

Introduction to the environment knowledge

Physical definition of environment

Physiological definition of environment

Psychological definition of environment

The environmental language

2nd PART. THE ENVIRONMENTAL CONTROL IN TIME AND SPACE

The climate and other environmental pre-existing elements

Climate and popular architecture

The history of environmental control in architecture

3rd PART. NATURAL MEANS OF ENVIRONMENTAL CONTROL

General project characteristics

Location choice

Condition of the surroundings

The general shape of the building

Skin characteristics

The building interior

Special systems of natural conditioning

Solar gain based systems

Inertia-based systems. Interior and peripheral

Ventilation systems and air treatment

Solar radiation protection systems

Special systems of natural lighting

Lighting conduction components

Trackable components

Control elements

Special acoustics systems

Acoustic connection and protection

Natural lighting evaluation

Local acoustic evaluation

Climatic building’s evaluation

Condicionament I Serveis I (Environmental Conditioning and Services Equipment)
PROJECT 2. STUDIO FOR A USER IN A SPECIFIC CLIMATE AND LOCATION. THREE EXAMPLES OF SIMILAR CLIMATES AND USERS

1. ANALYSIS OF THE PRE-EXISTING
   - Studio for Joan Miró
   - Studio for Vasily Kandinski
   - Studio for Maitena

2. CORRECTION OF SURROUNDINGS + PRE-SHAPE
   - Continental Mediterranean Climate
     - Sound: Aerial noise of 70 dB(A)
     - Vegetation: Perennial forest
     - Landscape: Pleasant views at the South-West

   - Northern littoral Mediterranean Climate
     - Sound: Noise at the East of 90 dB at 100 m
     - Vegetation: Deciduous trees forest
     - Landscape: Pleasant views at the East

   - Prelitoral Mediterranean Climate
     - Sound: Noise at the East of 80 dB at 75 m
     - Vegetation: Deciduous trees forest
     - Landscape: Pleasant views at the South-East

3. DEFINITION OF SHAPE, SKIN AND INTERIOR

4. WINTER ENERGETIC BEHAVIOUR
   - Calculation using balance and variability algorithms

5. SUMMER ENERGETIC BEHAVIOUR
   - Calculation using balance algorithms

6. ACOUSTICS AND LIGHTING
   - Functioning checked through calculations

USERS
The users dependent characteristics are defined in order to adapt the project to their needs.

- The program
- User’s character and preferences
- Environmental volitions regarding the space structure, lighting, visual, acoustic and climatic parameters.