

	BSc IN ARCHITECTURAL ENGINEERING	
	COURSE : Heat transfer	
	TEACHING STAFF: Joan I. Rosell	
	ACADEMIC YEAR: 2 nd	CREDITS: 6

1.OBJECTIVES

1. To acquire heat transfer basic concepts in order to understand and use the Technical Code and the Basic Regulation of Construction.
2. To be able to identify states and handle air conditioning processes over the psychrometrical diagram.
3. To be able to evaluate the energetic necessities of a building.
4. To be able to discern the viability of different energy saving systems and production systems, including the removable energies.
5. To know the correct dimensions for a thermal solar energy installation.
6. To know the regulation in force.

2.STRUCTURE

Credits per semester: 6
 Theory credits: 3
 Practical credits: 3

3.PROGRAM

Theme 1 HEAT TRANSFER BASIC MECHANISMS

1. Introduction. Fundamental concepts.
2. Conduction. Fourier Law. Thermal resistance method.
3. Convection. Newton Law.
4. Radiation. Stephan-Boltzmann Law.
5. Grey bodies. Emission, absorption, reflection, transmission. Radiosity.
6. Exchangers. Basic equations.

Theme 2 CONDICTION IN STATIONARY REGIM. 1-D ANALISIS

1. Flat walls in series and in parallel.
2. Walls in contact with fluids.
3. Contact resistance.
4. Cylindrical walls.
5. Global coefficient of heat transmission.
6. Fins???
7. Optimum thickness for isolation.

Theme 3 CONDUCTION IN STATIONARY REGIM. 2-D ANALYSIS

1. Conduction general equation.
2. Introduction to analysis through finite differences. Biot number.
3. Application example of the finite differences method.

Theme 4 CONDUCTION IN TRANSITORY REGIM

1. Introduction
2. Transitory conduction with negligible intern resistance. Fourier number.
3. Graphical solutions to transitory exercises. Heisler and Gröber abacus.
4. Numerical solutions. Implicit method.

Theme 5 CONVECTION

1. General concepts.
2. Forced convection with tubes.
3. Empirical correlations in flux in tubes and conduits.
4. Empirical correlations in natural convection. Grashoff number.

Theme 6 AIR CONDITIONING PROCESSES

1. Introduction. Basic concepts.
2. Humid air properties. Properties representation. Carrier diagram.
3. Main psychrometrical processes.
4. Air conditioning processes. Practical calculations.

Theme 7 RADIATION AND ILLUMINATION

1. Thermal radiation. Radiation Physics. Planck and Wein Laws.
2. Shape factor. Shape factors Algebra.
3. Interchanges between Black, Grey and Refractory surfaces.
4. Illumination installations energy efficiency.

Theme 8 ENERGETICAL SIZES

1. Design conditions. The thermal balance of the human body.
2. Basic climate concepts. Degrees per day of central heating and cooling.
3. Heat transmission in closed spaces. Typology isolations.
4. Infiltration and ventilation. Condensation.
5. Estimation of the thermal charge.

Theme 9 SOLAR CONTRIBUTION TO HOT WATER AND CENTRAL HEATING.

1. Characterisation and qualification of the energetic requirements.
2. Calculation and sizes.
3. Solar installation. Systems and components.

4.COURSE MATERIALS AND SOFTWARE

Exercise book.

Lab practice guide.

5.READINGS

-F.Kreith, M.S. Bohn. "Principios de Transferencia de Calor", 6ªed. 2001. Ed. Paraninfo

Thompson Learnig. ISBN: 970-686-063-0.

-A.F. Mills, "Heat and mass transfer", ed. Richard D. Irwin, Inc. 1995

-J.P. Holman, "Transferencia de calor", 8ª ed. McGraw-Hill,1998. ISBN: 84-481-2040-

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-F.P. Incropera, D.P. De Witt, Fundamentos de transferencia de calor", 4ª ed. Prentice

Hall Hispanoamericana,1999, ISBN:970-17-0170-4

-J.Illa, "Problemes de termotècnia", 1991, Ed Eumo

6.ASSESSMENT

The final mark will be obtained from the exams, the practical exercises and the teacher's personal criteria.

Between the established dates, there will be: a partial exam which will not relieve you from coursework (half way through the semester, P1), a final exam in February (EF) and a final exam in September (ES). In order to qualify for the exams, the student should have attended and passed the practical exercises which will be completed during the class timetable in the first semester.

$$FM = 0,75 NT + 0,2 NP + 0,05 NPP$$

Where:

NT = max. {EF, (P1 + EF)/2} for the first examination, and NT = ES for the re-sit.

NPP = the mark of the teacher's personal criteria (not to be questioned).