COURSE: Heat Transfer		
DEGREE: Mechanical Engineering	YEAR: 3rd	TERM: 1st

WEEKLY SCHEDULE

WEEK	SESSION	CONTENTS DESCRIPTION	GROUP (marked with X)		SPECIAL ROOM FOR SESSION (Computer classroom, audio-visual classroom)	WEEKLY SCHEDULE FOR STUDENTS		
			LECTURE	SEMINAR		DESCRIPTION	IN-CLASS HOURS	HOMEWORK HOURS. Max 7 H per week
1	1	Course presentation **1. Introduction to convection heat transfer.** 1.1 Introduction. 1.2. Boundary layer in convective processes: hydrodynamic and thermal boundary layer, laminar and turbulent flow. 1.3 Boundary layer equations. 1.4 Non-dimensional equations of convective processes: Reynolds number, Nusselt number. 1.5 Turbulent boundary	X			Reading and study.	1,66	6,5

		layer.						
2	2	**Problems Chapter 1.**		X		Problems of introduction to convection heat transfer	1,66	
2	3	**2. External flow:** 2.1 Introduction 2.2 Determination of convection heat transfer coefficients. 2.3 Correlations for flat plates in parallel flow Laminar and turbulent flow, Critical Reynolds number), cylinders and spheres in cross flow, non-circular cylinders, tube bank and impinging jets.	x			Reading and study	1,66	6,5
3	4	**2. Problems Chapter 2.**		x		Problems of external flow.	1,66	
3	5	**3. Internal flow**. 3.1 Hydrodynamics: laminar and turbulent flow, critical Reynolds number, fully developed conditions, pressure drop in tubes. 3.2 Thermal aspects. 3.3 Energy balance.	x			Reading and study.	1,66	6,5
4	6	**Problems Chapter 3.**		x		Problems. Temperature profile in a tube for different conditions.	1,66	
4	7	**3. Internal flow (cont.).** 3.3 Energy balance (cont.): constant surface heat flux, constant surface temperature, external flow; the log mean temperature difference. 3.4 Internal flow correlations.	x			Reading and study	1,66	6,5
5	8	**Problems Chapter 3.**		x		Problems. Temperature profile for different conditions, calculation of the heat transfer coefficient, problems combining internal and external convection.	1,66	
5	9	**4. Free convection.** 4.1 Introduction 4.2 Conservation equations: introduction of the buoyancy force in the conservation equations. 4.3 Non-dimensional equations: Grashof and Rayleigh numbers, transition to	x			Reading and study.	1,66	6,5

		turbulent flow in a vertical surface, combines free and forces convection. 4.4 Correlations: external free convection, free convection within parallel plate channels, enclosures.						
6	10	**Problems Chapter 4.**		x		Problems of free convection	1,66	
6	11	**5. Boiling and condensation.** 5.1 Introduction: non-dimensional parameters 5.2 Boiling: pool boiling, forced convection boiling. 5.3 Condensation: film condensation on a vertical plate, film condensation on tubes and spheres, condensation on a vertical tier of tubes, film condensation in horizontal tubes, drop condensation on a horizontal surface.	x			Reading and study.	1,66	6,5
7	12	**Labs 1: Internal flow.**		x	Computer room	Case study: internal flow in a pipe, hydrodynamics and heat transfer study. Solution using CFD software. - Data collection - Critical analysis of the results. - Report writing	1,66	
7	13	**Problems Chapter 5.**	x			Problems of boiling and condensation	1,66	6,5
8	14	**Review problems: Chapters 1-5.**		x		Problems and review of general concepts.	1,66	
8	15	**Quiz: until chapter 5 included (week not confirmed)**	x				1,66	6,5
9	16	**Labs 2: Free convection**		x	Computer room	Case study: free convection inside a cavity. Hydrodynamics and heat transfer study. Solution using a CFD	1,66	

						software. - Data collection - Critical analysis of the results. - Report writing		
9	17	**6. Heat exchangers.** 6.1 Types of heat exchangers, parallel and counter-current heat exchangers. 6.2 Global heat transfer coefficient and total thermal resistance. 6.3 Heat exchanger analysis: log-mean temperature difference, Epsilon-NTU method, P-NTU method, characteristic curves.	x			Reading and study.	1,66	6,5
10	18	**Problems Chapter 6.**		x		Problems. Use of the characteristic curves to analyze shell-and-tube heat exchangers.	1,66	
10	19	**6. Heat exchangers (cont.).** 6.4 Shell-and-tube heat exchangers. 6.5 Cross-flow heat exchangers and compact heat exchangers. 6.6 Plate heat exchanger.	x			Analysis of a shell-and-tube heat exchanger use for the characteristic curves to analyze cross-flow and compact heat exchangers. Analysis of a cross-flow finned tube heat exchanger. Analysis of condensers and evaporator.	1,66	6,5
11	20	**Problems Chapter 6.** Shell-tube heat exchanger. Number of shells. Special operation conditions. Plate heat exchangers.		x		Problems of Shell-tube heat exchangers and plate heat exchangers	1,66	
11	21	**7. Psychometry**. 7.1 Moist air. 7.2 Moist content parameters. 7.3 Mass and energy balance, mixture enthalpy. 7.4 Air saturation processes: dew point, adiabatic saturation temperature, wet-bulb temperature.	x			Reading and study.	1,66	6,5

		Psychrometric diagram.						
12	22	**Labs 3: Analysis of a heat exchanger.**		x	Computer room	Computer lab: Calculation of a heat exchanger.	1,66	
12	23	**7. Psychometry (cont.)** 7.6 Psychrometric applications: sensible heating/cooling, humidification, evaporative cooling, dehumidification, adiabatic mixing, cooling towers. Examples of some applications.	x			Reading and study.	1,66	6,5
13	24	**Problems Chapter 7.**		x		Problems. Analysis of a cooling tower. Air-conditioning problems.	1,66	
13	25	**8. Radiation.** 8.1 Introduction to thermal radiation. 8.2 Black body radiation. 8.3 Radiation intensity and radiation power. 8.4 Real surfaces radiation: emissivity, absorptivity, reflectivity, transmissivity. Kirchhoff´s law. 8.5 Solar radiation. Net radiation exchange at a surface.	x			Reading and study.	1,66	6,5
14	26	**Problems Chapter 8**		x		Problems. Radiation exchange in a surface. Multimode heat transfer problems.	1,66	
14	27	**8. Radiation (cont).** 8.6 Radiation exchange between surfaces: view factor relations, net radiation exchange between black surfaces, net radiation exchange between gray diffuse surfaces, radiation network, application examples (radiation shields, the reradiating surface), and multimode heat transfer. Examples of some applications.	x			Reading and study.	1,66	6,5
15	28	**Problems Chapter 8**		x		Problems. Radiation exchange between surfaces. Multimode heat transfer problems.	1,66	

		Cont. lab 3: Analysis of a heat exchanger						3,25
						Subtotal 1	**48**	**94**
						Total 1 (Hours of class plus student homework hours between weeks 1-14)	**142**	

15		Tutorials. Work assignments completion						
16		Final examination					3	15
17								
18								
						Subtotal 2	**3**	**15**
						Total 2 (Hours of class plus student homework hours between weeks 15-18)	**18**	

TOTAL *(Total 1 + Total 2)*	**160**