COURSE: Thermal Engineering

DEGREE: Industrial Technologies Engineering | **TERM: Spring** | **YEAR: 2nd**

The course consists of 28 sessions distributed along 14 weeks
Weekly, the student has two sessions, and exceptionally three in weeks 7 & 9.
There are three lab sessions. Two of them are outside the regular schedule.
The partial exam, lasting around 1h 40', takes place in the regular schedule of masterclass (large group).

WEEKLY PLANNING

	WEEK	SESSION	DESCRIPTION OF THE SESSION CONTENT	GROUP: LARGE	GROUP: SMALL	Indicate if different to classroom	STUDENT'S WEEKLY WORK: DESCRIPTION	FACE-TO-FACE HOURS	HOURS OF WORK (Max. 7h per week)
jan 31	1	1	Introduction. Contents and methodology. Review of previous concepts. Properties and Ts diagram of water. Substance models. Examples.	x			Theoretical study on properties and T-s diagram of water. Recall on incompressible liquid and ideal gas models. Examples.	1.67	3
feb 4-5	2	2	Problems: properties.		x		Resolution of exercises to determine thermodynamic properties for a state or its variation in thermodynamic processes.	1.67	6
feb 7	2	3	Balances in thermodynamic systems. Energy and entropy balance in closed systems. Balance of mass, energy and entropy in open systems or control volumes. Examples.	x			Theoretical study about mass, energy and entropy balances in closed systems. Work on examples.	1.67	
feb 11-12	3	4	Problems of closed systems.		x		Resolution of exercises on closed systems.	1.67	6
feb 14	3	5	Devices under steady-state - I. Nozzles, Diffusers, Compressors, Pumps and Turbines. Hydraulic turbine.	x			Theoretical study of balances in steady-state devices. Application to nozzles, compressors, pumps and turbines.	1.67	
feb 18-19	4	6	Problems: nozzles, compressors, pumps and turbines.		x		Resolution of exercises.	1.67	6
feb 21	4	7	Devices under steady-state - II. Heat exchangers, boilers, combustion chambers, condensers. Valves and mixers.	x			Theoretical study about heat exchangers, valves and mixers.	1.67	
feb 25-26	5	8	Problems: heat exchangers and valves.		x		Resolution of exercises.	1.67	6
feb 28	5	9	Thermal engines. Basic concepts. Carnot power cycle. Intro to Rankine cycle.	x			Theoretical study about thermal engines and Carnot power cycle. Rankine cycle (intro).	1.67	
mar 3-4	6	10	Problems: thermal engines and Carnot cycle.		x		Resolution of exercises.	1.67	6
mar 6	6	11	Rankine cycle: theory and problems.	x			Theoretical study about Rankine cycle. Resolution of exercises.	1.67	
mar 10-11	7	12	Brayton cycle: theory and problems.		x		Theoretical study about Brayton cycle. Resolution of exercises.	1.67	
	7	L1	Lab 1: Performance of a power cycle.	External		Computer room	Study of the lab guide. Development of the lab. Processing of data and delivery of datasheet.	1.67	
ONLINE (covid19)									
mar 20	7	13	Cycles in internal combustion engines.	x			Theoretical study on internal combustion engine cycles.	1.67	
mar 24-25	8	14	Problems: internal combustion engines.		x		Resolution of exercises.	1.67	6
mar 27	8	15	Refrigeration cycles. Reversed Carnot cycle.	x			Theoretical study on refrigeration cycles.	1.67	
mar 31 - apr 1	9	16	Problems: refrigeration cycles and reversed Carnot cycle.		x		Resolution of exercises.	1.67	
scheduled	9	L2	Lab 2: Performance on internal combustion engine and refrigeration cycle.	External		Computer room	Study of the lab guide. Development of the lab. Processing of data and delivery of datasheet.	1.67	7
apr 3	9	17	Heat transfer modes, properties. Problems. Heat diffusion equation. Boundary conditions.	x			Theoretical study about heat transfer modes, and associated properties. Resolution of exercises. Heat diffusion equation. Temporal and spatial boundary conditions. Resolution procedures.	1.67	
apr 14-15	10	18	One-dimensional steady-state conduction in plane wall. Thermal resistances: series/parallel and contact. Problems.		x		Theoretical study about one-dimensional steady-state conduction. Resolution for conduction in plane wall without heat generation.	1.67	6
apr 17	10	P	Partial exam: Thermodynamics and cycles.	x			Mid-term exam	1.67	
apr 21-22	11	19	One-dimensional steady-state conduction in cylindrical and spherical geometries. Concept of critical radius. Problems.		x		Theoretical study about one-dimensional steady-state conduction in cylindrical and spherical geometries. Thermal resistances. Critical radius of insulation. Resolution of exercises.	1.67	6

apr 24	11	20	One-dimensional steady-state conduction with heat generation in plane, cylindrical and spherical coordinates. Examples and problems.	x			Theoretical study and resolution of exercises about conduction with heat generation.	1.67	
apr 28-29	12	21	Problems of heat transfer by conduction: with and without generation.		x		Resolution of exercises.	1.67	6
may 1	12	22	Transient conduction: theory and problems.	x			Theoretical study and resolution of exercises about transient conduction.	1.67	
may 5-6	13	L3	Lab 3: Heat dissipation in electronic devices.			Lab.	Study of the lab guide. Development of the lab. Processing of data and delivery of datasheet.	1.67	6
may 8	13	23	Fins.	x			Theoretical study on heat conduction in fins	1.67	
may 15	14	24	Problems: fins.	x			Resolutions of exercises.	1.67	6
							Subtotal 1	**46.7**	**76**
								122.7	
	15		Lab exam. Recovery and tutorials.				Lab exam in AG. Attendance to tutorials.		5
	16		Preparing final exam and assessment				Theoretical study and resolution of problems about the course contents.		35
	17								
	18								
							Subtotal 2	**0.0**	**40**
								40.0	
	TOTAL *(Total 1 + Total 2. Max. 180 hours)*							**162.7**	