MM 479E Process Heat Transfer	DEPARTMENT of MECHANICAL ENGINEERING

Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project / Field Study	Homework	Other	Total	Credit	ECTS Credit
7	42	0	-		13	20	75	3	3.0

Language	English
Compulsory / Elective	Elective
Prerequisites	MM 309 E
Course Contents	Basic laws of heat transfer. Boiling; pool boiling and correlations, forced convection boiling. Condensation; laminar and turbulent film condensation, dropwise condensation. Heat exchangers; heat exchanger analysis; the LMTD and Effectiveness-NTU method, heat exchanger calculation. Multimode heat and mass transfer. Diffusion mass transfer; rate equations, conservations of species, mass diffusion with and without homogeneous chemical reactions, transient diffusion.
Course Objectives	The course is designed to give fourth year mechanical engineering students the fundamental physics of boiling, condensation and mass transfer. Students are instructed in the analysis and solution of basic two phase heat transfer, heat exchangers and mass transfer problems, as supplemented by practical charts and tables as well as empirical correlations.
Learning Outcomes and Competences	Understanding of the boiling, condensation heat transfer, heat exchangers and mass transfer mechanisms. Learning the methods used for the design of two-phase heat transfer systems and heat exchangers. Understanding of convective heat-mass transfer analogy.
Textbook and / or Reference	Y.A. Çengel, "Heat Transfer, A Practical Approach", 2nd Edition, WCB/McGraw-Hill, 2002. F.P. Incropera and D.D. DeWitt, "Fundamentals of Heat and Mass Transfer", 5th Ed., John Wiley, 2002.

Assessment Criteria		If any, mark as (x)	Percentage (%)
	Midterm Exams	X	50
	Quizzes	X	5
	Homeworks	X	5
	Projects		
	Term Paper		
	Laboratory Work		
	Other		
	Final Exam	X	40

Instructors	-

Week	Subject
1	BOILING HEAT TRANSFER: Pool boiling, boiling regimes and the boiling curve, heat transfer correlations in pool boiling, enhancement of heat transfer in pool boiling, flow boiling.
2	CONDENSATION HEAT TRANSFER: Film condensation, flow regimes, heat transfer correlations for film condensation, film condensation inside horizontal tubes, dropwise condensation and heat pipes.
3	TWO PHASE FLOW: Quality and void fraction in a nonflow system, the flow system, critical flow, two phase critical flow.
4	HEAT EXCHANGERS: Types of heat exchangers, the overall heat transfer coefficient, fouling factor. Analysis of heat exchangers; the log mean temperature difference method, counter flow heat exchangers.
5	HEAT EXCHANGERS: Multipass and cross flow heat exchangers. Effectiveness-NTU method, selection of heat exchangers, compact heat exchangers.
6	HEAT EXCHANGERS: Boilers, evaporators and condensers for refrigeration and air-conditioning systems
7	MASS TRANSFER: Analogy between heat and mass transfer. Mass diffusion; mass and mole bases, ideal gas mixtures.
8	MASS TRANSFER: Fick's law of diffusion, mass diffusion coefficient, stationary medium consisting of two species. MIDTERM EXAMINATION I
9	MASS DIFFUSION: The mass diffusion equation, boundary and initial conditions, steady mass diffusion through a wall,
10	MASS DIFFUSION: Water vapor migration in buildings, transient mass diffusion, diffusion in a moving medium, gas mixtures at constant pressure and temperature.
11	MASS DIFFUSION: Diffusion of vapor through a stationary gas; Stefan flow, equimolar counter diffusion.
12	MASS DIFFUSION: Transient mass diffusion in a moving medium, gas mixtures at constant pressure and temperature.
13	MASS CONVECTION: Limitations on the heat-mass convection analogy. MIDTERM EXAMINATION II.
14	MASS CONVECTION: Mass convection relations. Simultaneous heat and mass transfer.