

MM 497 Thermal Analysis of Electronic Devices				DEPARTMENT of MECHANICAL ENGINEERING					
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project /Field Study	Homework	Other	Total	Credit	ECTS Credit
	42			28	5		75	3	3.0
Language	Turkish								
Compulsory / Elective	Elective								
Prerequisites	MM 309 E								
Course Contents	Introduction to packaging and heat transfer principles (thermal management, heat transfer modes, spreading resistance); Cooling technologies (fin analysis, jet impingement, immersion cooling, phase change energy storage, multi mode problems and case studies); Systems analysis; Thermal measurements; Emerging technologies (heat pipes and thermosyphons, microchannel heat exchangers and thermal challenges.								
Course Objectives	This course provides the student with the theoretical background and analysis methods required to predict the thermal behavior of air-cooled electronic systems and components. The course emphasizes first order analysis methods of forced and buoyancy driven systems, as well as conductive, natural and forced convection, and radiative heat transfer in these systems and associated components.								
Learning Outcomes and Competences	This course provides the student with the theoretical background and analysis methods required to predict the thermal behavior of air-cooled electronic systems and components. The course emphasizes first order analysis methods of forced and buoyancy driven systems, as well as conductive, natural and forced convection, and radiative heat transfer in these systems and associated components.								
Textbook and /or Reference	1. Cooling Techniques of Electronic Equipment, Dave Steinberg, John Wiley&Sons Inc.,1991 2. Thermal Design of Electronic Equipment, Ralph Ramsburg,CRC Pres,2001. 3. Thermal Management Of Microelectronic Equipment,LT Yeh, RC Chu, ASME Pres,2002. 4. Practical Guide to the Packaging of Electronics, Ali Jamnia, Marcel Dekker Inc., 2002.								
Assessment Criteria						If any, mark as (x)		Percentage (%)	
	Midterm Exams					X		30	
	Quizzes								
	Homeworks					X		10	
	Projects					X		20	
	Term Paper								
	Laboratory Work								
	Other								
Final Exam					X		40		
Instructors	Instr. Dr. Abuzer OZSUNAR								
Week	Subject								
1	Introduction to Formulas for Thermal Design of Electronic Equipment. Introduction to the Modes of Heat Transfer in Electronic Equipment. Theoretical Power Dissipation in Electronic Components. Thermal Engineering Software for Personal Computers								
2	Formulas for Conductive Heat Transfer, Conduction Electronic, Equipment: Introduction, Thermal Conductivity, Conduction - Steady State, Conduction – Transient, Boundary Conditions, Conduction in Extended Surfaces, Thermal Contact Resistance in Electronic Equipment Interfaces, Discrete Heat Sources and Thermal Spreading								
3	Fluid Dynamics for Electronic Equipment, Hydrodynamic Properties of Fluids, Fluid Statics, Fluid Dynamics, Incompressible Ideal Fluid Flow, Incompressible Real Fluid Flow, Loss Coefficients and Dynamic Drag, Fans and Pumps, Electronic Chassis Flow								
4	Convection Heat Transfer in Electronic Equipment, Fluid Properties, Boundary Layer Theory, Dimensionless Groups, Forced Convection, Natural Convection								
5	Radiation Heat Transfer in Electronic Equipment, Radiation Equations, Surface Characteristics, View Factors, Environmental Effects								
6	Heat Transfer with Phase Change, Dimensionless Parameters in Boiling and Condensation, Modes of Boiling, Liquids, Evaporation, Condensation ,Melting and Freezing								
7	Combined Modes of Heat Transfer for Electronic Equipment, Conduction in Series and Parallel, Conduction and Convection in Series, Radiation and Convection in Parallel, Overall Heat Transfer Coefficient								
8	Midterm Exam								
9	Design with CFD (ICEPAK)								
10	Design with CFD (ICEPAK)								
11	Project Presentations								
12	Project Presentations								
13	Project Presentations								
14	General view								