

MAAE 4906F/ELEC 4906F
Thermal Management of Electronics

Preliminary/Draft Course Outline

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Course Description: Physical understanding and design practices for thermal management of electronics. Analysis methodologies, optimization approaches & tools, measurement methods for component, board and system level thermal design of electronics.

Course Evaluation:	Assignments	20%	
	Project	20%	
	Final	60%	Total 100%

Textbooks: ‘Thermal Management Handbook for Electronic Assemblies’, 1998, Sergent & Krum, McGraw-Hill

Course Contents:

1. Basic Heat Transfer and Electrical Analogy
 - Basic conduction, convection, radiation heat transfer
 - Electrical analogy of temperature and heat flow, Resistance analysis
2. Thermal Management Design Requirements and Practices
 - Temperature dependant performance functionality
 - component/semiconductor/ board/ system level packaging
 - Reliability and reliability models
 - Requirements for safety and standardization
 - Thermal design applications
3. Component Level Thermal Design and Analysis
 - Analysis of conduction through component packaging
 - Concept of heat spreader – analysis, design and optimization
 - Types and analysis of interconnects
 - Design for reliability – thermal mismatch analysis and material selection
4. Board Level Thermal Design and Analysis
 - Metalisation (signal, power, ground) effects on board heat transfer
 - Analysis and optimization of air flow over board
 - Natural convection (fanless) cooled board

Design and selection of heat sink

Thermal interface material

5. System Level Thermal Design and Analysis

Air moving device (fan & blower) selection and analysis

System air flow design and optimization

Liquid cooled systems

Enclosed and outdoor systems

Cryogenic systems

6. Measurement Methods

Temperature/ Heat flow/ Airflow/ Pressure measurements

7. Numerical Methods and Software Tools

Resistor network model

Analysis and design with software tools

8. Application of Advanced Technology

Heat pipes and vapor chambers

Thermoelectric devices

Phase change materials as thermal capacitor
