ME 597G
HEAT TRANSFER IN ELECTRONIC SYSTEMS

COURSE OBJECTIVES

1. To introduce concepts in thermal management of electronics to senior undergraduate and graduate students and practising engineers.
2. To provide an appreciation for the applications of first principles to electronics cooling and packaging problems in industry.
3. To provide students with sound tools to approach existing packaging and cooling applications, while also raising awareness of novel techniques at the cutting edge.

Introduction to Packaging & Heat Transfer Principles (4 wks)
1. Introduction to thermal management
2. Heat transfer modes
3. Thermal spreading and contact resistance
4. Natural convection and radiation
5. Forced convection
6. Boiling and condensation
7. Microscale heat transfer

Cooling Technologies (4 wks)
1. Fin analysis; heat sink design and optimization
2. Air and liquid jet impingement
3. Immersion cooling
4. Phase change energy storage
5. Multi-mode heat transfer problems
6. Case studies and applications

Systems Analysis (2.5 wks)
1. Thermal systems analysis
2. Cold plates and heat exchangers
3. Flow network modeling
4. Thermodynamic analysis of cooling systems; economic analysis
5. Compact models
6. Acoustics and mechanical design issues

Thermal Measurements (1.5 wks)
1. Temperature, pressure, flow, sound, strain and other measurements
2. Microscale measurement techniques
3. Uncertainty in experimental measurements

Emerging Technologies (3 wks)
1. Heat pipes and thermosyphons
2. Microchannel heat exchangers
3. Thermo-electric and thermoacoustic cooling
4. Piezoelectrics
5. Other
6. Thermal challenges and trends

Design Projects
Several short-term design projects involving open-ended problems and case studies, needing computational analysis, using commercial codes and solvers