HEAT TRANSFER AND HEAT EXCHANGERS (Prof M. Vrachopoulos)

Topics Covered:

Heat Transfer

Introduction to Heat Transfer

Introduction to Conduction

One-Dimensional, Steady State Conduction

Two-Dimensional, Steady State Conduction

Transient Conduction

Introduction to Convection

Forced Convection - External Flow

Forced Convection - Internal Flow

Free Convection

Radiation

Mass Transfer

Problems and examples will include theory and applications drawn from a spectrum of engineering design problems.

Heat Exchangers

Basic Concept- Classification of Heat Exchangers

Design Methodology - General Design Requirements-Temperature Distribution and Its Implications

Design Correlations and Fouling

Double-Pipe Heat Exchangers, Shell-and-tube Heat Exchangers, Other Heat Exchangers, Condensers and Evaporators – Performance and design considerations

Problems and examples will include theory and applications drawn from a spectrum of engineering design problems.

Objectives:

Students will:

- Understand the basic modes of heat transfer.
- Analyze thermal systems. They will be able to assess the feasibility of a design and estimate efficiency of a configured system.

- Apply calculations appropriate to solve specific heat transfer problems in an engineering setting.
- Understand the basic concept and design methodology of heat exchangers.
- Distinguish different types of heat exchangers and determine general design requirements for different types of heat exchangers.
- Predict the thermal performance and pressure drop characteristics of a given type of heat exchanger.
- Estimate the overall heat transfer coefficient and the effectiveness of a heat exchanger.

Prerequisites:

- Integration-Differentiation- Solutions to Differential Equations
- General Physics
- Thermodynamics

Textbooks:

1. Fundamentals of Heat and Mass Transfer, Frank P. Incropera and David P. DeWitt, John Wiley & Sons, Fifth Edition, 2002.
2. Thermal design of heat exchangers: a numerical approach: direct sizing and stepwise rating / Eric M. Smith. -Chichester : Wiley, 1997
3. Heat transfer / J. P. Holman. - 8th ed.. - New York : McGraw - Hill, 1997
4. Heat exchangers: selection, rating, and thermal design /Sadik Kakac, Hongtan Liu. - Boca Raton : CRC, 1998
5. Computational fluid mechanics and heat transfer / John C.Tannehill, Dale A. Anderson, Richard H. Pletcher. - Washington : Taylor & Francis, 1997.

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