Sample Syllabus

ME 411 - Heat Exchanger Design
Spring Semester 2018

References:

R. K. Shak and D. P. Sekulic, Fundamentals of Heat Exchanger Design, Wiley, 2015
K. Thulukkanam, Heat Exchanger Design Handbook, 2nd edition, Mechanical Engineering, 2013
S. Kakac, Heat Exchangers: Selection, Rating, and Thermal Design, 2nd Ed., CRC Press, 2012
R. L. Webb and N. H. Kim, Principles of Enhanced Heat Transfer, 2nd ed., Taylors & Francis, 2005
N. Afgan, New Developments in Heat Exchangers, Gordon and Breach, 1996
G. Walker, Industrial Heat Exchangers: A Basic Guide, Hemisphere Philadelphia, 1990
A.P. Fraas, Heat Exchanger Design, 2nd Ed., Wiley, New York, 1989.
R.K. Shah and A.C. Mueller, “Compact Heat Exchangers”, Handbook of Heat Transfer Applications, 2nd Ed., McGraw-Hill, New York, 1985.
W.M. Kays and A.L. London, Compact Heat Exchangers, 3rd Ed., McGraw-Hill, New York, 1984.

Journals:

Heat Transfer Engineering, Hemisphere
Journal of Enhanced Heat Transfer, Gordon & Breach
Journal of Heat Transfer, ASME
International Journal of Heat Exchangers, R.T. Edwards, Inc.

Major Topics:

1. Introduction
- 1.1. Basic Concept
- 1.2. Classification of Heat Exchangers
- 1.3. Design Considerations

2. Design Methodology
- 2.1. General Design Requirements
- 2.2 Heat Exchanger Variables and Thermal Circuit
- 2.3 Temperature Distribution and Its Implications
- 2.4 LMTD Method
- 2.5 ε-NTU Method
- 2.6 Fin Performance and Selection
- 2.7 Cost Estimation

3. Concentric-Tube Heat Exchangers
- 3.1 Functional Dependence
- 3.2 Selection of the Optimal Operation Conditions
- 3.3 Performance and Design Calculations

4. Double-Pipe Heat Exchangers
   - 4.1 General Description
   - 4.2 Thermal and Hydraulic Design
   - 4.3 Heat Transfer and Pressure Drop Evaluations
   - 4.4 Performance and Design Calculations

5. Shell-and-Tube Heat Exchangers
   - 5.1. General Description
   - 5.2. Selection Criteria
   - 5.3. Mechanisms of Shell-Side Flow
   - 5.4. Controlling Parameters
   - 5.5. Heat Transfer and Pressure Drop Evaluations
   - 5.6. Performance and Design Calculations
   - 5.7. Design Project

6. Fin-and-Tube Heat Exchangers
   - 6.1. General Description
   - 6.2. Heat Transfer and Friction Characteristics
   - 6.3. Fin Geometries and Fin Efficiency
   - 6.4. Enhanced Surface Geometries
   - 6.5. Design Calculations

7. Compact Heat Exchangers
   - 7.1. General Description
   - 7.2 Heat Transfer and Friction Characteristics
   - 7.3 Comparison of Surface Performance
   - 7.4 Relative Performance Evaluation

8. Special Topics
   - 8.1. Heat Pipes
   - 8.2. Other Advanced Heat Exchangers

Grading Policy:	Homework	40%
	Projects	30%
	Final Exam (Term Paper)	30%

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Course Description: Thermal design and application of different heat-exchanger types, including surface selection, economics, performance calculations and design optimization.

ME 420 Heat Exchanger Design

Course Objectives

Upon completion of this course, students should be able to:

1. Understand the basic concept and design methodology of heat exchangers.
2. Distinguish different types of heat exchangers.
3. Determine general design requirements for different types of heat exchangers.
4. Identify the important heat-exchanger design parameters.
5. Perform thermal and hydraulic design and application of different heat exchanger types.
6. Predict the thermal performance and pressure drop characteristics of a given type of heat exchanger.
7. Make use of basic knowledge of fluid mechanics, heat transfer, and material properties in both performance and design calculations.
8. Select appropriate fin configuration and fin density.
9. Select the operating conditions that meet the heat load and pressure drop requirements.
10. Estimate the overall heat transfer coefficient and the effectiveness of a heat exchanger.
11. Perform sizing of a given type of heat exchanger for a specific application.
12. Consider economic factors and perform cost-effective design optimization.
13. Tackle heat exchange design problems involving multiple design requirements and multiple design parameters.
14. Develop computer programs to perform parametric analysis and optimization of heat exchanger designs.
15. Prepare written report on the design and the performance evaluation of a given type of heat exchanger.
16. Demonstrate professionalism in interactions with colleagues, faculty, and staff.