بسم الله الرحمن الرحيم

King Abdulaziz University
Faculty of Engineering

Mechanical Engineering Department
MEP460 Design of heat exchangers
Spring 2021

Course outline

1. Course description: Classification of heat exchangers, Design correlations and fouling. Basic thermal design methods and iterative techniques. Double pipe heat exchangers. Shell and tube heat exchangers. Compact heat exchangers. Other types of heat exchangers. Correlations for two-phase flow. Condensers and evaporators. (3 credit hours)

2. Prerequisites: MEP360 Heat transfer, MEP361 Thermo. II, EE332 Numerical Method Analysis

3. Textbooks:

1-Incropera, Frank, Theodore Bergman, Andrienne Lavine, and David Dewitt, Fundamentals of heat and mass transfer, 7th edition, John Wiley & Sons, 2011.
2-Kakac, Sidik, Hongtan Lie, and Anchasa Parmuanjaroenkj, Heat exchangers: Selection, Rating and Thermal Design. CRC press, third edition, 2012.

4. References

1. Rohsenow, W. M., J. P. Hartentt, and Y. I. Cho, Handbook of Heat Transfer, 3ed edition, McGraw-Hill, 1998
2. Kakac, S. , A. E. Bergles and F. Mayinger, Heat Exchangers, Thermal-Hydraulic Fundamentals and design, Hemisphere Publication & McGraw-Hill,1981
3.Kays, M.W. and A.L. London, Compact Heat Exchangers, 3ed edition, McGraw-Hill, 1984.
4. Hewitt, G. F., G.L. Shires and T. R. Bott, Process Heat Transfer, CRC press, 1994.
5.Serth, R. W., Process Heat Transfer (Principles and Applications), Elsevier, 2007.
7.Hodge B. K. and Taylor R. P., Analysis and Design of Energy Systems, 3rd edition, Prentice Hall, 1999
8. Handouts from references and Lab. manuals

5. Course Learning Outcomes:

CLO	Course Learning Outcomes
CLO_1	Identify the appropriate Nusselt number and friction factor correlations, review of fins
CLO_2	Describe the physical mechanism of different boiling and condensation modes
CLO_3	Describe the common types of heat exchangers, their applications and their TEMA classifications.
CLO_4	Apply LMTD and ε-NTU methods for rating and sizing different types of heat exchangers. Ability to add fouling resistance.
CLO_5	Rate and thermal design of double pipe heat exchangers
CLO_6	Rate and thermal design of shell and tube heat exchangers
CLO_7	Rate and know how to design thermally compact heat exchangers
CLO_8	Rate heat exchanger taught in class such as cooling tower or Gasketed plate heat exchangers
CLO_9	Run (conduct/record data/ analyze results) heat exchanger experiments

6. Topics and time duration

No	Topic	CLO	Weeks
1	Review of basic heat transfer and fluid mechanics	1	1
2	Boiling and condensation phenomena and modes	2	1.5
3	Classifications of heat exchangers	3	1
4	LMTD and ε-NTU methods for analyzing heat exchangers. Fouling estimation	4	2
5	Thermal design and rating of double pipe heat exchangers	5	1.5
6	Thermal design of shell and tube heat exchangers	6	2
7	Thermal design and rating of compact heat exchangers	7	2
8	Rating and design of Cooling tower	8	2
9	Heat exchangers experiments	9	1

7. Relation to Students Outcomes (SO)

Outcome (2): Student work samples demonstrate the student's ability to apply the engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

Outcome (3): Student work samples demonstrate the student's ability to communicate effectively with a range of audiences.

8. Class schedule:

Lecture: 2 sessions, 80 min. each
Lab. one session 110 min.

9. Grading:

HW.	Lab.	Quizzes	Mid. term	Final	Mini project
10	10	20	20	30	10

10. Instructor:

Omar. M. Al-Rabghi, orabghi@kau.edu.sa

11. Course web site:

https://orabghi.kau.edu.sa/

Date: Jan. 2021.