



Heat Exchanger Design

Course Code:	70
Credits:	3
Course Type:	Theoretical
Requisites:	Heat Transfer 1
Course Length:	51 hours

Outlines:

1. Introduction

- a. Introduction to heat exchangers
- b. Design of heat exchangers
- c. Rating of heat exchangers

2. Various Types of Heat Exchangers

- a. Common types of heat exchangers
- b. Double-pipe heat exchangers
- c. Shell and tube heat exchangers
- d. Compact heat exchangers
- e. Plate heat exchangers
- f. Other heat exchangers
- g. Classification of heat exchangers
- h. Classification based on tube arrangement
- i. Classification based on number of fluids
- j. Classification based on heat transfer mechanism
- k. Classification based on temperature range
- l. Heat exchangers with periodic flow
- m. Advanced Heat Exchangers

3. Heat Transfer Mechanisms

- a. Conduction
- b. Convection
- c. Internal flow
- d. External flow
- e. Radiation
- f. Heat transfer coefficients
- g. Fins

4. Basic Theory

- a. Basic assumptions
- b. LMTD method
- c. $\epsilon - NTU$ Method
- d. Other methods
- e. Tables and their use

- f. Heat exchangers in Series
- g. Heat Exchangers in parallel

5. Selection of Heat Exchangers

- a. Double-pipe
- b. Shell and tube
- c. Finned
- d. Plate

6. Design of Double-pipe Heat Exchangers

- a. Applications and limitations
- b. Heat transfer and pressure drop in smooth pipes
- c. Heat transfer and pressure drop in finned straight pipes
- d. Mutual effect of heat transfer and pressure drop
- e. Considerations in detail design

7. Design of Shell and Tube Heat Exchangers

- a. Applications and limitations
- b. Classifications
- c. Standards
- d. Important parts
- e. Calculation of heat transfer and pressure drop using Kern's method
- f. Calculation of heat transfer and pressure drop using Bell-Delaware method
- g. Calculation of heat transfer and pressure drop using network method
- h. Advanced techniques for heat transfer and pressure drop calculations
- i. Considerations in detail design

8. Design of Finned Heat Exchangers

- a. Applications and limitations
- b. Various types of fins and tubes
- c. Heat transfer on fin side
- d. Pressure drop on fin side
- e. Effect of fittings in pressure drop on both sides
- f. Mutual effect of heat transfer and pressure drop
- g. Considerations in detail design

9. Design of Plate Heat Exchangers

- a. Applications and limitations
- b. Various types of flow patterns
- c. Types of Plates
- d. Heat transfer calculations
- e. Pressure drop calculations
- f. Mutual effect of heat transfer and pressure drop
- g. Considerations in detail design



References:

1. Hewitt, G. F., Shires, G. L., Bott, T. R., "Process Heat Transfer", CRC Press, 1994.
2. Kem, D. Q., "Process Heat Transfer", Mc- Graw Hill International Book Company, 1965.
3. Taborek, J., Hewitt, G. F., Afgan, N., "Heat Exchangers: Theory and Prcatice, Hemisphere Pub, Co. 1983.
4. Perry, R.H., Green, D., "Perry's Chemical Engineers, Handbook", McGraw – Hill International Book Company, 1984.
5. "Standards of the Tubular Exchangers Manufacturers Association", Tubular Exchangers Manufacturers Association (TEMA), Inc. 7th Ed., 1988.
6. Rohsenow, W. M., Hartnett, J. P., "Handbook of Heat Transfer". McGraw Hill International Book Company, 1973.
7. Saunders, E. A. D., "Heat Exchangers, Selection, Design and Construction", Longman Scientific and Technical, 1988.
8. "Heat Exchanger Design Handbook", Hemisphere Pub. Co., 1985.
9. Afgan, N. Carvalho, M. G., Bar Cohen. A., Butterworth, D., Roetzel. W., "New Developments in Heat Exchangers", Gordon and Breach Pub., 1996.