Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
M. Tech. in Thermal Engg.	Heat Exchanger Analysis and Design	MET 607	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
III	3	3-0-0	3 Hours

Unit - I

Classification of Heat Exchangers: Overview of heat exchanger design methodology; Process and design specifications; Thermal and hydraulic design; Mechanical design; Manufacturing considerations and cost estimates; Trade-off factors; Optimum design; Other considerations; Interactions among design considerations. **(06 Hours)**

Unit - II

Basic Thermal Design: Theory for recuperators; Formal analogy between thermal and electrical Entities; Heat exchanger variables and thermal circuit; The ϵ-NTU method; Effectiveness; Number of transfer unit relationships; The P-NTU method; P–NTU relationships; The mean temperature difference method; F factors for various flow arrangements; Comparison of the ϵ-NTU; P–NTU and MTD methods; Determining exchanger effectiveness; Heat exchanger design problems.

(08 Hours)

Unit - III

Thermal Design: Theory for regenerators; Heat transfer analysis; The ϵ-NTU method; Influence of longitudinal wall heat conduction; Influence of transverse wall heat conduction; Influence of pressure and carryover leakages; Influence of matrix material; Size and arrangement. **(07 Hours)**

Unit - IV

Heat Exchanger Pressure Drop Analysis: Introduction; Extended surface heat exchanger pressure drop; Regenerator pressure drop; Tubular heat exchanger pressure drop; Plate heat exchanger Pressure drop; Pressure drop associated with fluid distribution elements; Pressure drop presentation; Pressure drop dependence on geometry and fluid Properties. **(08 Hours)**

Unit - V

Surface Basic Heat Transfer and Flow Friction Characteristics: Basic concepts; Dimensionless groups; Experimental techniques for determining surface characteristics; Analytical and semi-empirical heat transfer and friction factor correlations for simple geometries; Experimental heat transfer and friction factor correlations for complex geometries; Influence of temperature-dependent fluid properties; Influence of superimposed free convection and radiation.

(08 Hours)

Unit - VI

Heat Exchanger Surface Geometrical Characteristics: Tubular heat exchangers; Tube-fin heat exchangers; Plate-fin heat exchangers; Regenerators with continuous cylindrical passages; Shell-and-tube exchangers with segmental baffles; Gasketed plate heat exchangers; Heat exchanger design procedures: Fluid mean temperatures; Plate-fin heat exchangers; Tube-fin heat exchangers; Plate heat exchangers; Shell-and-tube heat exchangers; heat exchanger optimization.

(08 Hours)

Recommended Books:

1. Fundamentals of Heat Exchanger Design; R.K. Shah & D. P. Sekulic; John Wiley & Sons; 1st Edition; 2003.
2. Heat Exchangers: Selection; Rating; and Thermal Design; Sadik Kakaç; Hongtan Liu; Anchasa Pramuanjaroenkij; CRC Press; 3rd Edition; 2002.
3. Thermal Design of Heat Exchangers: A Numerical Approach Direct Sizing and Stepwise Rating; Eric M. Smith; Wiley; 1st Edition; 1997.
4. Thermal Design and Optimization; A. Bejan; G. Tsatsaronis and M. Moran; John Wiley and Sons; 1st Edition; 1996.
5. Heat Exchanger Design Handbook; T. Kuppan; CRC Press; 1st Edition; 2000.