Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
M. Tech. in Thermal Engg.	Optimum Design of Thermal Systems	MET 605	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
III	3	3-0-0	3 Hours

Unit - I

Review and Introduction: Primary energy analysis; Dead states and energy components; Eenergy balance for closed and control volume systems; Applications of energy analysis for selected energy system design; Introduction to economics; Introduction to Thermal Systems Design. **(06 Hours)**

Unit - II

Principles of Designing: A workable engineering system; Probabilistic approaches to design; Modelling overview: levels and steps in model development; Examples of models; Mathematical modeling; Equation/curve fitting; Regression analysis; Modeling systems; System simulations; Lagrange multipliers; Search methods; Dynamic programming; Geometric programming; Calculus methods of optimization; System simulation; Optimization. **(07 Hours)**

Unit - III

Modeling of Energy Systems: Heat exchanger; Solar collectors; Distillation; rectifications; Turbo-machinery components; Refrigeration systems; Information flow diagram; Solution of set of nonlinear algebraic equations; Successive substitution; Newton Raphson; Examples of energy systems simulation; Modeling of thermal properties; Steady state simulation; Dynamic behavior of thermal systems. **(08 Hours)**

Unit - IV

Introduction to Piping Systems: Piping systems; Economics review; Optimum economic diameter; Parallel piping systems; Flow rate measurement; Pumps and piping systems; NPSH and dimensional analysis; Pumps in series and parallel. **(08 Hours)**

Unit - V

Introduction to Heat Transfer Fundamentals: Introduction to heat exchangers (LMTD); Double pipe heat exchangers; Effectiveness-NTU; Intro to shell and tube heat exchangers; Shell and tube heat exchangers; Plate and frame heat exchangers; Cross flow heat exchangers; Review of radiation heat transfer; Introduction to solar radiation; Heat gain through fenestrations; Solar flat-plate heat exchangers. **(08 Hours)**

Unit - VI

Optimization of Thermal Systems: Objectives-constraints; Problem formulation; Unconstrained problems; Necessary and sufficiency conditions; Constrained optimization; LaGrange multipliers; Constrained variations; Linear programming; Simplex tableau; Pivoting; Sensitivity analysis; Energy- economy models: Multiplier analysis; Energy and environmental input / output analysis; Energy aggregation; Econometric energy demand modeling; Overview of econometric methods; Dynamic programming; Search techniques: Univariate and multivariate. **(08 Hours)**

Recommended Books:

1. Design of Thermal Systems; W. F. Stoecker; McGraw-Hill Companies; 3rd Edition; 1989.
2. Analysis and Design of Energy Systems; B. K. Hodge and R. P. Taylor; Prentice Hall PTR; 3rd Edition; 1999.
3. Design and Optimization of Thermal Systems; Yogesh Jaluria; CRC Press; 2nd Edition; 2008.
4. Design and Simulation of Thermal Systems; N. V. Suryanarayana & O. Arici; McGraw Hill; 1st Edition; 2003.
5. Thermal Design and Optimization; A. Bejan; G. Tsatsaronis and M. Moran; John Wiley and Sons; 1st Edition; 1996.