

MEME456: DESIGN OF THERMAL SYSTEMS
CREDITS = 5 (L=3, T=0, P=2)

Course Objective: To design and optimize thermal systems.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P		Theory		Practical		Total Marks
			ESE	CE	ESE	CE		
3	0	2	5	70	30	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	<p><u>Introduction:</u> Engineering Design, Design as Part of Engineering Enterprise, and Design versus analysis, need for optimization, basic characteristics of thermal system, Formulation of the Design Problem, Steps in the Design Process, Computer-Aided Design.</p>	10
2	<p><u>Modelling and Simulation of thermal systems:</u> Basic considerations in design, importance of modeling in design, types of models, mathematical modeling, physical modeling and dimensional analysis, solution procedure, merging of different models, accuracy and validation, system simulation, curve fitting, methods of numerical simulation, numerical simulation versus real systems.</p>	10
3	<p><u>Introduction to optimization techniques:</u> Introduction, Formulation of optimization problems, Calculus techniques: Lagrange multiplier method, Search methods, Concept of interval of uncertainty, reduction ratio, reduction ratios of simple search techniques like exhaustive search, dichotomous search, Fibonacci search and Golden section search, numerical examples Method of steepest ascent/steepest descent, conjugate gradient method: examples, New generation optimization techniques: Genetic algorithm and simulated annealing, Introduction to Bayesian framework for optimization.</p>	10

Unit No.	Topics	Teaching Hours
4	<u>Dynamic response of thermal systems:</u> Importance of dynamic analysis, one dynamic element in a steady state simulation.	04
5	<u>Economics of thermal systems:</u> Calculation of Interest, Worth of Money as a Function of Time, Series of Payments, Raising Capital, Taxes, Economic Factor in Design, Application to Thermal Systems, Carbon Credit Calculation.	08
6	<u>Comprehensive case studies:</u>	
TOTAL		42

List of References:

1. *“Design and optimization of thermal systems”*, Y Jaluria, Mc Graw Hill.
2. *“Elements of thermal fluid system design”*, L C Burmeister, Prentice Hall
3. *“Essentials of Thermal System Design and Optimization”*, Prof. C Balaji, Ane Books, New Delhi in India and CRC Press in the rest of the world
4. *“Design of thermal systems”*, W F Stoecker, Mc Graw Hill
5. *“Introduction to optimum design”*, J S Arora, Mc Graw Hill

Course Outcomes (COs):

After learning the course the students should be able to:

1. Outline the concept of design of thermal systems.
2. Develop Model of thermal systems and its simulation.
3. Apply optimization techniques to thermal systems.
4. Appraise dynamic response of thermal systems
5. Apply concept of economics to thermal system.
6. Analyze Case Studies