Name of Faculty	:	Faculty of Engineering & Technology
Name of Program	:	Master of Technology (M. Tech)
Course Code	:	2MTE05
Course Title	:	Design and Optimization of Thermal Systems
Type of Course	:	PE
Year of Introduction	:	2023-24

Prerequisite	:	Basic about thermodynamics system
Course Objective	:	To perform analysis of all the parameter and their effect on the performance of equipment and select the optimum condition.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	Explain engineering design of thermal systems.
	CO2	Discuss different models used in modelling of thermal systems.
	CO3	Appraise various optimization techniques and apply the same to thermal system design.
	CO4	Determine costing of thermal systems.

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
				Theory Marks		Practical Marks		Total Marks
L	**T**	**P**	**C**	**SEE**	**CIA**	**SEE**	**CIA**	
03	00	02	04	70	30	30	20	150

*Legends: **L**-Lecture; **T**–Tutorial/Teacher Guided Theory Practice; **P** – Practical, **C** – Credit, **SEE** – Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.))*

Course Content

Unit No.	Topics	Teaching Hours	Weightage
1	Introduction: Engineering Design, Design as Part of Engineering Enterprise, Design versus analysis, need for optimization, basic characteristics of thermal system, Formulation of the Design Problem, Steps in the Design Process, Computer-Aided Design	8	20%
2	Modeling & Simulation of thermal systems: 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	10	30%

	validation, system simulation, curve fitting, methods of numerical simulation, numerical simulation versus real systems		
3	Optimization: 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	12	25%
4	Economic Considerations: 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	12	25%

NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Suggested List of Experiments/Tutorials

Sr. No.	Name of Experiment/Tutorial	Teaching Hours
1	To evaluate need for optimization in engineering enterprise	02
2	Exercise on mathematical modelling and problem formulation for optimization of various thermal system	02
3	Write a program to implement single variable optimization technique.	02
4	Write a program to implement multivariable optimization techniques.	02
5	Write program to implement genetic algorithm.	02
6	To discuss different economics considerations used for design and optimization of thermal systems.	02
7	To apply various methods of numerical simulation for thermal systems optimization.	02
8	To apply reduction ratios of simple search techniques used for optimization.	02
9	To calculate carbon credit for specific case study.	02
10	To appraise different types of modeling techniques.	02

Suggested Learning Websites

Sr. No.	Name of Website

1	https://nptel.ac.in

Reference Books

Sr. No.	Name of Reference Books
1	Design and optimization of thermal systems, Y Jaluria, McGraw Hill.
2	Elements of thermal fluid system design, L C Burmeister, Prentice Hall
3	Essentials of Thermal System Design and Optimization, C Balaji, Ane Books/CRC Press
4	Design of thermal systems, W F Stoecker, McGraw Hill