GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL (THERMAL ENGINEERING) (21)
DESIGN AND OPTIMIZATION OF THERMAL SYSTEM
SUBJECT CODE: 2722111
SEMESTER: II

Type of course: Major Elective - II

Prerequisite: -- Engineering thermodynamics & Heat Transfer.

Rationale: The course is designed to give fundamental knowledge, relevant technologies and design aspects of various thermal systems used in engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	PA (V)		PA(I)		
						ESE	OEP	PA	RP	
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No	Content	Total Hrs	% 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	10	15%
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 validation, system simulation, curve fitting, methods of numerical simulation, numerical simulation versus real systems	15	30%
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	20	40%
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	8	15%

Reference Books:

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 Outcome:
After learning the course the students should be able to:
- Understand the basic concept of design and optimization relevant to thermal system.
- Acknowledge, access and analysis various thermal systems used in engineering applications.

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.