GUJARAT TECHNOLOGICAL UNIVERSITY

ENERGY ENGINEERING (39)
SOLAR REFRIGERATION AND AIR CONDITIONING
SUBJECT CODE: 2733905
M.E. 3rd SEMESTER

Type of course: Elective-IV

Prerequisite: Solar Energy, Thermodynamics, psychometric

Rationale: The course is designed to give fundamental knowledge and relevant technologies of solar energy applied in the field of refrigeration and Air Conditioning

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1.	Introduction to solar energy used for cooling; Potential and scope of solar cooling, Types of solar cooling systems, Solar collectors and storage systems for solar refrigeration and air-conditioning	**12**	25%
2.	Solar operation of vapor absorption and vapor compression refrigeration cycles and their thermodynamic assessment, Rankine cycle, sterling cycle based on solar cooling systems, Fuel assisted solar cooling systems	**12**	25 %
3.	Solar desiccant cooling systems Open cycle absorption / desorption solar cooling alternatives, Advanced solar cooling systems	**12**	25%
4.	Thermal modeling and computer simulation for continuous and intermittent solar refrigeration and air-conditioning systems, Refrigerant storage for solar absorption cooling systems	**8**	15%
5.	Solar thermoelectric refrigeration and air-conditioning. Solar thermo acoustic cooling and hybrid air-conditioning, solar economics of cooling systems	**4**	10%

Reference Books:

1. Solar air conditioning and refrigeration, A. A. M. Sayigh, J. C. McVeigh
2. Solar Refrigeration and Space conditioning, Kaushik S C., Divya Jyoti Publication
3. T. Nejat Vezirogulu, "Solar cooling and Heating Volumes" I, II & III.
4. Emerging Technologies in Air-conditioning and Refrigeration, R S Agrawal, P L Dhar, M M Pande, Sajeev Jain, ASHRAE,ISHRAE, Allied Publishers Limited
5. Solar-assisted air conditioning in buildings, Hans-Martin Henning, Springer
6. Desiccant Assisted Cooling Fundamentals and Applications, Carlos Eduardo Leme No'brega, Nisio Carralho Lobo Brum, Springer

7. Solar Energy – Principles of Thermal Collection and Storage, S P Sukhatme, McGraw Hill
8. Solar Energy: Fundamentals and Applications, H P Garg & Jai Prakash, McGraw Hill
9. ASHRAE Hand Book, (1) Fundamentals (2) Refrigeration
10. Refrigeration and air conditioning, C P Arora, McGraw Hill

Course Outcome: After learning the course the students should be able:

1. To know the concept of solar cooling opportunities and technology both Active and Passive
2. To analyze thermodynamically both solar operated VCR and VAR systems.
3. To get exposure to desiccant cooling systems and its applications
4. To develop modeling and simulation of various solar refrigeration systems
5. To know the advanced and hybrid solar refrigeration and air conditioning system

List of Experiments:

1. Study of solar photovoltaic and solar thermal refrigeration and air conditioning system
2. Performance evaluation of solar photovoltaic system
3. Performance evaluation of solar flat plate collector and/ or concentrating solar collector
4. Performance evaluation of Aqua Ammonia Vapour absorption system integrated with solar collectors
5. Performance evaluation of LiBr-H2O Vapour absorption system integrated with solar collectors
6. Performance evaluation of solar operated solid and liquid desiccant system
7. Study of solar thermoelectric and thermo acoustic cooling system
8. Study of various sorption systems having single, double effect
9. Study of various psychometric process on air conditioning trainer
10. Study of steam jet ejector cooling system

Open Ended Problem:

1. To design / make model flat plate collector integrated absorption refrigeration system
2. To develop experimental model for photovoltaic or thermo electric refrigeration system
3. To develop computer simulation of solar operated refrigeration or air conditioning system
4. To design/ make model on solar thermo acoustic cooling system

List of Open Source Software/learning website:
TRNSYS/EES
www.nptel.iitm.ac.in/courses/;
http://www.catool.org/
http://ocw.mit.edu/

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.