

# GUJARAT TECHNOLOGICAL UNIVERSITY

## MECHANICAL (CRYOGENIC ENGINEERING) (10)

ADVANCED REFRIGERATION

SUBJECT CODE: 2711003

SEMESTER: I

**Type of course:** Major Elective I

**Prerequisite:** Basic concept of thermodynamics and refrigeration

**Rationale:**

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	PA (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2	2	5	70	30	20	10	20	0	150

**Content:**

Sr. No.	Content	Total Hrs	% Weightage
1.	Balancing of vapor compression refrigeration system	3	8
2.	Dual pressure vapor compression system and its analysis.	2	7
3.	Compound compression with flash cooler and flash intercooler,	4	10
4	multiple expansions, parallel operation, sectionalizing, booster operations, various types of cascade systems analysis	4	10
5	Refrigerants: Ecofriendly refrigerants & their properties, secondary Refrigerants, mixture of refrigerants, azeotropics, salient characteristics of various refrigerants. Synthetic lubricating oil & their properties	4	7
6	Absorption refrigeration: H-x charts of LiBr-H <sub>2</sub> O and NH <sub>3</sub> -H <sub>2</sub> O solutions. analysis of vapor absorption refrigeration system on H-X charts, mass concentration & equilibrium charts, heat balance, COP comparison with vapor compression refrigeration systems, two stage vapor absorption refrigeration system, balancing of vapor absorption refrigeration systems.	4	10
7	Air cycle refrigeration, Analysis of various cycles and their applications. Calculations of COP	5	10
8	Steam jet refrigeration - cycle analysis, analysis on H-O charts performance, control and various applications.	3	7
9	Steam jet refrigeration - cycle analysis, analysis on H-O charts performance, control and various applications.	3	7
10	Heat pumps: Sources and sinks, refrigerant circuits, heating and cooling performance of heat pumps.	4	7
11	Design of refrigeration systems for industrial & other application for transport refrigeration, walk in coolers & cold storages for different applications.	3	10

12	Preservation & processing of food by use of refrigeration.	3	7
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**Reference Books:**

1. Mechanical refrigeration, sparks and dilio
2. Refrigeration and air conditioning, stocker
3. Refrigeration and air conditioning, Jordan and priester
4. Refrigeration and air conditioning, C. P. Arora
5. Ashrae hand book, refrigeration 1998
6. Thermal environmental engineering-threlked 1998
7. Industrial refrigeration handbook, stoecker, 1998M.E. I(MECHANICAL)

**Course Outcome:**

After learning the course the students should be able to:

Design and analyze compound vapour compression system, Vapour absorption system, multiple evaporator system. Students should know about new refrigerants, Steam jet refrigeration system and different cycles of air refrigeration system. Balancing of vapour compression refrigeration system. Refrigeration application like Heat pump, walk in cooler, cold storage plant and transport refrigeration. Preservation and processing of food

**List of Experiments:**

1. To build up a vapour compression refrigeration system and change it with R-134a.
2. Study and testing of a steam jet refrigeration system.
3. Study and testing of forced draft cooling towers.
4. Study and testing of cascade refrigeration system.
5. Study of a mechanical heat pump system and to test it.
  - a. On air cooled condenser mode
  - b. On water cooled condenser mode
6. Study and testing of walk in cooler.
7. Study and testing of a short vortex tube.
8. To carry out test on reciprocating refrigerant compressor and plot. Volumetric efficiency curve of a given compressor.
9. Study of NH<sub>3</sub> condensing plant of a cold storage.
10. Study of freeze drying machine.

**Design based Problems (DP)/Open Ended Problem:**

Analysis of compound compression, Multiple evaporator system and cascade refrigerator.

**Major Equipments:**

Heat pump, Walking cooler, Cold storage, Freeze drying machine, Cascade refrigerator, Steam jet refrigeration

