



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechanical Engineering

Subject Code: DI05019051

Subject Name: Refrigeration and Air Conditioning

W. e. f. Academic Year:	2025-26
Semester:	5 th
Category of the Course:	PEC-04

Prerequisite:	(1) Elements of Mechanical Engineering (DI01000191) (2) Engineering Thermodynamics (DI03019011) (3) Thermal Engineering-I (DI04019011)
Rationale:	Diploma Mechanical engineers with program elective subject “Refrigeration and Air Conditioning” have to bridge the gap between theoretical knowledge of Thermodynamics, Thermal Engineering and the practical industrial/domestic demand for cooling, air conditioning and ventilation solutions. As urbanization and industrialization increase, the need for skilled technicians to manage thermal environments, from food preservation to human comfort, has become a cornerstone of mechanical engineering field. Students gain a thorough understanding of essential cycles, such as Vapor Compression Cycle, Vapor Absorption Cycle and Reverse Brayton Cycle, along with psychrometry (air treatment) and the functioning of components like compressors, condensers, expansion devices and evaporatorsto run all these systems energy efficient and environmentally friendly to minimize problem of energy crisis and pollution.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
CO-1	To understand the need and importance of Refrigeration and Air Conditioning.
CO-2	To understand basics of vapor compression cycle, vapor absorption cycle and reverse Brayton cycle.
CO-3	To identify components, refrigerants and lubricants of a refrigeration system and air conditioning system.
CO-4	To understand Psychometric properties of airto be handled in air conditioning system.
CO-5	To use Tools used in refrigeration and Air conditioner installation and maintenance.



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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR		C	Theory		Tutorial / Practical	
			ESE(E)		PA(M)	PA(I)	ESE(V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Unit-1 Introduction 1.1 Definition of Refrigeration and air-conditioning. 1.2 Refrigerating effect, unit of refrigeration, Coefficient of performance. 1.3 Types of Refrigeration-Ice, dry ice, Steam jet, Throttling, Liquid nitrogen refrigeration 1.4 Carnot refrigeration Cycle on PV & TS diagrams 1.5 Air refrigeration cycle (Reverse Brayton or Bell - Coleman cycle) on PV& TS diagrams. 1.6 Advantages, disadvantages and applications of air refrigeration cycles. 1.7 Simple numerical on Reverse Brayton cycle.	5	10
2.	Unit-2 Vapor Refrigeration Systems 2.1 Flow diagram with basic components of Vapor Compression Refrigeration system. 2.2 Representation of the vapor compression cycle on P-H, T-S & P-V Diagram; 2.3 Expression for Refrigerating effect and coefficient of performance. 2.4 Effects of changes in operating conditions (sub-cooling, super heating of suction vapor and change in suction pressure of compressor) on performance of vapor compression refrigeration cycle. 2.5 Simple Vapor absorptions cycle and its flow diagram; 2.6 Simple Electrolux system for domestic units 2.7 Comparison of Vapor absorption and vapor compression system. 2.8 Simple numerical on vapor compression cycle.	10	22
3.	Unit-3 Common Equipments and refrigerants of Vapor Compression Refrigeration System.	15	36



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	3.1 Common equipments of Vapor Compression Refrigeration System with classification, advantage and disadvantages. (A) Compressors (B) Condensers (C) Evaporators (E) Expansion devices 3.2 Refrigerants and lubricants: a) Classification of refrigerants b) Properties of refrigerants c) Commonly used refrigerants in practice and green refrigerants d) Detection of refrigerants leakage e) Charging the system with refrigerant f) Lubricants used in refrigeration and their properties.		
4.	Unit-4 Air conditioning. 4.1 Air conditioning: Introduction, classification and applications of Air conditioning. 4.2 Psychometric Properties of air 4.3 Psychometric chart and its use; 4.4 Psychometric processes-sensible heating and cooling, Humidifying and dehumidifying, Adiabatic saturation process. 4.5 Air conditioning units and plants. a) Desert cooler b) Window air conditioner c) Split air conditioner d) Ducts in air conditioning systems e) Air Filters in air conditioning systems 4.6 Simple numerical on Psychometric Properties of air	10	22
5.	Unit-5 Installation and Maintenance of Refrigeration and Air-conditioning units. 5.1 Tools used in refrigeration and Air conditioner installation and maintenance; 5.2 Installation of Refrigeration and Air-conditioning units. 5.3 Faults in refrigeration and air conditioning systems. 5.4 Servicing procedure of Refrigeration and Air-conditioning units.	5	10
	Total	45	100



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Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
37	38	25	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Books	Author	Publication & ISBN
1.	Thermal Engineering	P. L. Ballaney	Khanna Publishers
2.	Refrigeration and Air Conditioning	R.K.Rajput	Katson Books
3.	Refrigeration and Air Conditioning	G.F.Hundy, A.R.Trott, T.C.Weich	Elsevier
4.	Refrigeration and Air Conditioning	C.P.Arora	McGraw Hill India
5.	Refrigeration and Air Conditioning Technology	Tomczyk J. A.	Cengage

(b) Open-source software and website:

1. <https://www.ashrae.org/technical-resources/free-resources/software>
2. <https://theengineeringmindset.com/free-refrigeration-software/>
3. <https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=709&cnt=4>
4. https://swayam.gov.in/nc_details/NPTEL
5. <https://sewabharat.org/what-we-do/skills-development/>
6. <https://cursa.app/en/free-course/refrigeration-and-air-conditioning-cifeQd2bz&index=7>
7. <https://www.classcentral.com/subject/refrigeration>
8. https://nctaindia.in/courses?course_id=155
9. <https://www.danfoss.com/en-in/service-and-support/learning/cooling-learning/>

Suggested Course Practical List (Depends on available facility at institute)

1. Demonstration of vapor compression refrigeration system and determine its COP.
2. Demonstration of Electrolux refrigerator and determine its COP.



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3. Demonstration of construction and working of various types of compressors commonly used in refrigeration and air conditioning.
4. Demonstration of various types of hand tools, which are utilized in refrigeration and air conditioning and hands on practice of various operations like cutting, bending, swaging, flaring, pinching, soldering.
5. Demonstration of sling psychrometer to find out relative humidity of close room.
6. Demonstration of construction and working of double door frost free refrigerator.
7. Demonstration of construction and working of window/ split air conditioner.
8. Demonstration of evaporator coil, condenser coil and air filter cleaning during service of split air conditioner.
9. Demonstration of leak detection techniques in refrigeration and air conditioning systems.
10. Demonstration of charging refrigerant in refrigeration or air conditioning systems.

List of Laboratory/Learning Resources Required:

1. Vapor compression refrigeration test rig.
2. Vapor absorption refrigeration test rig.
3. Air conditioning Test rig.
4. Various types of hand tools for refrigeration and air conditioning
5. Models/charts of various types of compressors.
6. Different types of equipments for leak detection.
7. Models/charts of various types of evaporators of refrigeration systems.
8. Models/charts of various types of condensers of refrigeration systems.
9. Models/charts of various cooling towers.
10. Set of thermometers and pressure gauges, Sling psychrometer and vacuum pump.
11. Refrigerator (single door/ double door), Air Conditioner (window/split)
12. Suitable fire fighting equipments for premises of laboratory.



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Suggested Project List:

1. Make a Model of any heat exchanger with parallel and counter flow arrangement in a workshop with 4-6 students in a group.
2. Prepare a tabulated summary of the types of air compressors available in the market for refrigeration system. (Summary includes type, specification, rate, and applications).
3. Collect and analyze technical specifications of Reciprocating / Rotary Air Compressors from manufacturers' websites and other resources.
4. Collect technical data of major centralized air conditioning system from nearby mall/ hotel/ industry.
5. Prepare a display chart of different types of condensers along with application.
6. Prepare a display chart of different types of evaporators along with application.
7. Arrange a visit and prepare a report on nearby ice plant/ cold storage/ dairy.

Suggested Activities for Students:

1. Collect/ download product catalogues with a specification of various types of refrigerators, air conditioners, water coolers, deep freezers, etc. of recent trends.
2. List out various ways of energy loss in different refrigeration and air conditioning systems. Also, state the mode of heat transfer and methods used to prevent this energy loss.
3. Prepare a chart/presentation for routine maintenance of refrigeration and air conditioning systems.
4. Select at least three problems of domestic refrigerators and discuss its effects.
5. Prepare a chart/presentation for a selection criterion for a condenser in refrigeration field.

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