



**CVM**  
**UNIVERSITY**

Aegis: Charutar Vidya Mandal (Estd.1945)

## FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

**Programme:** Bachelor of Technology (Mechanical Engineering)

**Semester:** VI

**Course Code:** 202090604

**Course Title:** Refrigeration & Air-conditioning

**Course Group:** Professional Core Course-XIV

### Course Objectives:

1. Understand the basic concepts of refrigeration and air conditioning systems
2. Understand and analysis of various refrigeration cycles
3. Make basic calculation of psychometric properties and process
4. To design duct layout systems and describe air distribution configurations
5. Describing types of air-conditioning systems

### Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Theory		J/V/P*		Total
				Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25 / 9	25 / 9	150 / 53

\* J: Jury; V: Viva; P: Practical

### Detailed Syllabus:

Sr.	Contents	Hours
1	<b>Introduction:</b> Brief history and need of refrigeration and air conditioning, methods of producing cooling, ton of refrigeration, coefficient of performance, types and application of refrigeration and air conditioning systems	3
2	<b>Refrigerants:</b> Classification, nomenclature, desirable properties, secondary refrigerants, future industrial refrigerants	3
3	<b>Air refrigeration:</b> Reversed Carnot cycle and its limitation, Bell-Coleman cycle, aircraft refrigeration, working and analysis of Simple; Bootstrap; Reduced ambient and Regenerative air refrigeration systems	6



4	<p><b>Vapour Compression system:</b> Simple system on P-h and T-s diagrams, analysis of the simple cycle, factors affecting the performance of the cycle: effect of superheating, subcooling, drop in evaporator pressure and rise in condenser pressure, actual cycle</p> <p><b>Compound Compression System:</b> Compound compression, multiple evaporator systems and its analysis, cascade refrigeration system</p>	12
5	<p><b>Absorption refrigeration system:</b> Desirable characteristics of refrigerant, selection of pair, practical H<sub>2</sub>O -NH<sub>3</sub> cycle, LiBr – H<sub>2</sub>O system and its working, Electrolux refrigeration system ( to be covered in lab sessions)</p>	4
6	<p><b>Psychrometry:</b> Dalton's law of partial pressure, Properties of moist air, temperature and humidity measuring instruments, psychrometric chart, psychrometric processes such as sensible heating and cooling, heating and humidification cooling and dehumidification, chemical dehumidification, adiabatic saturation – plotting of the process on psychrometric chart and analysis of the same</p>	10
7	<p><b>Duct design and air distribution:</b> Function; classification and economic factors influencing duct layout, equal friction method of duct design, use of friction chart, dynamic losses and its determination, Requirements of air distribution system, air distribution, grills, outlets, application, location</p>	4
8	<p><b>Air-conditioning systems:</b> Classification, system components, all air; all water; and air-water systems, room air conditioners, packaged air conditioning plant, central air conditioning systems, split air conditioning systems</p>	3
<b>Total</b>		<b>45</b>

### List of Practicals / Tutorials:

1	To determine the co-efficient of performance (COP) of Vapor Compression refrigeration system
2	To determine theoretical COP, Carnot COP & cycle efficiency of refrigeration system
3	To evaluate & compare the effect of subcooling, superheating and underloading on performance of R-12, R717 VCR system with same evaporating and condensing temperatures
4	To perform different service operations using tools of refrigeration and to study different Charging technique.
5	To evaluate & compare the effect of multistage with flash gas removal & Flash Intercooling on the performance of R-12, R717 VCR system with same evaporating and condensing temperature
6	To determine the co-efficient of performance (COP) and cycle efficiency of the system in the summer mode and winter mode
7	To determine the Coefficient of Performance of Vapor Absorption Refrigeration System
8	To perform Sensible Heating process and to analyze the same using psychrometric chart
9	To perform Heating & Humidification process and to analyze the same using psychrometric chart
10	To perform cooling and dehumidification process and to analyze the same using psychrometric chart
11	To determine coefficient of performance of an Ice Plant
12	To design a duct system and to estimate the total power requirement for supply air fan



### Reference Books:

1	Refrigeration and Air Conditioning by C P Arora, McGraw-Hill India Publishing Ltd.
2	ASHRAE Handbook, (1) Fundamentals (2) Refrigeration
3	Refrigeration and Air-conditioning by Ramesh Arora, Prentice Hall of India
4	Refrigeration and Air Conditioning by Manohar Prasad, New Age International Publisher
5	Principles of Refrigeration by Roy. J Dossat, Pearson Education
6	Refrigeration and Air Conditioning by Jordon and Prister, Prentice Hall of India Pvt. Ltd.
7	Refrigeration and Air Conditioning by W.F. Stocker and J. W. Jones, McGraw-Hill

### Supplementary learning Material:

1	NPTEL resources
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### Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Industrial/ Field visits

### Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

### Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						R: Remembering; U: Understanding; A: Applying; N: Analyzing; E: Evaluating; C: Creating
R	U	A	N	E	C	
15%	20%	45%	10%	5%	5%	

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

### Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand basics of refrigeration, types of refrigerants, their properties, and select appropriate refrigerant for different applications	10
CO-2	Understand and analysis of various refrigeration cycles	35
CO-3	Make basic calculation of psychometric properties and process	25
CO-4	To design duct layout systems and describe air distribution configurations	20
CO-5	Describe types of air-conditioning system. and air distribution configurations.	10



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<b>Curriculum Revision:</b>	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	--
Next Review on (Month-Year):	June-2025