



**C. U. SHAH UNIVERSITY**  
**Wadhwan City**

**FACULTY OF:** - Technology and Engineering  
**DEPARTMENT OF:** - Mechanical Engineering  
**SEMESTER:** -VII  
**CODE:** - 4TE07RAC1  
**NAME:** – Refrigeration and Air Conditioning

**Teaching and Evaluation Scheme:-**

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE07RAC1	Refrigeration and Air Conditioning	3	0	2	5	4	30	1.5	70	3	---	20	30	150

**Objectives:**

- The course is designed to give fundamental knowledge of types of refrigeration, refrigeration cycles, refrigerants and behavior under various conditions, air refrigeration systems and its application in air crafts, VCR system with compound compression, different air conditioning terms with related processes, human comfort, load calculation, designing of components of air distribution system.

**Prerequisite:**

- Thermodynamics

**Course Outline:**

Sr. No.	Course Content	Hours
1	<b>Introduction:</b> Brief history and need of refrigeration, different methods of producing cooling, unit of refrigeration and its conversion in ton of refrigeration, COP, types and application of refrigeration.	02
2	<b>Refrigerants:</b> Classification, nomenclature, desirable properties, Primary and secondary refrigerants, Effect on ozone depletion potential and Global warming potential, total equivalent warming impact, Montreal and Kyoto protocol, alternate new refrigerants for different applications.	02
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, Numerical.	03
4	<b>Vapour Compression system:</b> Dry and wet compression, Simple system on P-h and T-s diagrams, analysis of the simple cycle, various factors affecting the performance of the cycle, actual cycle, Numerical. <b>Compound Compression System:</b> Compound compression with intercooler, flash gas removal and flash intercooler, multiple evaporators with back pressure valves and with multiple expansion valves without flash inter cooling, analysis of two evaporators with flash intercooler and individual expansion valve and multiple expansion valve, Numerical, cascade refrigeration system, its application to cryogenics Air liquification processes, Linde-Hampson.	10

5	<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, maximum COP, Elementary idea of refrigerant –absorbent mixtures, Temperature-concentration diagram, enthalpy-concentration diagram, its advantage, limitation and applications.	<b>05</b>
6	<b>Refrigeration system components and controls:</b> Types; construction; working; comparison and selection of compressors, condensers, expansion devices, evaporators, dryer, and fillers, refrigeration piping accessories, properties and classification of thermal insulation, flow controls, temperature controls, pressure controls, and safety devices. Defrosting systems, testing and charging of refrigeration systems, leak detection. <b>Other refrigeration Techniques:</b> vortex tube , thermo electric refrigeration, solar refrigeration.	<b>06</b>
7	<b>Psychrometry:</b> Properties of moist air, psychrometric parameter, temperature and humidity measuring instruments, psychrometric chart, various psychrometric processes, ADP, SHF, BF, Air washer and its application, numerical.	<b>04</b>
8	<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. <b>Human comfort:</b> Thermal comfort, metabolism of human body, heat balance equation for a human being, factors affecting thermal comfort, Effective temperature, comfort chart and factors governing effective temperature, ventilation requirements. <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, numerical.	<b>07</b>
9	<b>Load analysis:</b> Site survey, outdoor and indoor design conditions, classification of loads, flywheel effect of building material and its use in design, effect of wall construction on cooling load, instantaneous heat gain (IHG) and instantaneous cooling load (ICL) heat transmission through sunlit and shaded glass using tables, method of reduction of solar heat gain through glass, calculations of cooling load TETD due to sunlit and shaded roof and walls using tables, ventilation and air infiltration, load due to outside air, heat gain from occupants; electric lights; product; electric motor and appliances, RSHF, ERSHF, GSHF, ADP temperature, load calculations for Room, Theatre, Office, banks, Automobiles, etc., cooling and heating load estimation, selection of air conditioning apparatus for cooling and dehumidification , use of load estimation sheet, introduction of CLTD method, numerical.	<b>06</b>

### Learning Outcomes:

After learning the course the students should be able to:

- Understand the basic concepts of refrigeration and air conditioning systems
- Understand and analysis of various refrigeration cycles
- Make basic calculation of psychrometric properties and process
- Do basic calculations of heating and cooling load requirements of a room.
- Apply scientific and engineering principles to analyze and design aspects of engineering systems that relate to refrigeration and air conditioning.

### Books Recommended:

1. Refrigeration and Air Conditioning by **C P Arora**, McGraw-Hill India Publishing Ltd.
2. Refrigeration and Air Conditioning by **Manohar Prasad**, New Age International Publisher
3. Course in refrigeration and air-conditioning by **S C Arora & S Domkundwar** , Dhanpat Rai Publication
4. Principles of Refrigeration by **Roy. J Dossat**, Pearson Education
5. Textbook of refrigeration and air conditioning by **khurmi R.S and J. K. Gupta**, S. Chand Publication.
6. Refrigeration and air conditoning by **Ballaney P.L.**, Khanna publication.

### Reference Books:-

1. Refrigeration and Air-conditioning by **Ramesh Arora** , Prentice Hall of India
2. Refrigeration and Air Conditioning by **Jordon and Prister**, Prentice Hall of India Pvt. Ltd.
3. Refrigeration and Air Conditioning by **W.F. Stocker and J. W. Jones**, McGraw-Hill
4. Refrigeration and Air Conditioning by **Ameen Ahmadul**, PHI India
5. Automobile Air conditioning by **Crouse and Anglin**, McGraw Hill Publications