



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

**FACULTY OF:** - Technology and Engineering  
**DEPARTMENT OF:** - Automobile Engineering  
**SEMESTER:** -VII  
**CODE:** - 4TE07VRA1  
**NAME:** – Vehicle 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	
4TE07VRA1	Vehicle Refrigeration and Air Conditioning	4	0	2	6	5	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 of vehicles, air refrigeration systems and its application in vehicles, VCR system, different air conditioning terms with related processes, human comfort required in vehicles, vehicle load and its calculation, designing of components of air distribution system of vehicles, Air Routing & Temperature Control, Air Conditioning Service, Air Conditioning Control.

**Prerequisite:**

- Basic knowledge of Thermodynamics.

**Course Outline:**

Sr. No.	Course Content	Hours
1	<b>Introduction to Air conditioning &amp; Refrigeration:</b> Methods of refrigeration. vapour compression refrigeration system, vapour absorption refrigeration system, applications of refrigeration & air conditioning, Automobile air conditioning, air conditioning for passengers, isolated vehicles, Refrigerated transport vehicles, applications related with very low temperatures.	09
2	<b>Importance of Refrigerant:</b> Classification, properties, selection criteria, commonly used refrigerants, eco-friendly refrigerants, applications of refrigerants, refrigerants used in automobile air conditioning, future alternative refrigerants for vehicles.	04
3	<b>Study of Psychrometric charts:</b> Psychrometric properties, tables/charts, psychrometric terms and processes, comfort charts, factors affecting comfort, effective temperature, ventilation requirements.	08
4	<b>Air Conditioning Systems:</b> Classification, layouts, central / unitary air conditioning systems. System components like compressor, evaporator, condenser, expansion devices, Receiver dryer, fan blowers etc. Switch and electrical wiring circuit.	06
5	<b>Load Calculations &amp; Analysis:</b> Design considerations for achieving desired inside/room conditions with respect to prevailing outside/environment conditions. Factors affecting/contributing towards the load on refrigeration & air conditioning systems. Cooling & heating load calculations. Load calculations for automobiles.	09

6	<b>Air Distribution Systems:</b> Distribution ducting, sizing, supply / return ducts, type of grills, diffusers, ventilation, air noise level, layout of duct systems for automobiles and their impact on load calculations.	<b>05</b>
7	<b>Air Routing &amp; Temperature Control:</b> Objectives, evaporator air flow through Dash recirculating unit, Automatic temperature control, Duct system, Controlling flow, vacuum reserve, testing the air control and air handling systems.	<b>05</b>
8	<b>Air Conditioning diagnosis and services:</b> Initial vehicle inspection, causes of air conditioner failure, Testing of air conditioning system like temperature measurement, pressure gauge reading and cycle testing, refrigerant leak detection and detectors, Air Conditioning system diagnosis based on temperature and pressure measurements, sight glass, sound etc., Trouble shooting and Servicing of compressor, evaporator, condenser, and heater core etc. Servicing of heater system, Air conditioner maintenance & service - removing & replacing Components, Air routing system service. Refrigerant gas safety/ handling, refrigerant recovery, recycle, and charging procedure, system oil, system flushing, odor removal, retrofitting.	<b>06</b>
9	<b>Air Conditioning Control devices:</b> Common controls such as thermostats, humidistat, control dampers, pressure cut out, and relays.	<b>04</b>
10	<b>Air conditioner heating system:</b> Automotive heaters, Manually controlled air conditioner, heater system, automatic temperature control, air conditioning protection, engine protection.	<b>04</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 used in vehicles.
- Make basic calculation of psychometric properties and process
- Do basic calculations of heating and cooling load requirements of any vehicle.
- Apply scientific and engineering principles to analyze and design aspects of vehicle systems that relate to refrigeration and air conditioning.

### Books Recommended:

1. Automotive Air-Conditioning, by **Crouse & Anglin** – Mc Graw Hill Pub.
2. Fundamentals of CFD by **Anderson** McGraw-Hill, International Edition, Mechanical Engineering Series
3. Automotive Mechanic by **William H. Crouse** - Tata McGraw Hill Publishing House
4. Refrigeration and Air Conditioning by **C P Arora**, McGraw-Hill India Publishing Ltd.
5. Refrigeration and Air Conditioning by **Manohar Prasad**, New Age International Publisher
6. Course in refrigeration and air-conditioning by **S C Arora & S Domkundwar** , Dhanpat Rai Publication
7. Principles of Refrigeration by **Roy. J Dossat**, Pearson Education
8. Textbook of refrigeration and air conditioning by **khurmi R.S and J. K. Gupta**, S. Chand Publication.
9. Refrigeration and air conditoning by **Ballaney P.L.**, Khanna publication.

### Reference Books:-

1. Automotive Air-Conditioning by **Paul Weiser** – Reston Publishing Co.
2. Automatic Heating & Air Conditioning Systems by **Mitchell** Information Services.
3. Air Conditioning by **Paul Lang**, C.B.S. Publisher & Distributor, Delhi.
4. Principles of Refrigeration by **Roy J. Dossat** – Pearson Publication.
5. Automobile Engineering by **Anil Chhikara** - Satya Prakashan.
6. American Society of Heating, Refrigeration & Air Conditioning – Fundamentals, ASHRAE Handbook – 1985.