



Semester – V

Subject Name: Vehicle Air Conditioning

Subject Code: 09AE0503

Diploma branch in which subject is offered: - Automobile Engineering

Objective: The course is designed to provide the basic fundamental concept of vehicle air conditioner system and also help the students in identifying the troubles occurring in vehicle air conditioner system, its possible causes and remedies.

Credits Earned: 4

Course Outcomes:

After learning the course, the students should be able to:

- Understand different thermodynamic and heat transfer processes used in the refrigeration and air conditioning system of an automobile vehicles
- Explain various psychrometric processes related to air conditioning and heating system
- Illustrate manual and automatic air conditioning and heating system and carry out service and maintenance
- Identify and solve various faults in heating and air conditioning system

Pre-requisite of course: Elements of Mechanical Engineering

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term work	
3	0	2	4	50	30	20	25	25	150

Contents:

Sr. No.	Topics	Teaching hrs.	Weightage (%)
1	Introduction Introduction to Thermodynamic - Laws of thermodynamics, Heat Transfer - Modes of Heat Transfer: Conduction, Convection & radiation, Sensible & Latent heat, Air conditioning & Refrigeration, Applications of Refrigeration and Air conditioning, Automobile air conditioning, air conditioning for passengers, Refrigerated transport vehicles, Refrigerants, properties, applications of refrigerants, eco-friendly refrigerants	08	19



2	<p>Psychrometry Study of Psychrometric charts: Psychrometric properties, tables/charts, Psychrometric processes, comfort charts, factors affecting comfort, effective temperature, ventilation requirements.</p> <p>Air-conditioning system Principle and schematic layout of vapour compression refrigeration cycle, its working and operation of basic components such as magnetic clutch, different types of compressors, condensers, receiver drier and filter, different types of suction and expansion valves, evaporator and heat sensing tube, thermostats switch, evaporator pressure regulator, automotive air-conditioning controls.</p>	10	24
3	<p>Vehicle air-conditioning and heater systems Manually controlled air-conditioner heater systems: different types of air-conditioner heater systems, working and its operating modes, automatically controlled air-conditioning systems: Automatic temperature control system, different operating modes, different parts of automatic controlled air conditioning system, humidity control system such as humidifier and dehumidifier, automatic climate control.</p>	08	19
4	<p>Troubleshooting of heating and air-conditioner Safety in the automobile workshop: Shop safety rules, Fire prevention, Air-conditioner service safety rules Servicing heating system: Car heater system and trouble diagnosis chart Troubleshooting of the Air-conditioner system: Checking out a trouble, Air-conditioner trouble - diagnosis chart Checking the refrigeration system: Checking system with sight glass, Using the Leak detector, Checking pressures with the gauge set Causes of Air-conditioner failure</p>	08	19
5	<p>Servicing and maintenance of vehicle air conditioning systems Types of maintenance, vacuum pump service, discharging the system, adding and changing oil, Evacuating the air conditioning system, Liquid and vapour charging methods, use of recovery recharging unit, air-conditioner services such as removing/replacing components like O-rings, hose clamps, compressor drive belts, compressor, etc. Servicing Air-conditioner compressors</p>	08	19



References:

1. Heat & Mass Transfer by R.K. Rajput, S. Chand & Co. New Delhi.
2. Engineering Thermodynamics by R. K. Rajput, EVSS Thermo Laxmi Publications
3. Refrigeration and Air Conditioning by C P Arora, McGraw-Hill India Publishing Ltd.
4. A textbook of Refrigeration & Air-conditioning by R. S. Khurmi, S. Chand Publications
5. Automobile Engineering (Volume IV) by Anil Chhikara, Satya Prakashan
6. Automotive Air-conditioning by William H. Carouse & Donald L. Anglin, Tata McGraw-Hill Co., Ltd., New Delhi
7. Automotive Air-conditioning by Clifford L.Samuels, Prentice Hall International
8. Automotive Air-conditioning & Climate control system by Steven Daly, Butterworth-Heinemann

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
20%	42%	38%	0	0	0

List of Experiments:

1. To understand different components of VCR system and to determine its performance
2. To perform different psychrometric processes and analyze the same using psychrometric chart.
3. To determine the performance of heat pump
4. To perform recharging of air conditioning system
5. To perform evacuation of the air-conditioner system
6. To determine the thermal conductivity of the given material
7. To determine heat transfer co-efficient of the given material by natural convection
8. Trouble shooting of the air-conditioner system
9. To carry out service of air-conditioner, heating systems & air-conditioner compressors

Instructional Method:

1. Case studies of typical maintenance/installation problems in ACs for different makes of automobiles and problem-based learning
2. Arrange expert lectures of executives of different vehicle ACs companies



3. Visit of authorized workshop of four wheelers.
4. Collection of animation or video clips and presentation using same.
5. Internet based assignments, teacher guided self-learning activities, course/library/internet/lab based mini-projects etc.