FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

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

Semester: **VI**

Course Code: **202010605**

Course Title: **Automotive Air Conditioning**

Course Group: **Professional Elective Course-II**

Course Objectives: This course imparts the fundamental knowledge of Refrigeration and Air conditioning systems. The course is designed to give fundamental knowledge of types of refrigeration, refrigeration cycles, refrigerants and behavior under various conditions, different air conditioning terms and load calculation, designing of components of air distribution system. To understand the concept of air conditioning system and its working principle used in automobiles and to apply these concepts for repair and maintenance.

Teaching & Examination Scheme:

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

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

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction & Automotive Applications:** Methods of refrigeration, vapour compression refrigeration system, vapour absorption refrigeration system, desirable characteristics of refrigerant, selection of pair, practical H_2O-NH_3 cycle, LiBr-H_2O system & it's working, Electrolux refrigeration system, applications of refrigeration & air conditioning, automobile air conditioning, air conditioning for passengers, isolated vehicles and Refrigerated transport vehicles, difference between stationary and mobility applications, conventional and non-conventional vehicle applications.	06

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2	**Refrigerants:** Classification, nomenclature, desirable properties, selection criteria, commonly used refrigerants, alternative refrigerants, eco-friendly refrigerants, applications of refrigerants and refrigerants used in automobile air conditioning.	**03**
3	**Psychometric charts:** Dalton's law of partial pressure, properties of moist air, temperature & humidity measuring instruments, psychometric chart, psychometric processes such as sensible heating & cooling, heating & humidification, cooling & dehumidification, chemical dehumidification and adiabatic saturation.	**06**
4	**Air Conditioning systems:** Classification & layouts, system components, room air conditioners, packaged air conditioning plant, central air conditioning systems, central/unitary air conditioning systems and split air conditioning systems.	**08**
5	**Load Calculations & Analysis:** 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 and effect of air conditioning load on engine performance in terms of loss of available peak torque/power and fuel consumption.	**07**
6	**Air Distribution Systems:** 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. **Air Conditioning Control:** Common controls such as thermostats, humidistat, control dampers, pressure cutouts and relays.	**06**
7	**Human comfort:** Selection of inside design conditions, thermal comfort, heat balance equation for a human being, factors affecting thermal comfort, effective temperature, comfort chart &factors governing effective temperature and selection of outside design conditions.	**04**

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8	**Vehicle Air Conditioning Service & Maintenance:** Air conditioner maintenance & service - removing & replacing Components. Compressor service, testing, diagnosis & trouble shooting of air conditioning system, refrigerant gas charging procedure and servicing of heater system.	**05**

List of Practicals / Tutorials:

1	Performance of VCR system.
2	Performance of VAR system.
3	To understand different types of refrigerant used in automotive air conditioning systems.
4	Performance on Ice plant.
5	Demonstration of air conditioning recovery Unit.
6	Performance test on air conditioning tutor for studying the sensible heat process.
7	Performance test on air conditioning tutor for studying the cooling and dehumidification process.
8	Performance test on air conditioning tutor for studying the cooling and dehumidification process.
9	Demonstration of various tools used for refrigeration tubing and to perform various operations like flaring, swaging, bending, brazing etc.
10	Demonstration of window and split air conditioner.

Reference Books:

1	Refrigeration and Air Conditioning by C P Arora, McGraw-Hill India Publishing Ltd.
2	Refrigeration and Air-conditioning by Ramesh Arora, Prentice Hall of India
3	Refrigeration and Air Conditioning by Manohar Prasad, New Age International Publisher
4	Principles of Refrigeration by Roy. J Dossat, Pearson Education
5	Refrigeration and Air Conditioning by Jordon and Prister, Prentice Hall of India Pvt. Ltd.
6	Refrigeration and Air Conditioning by W.F. Stocker and J. W. Jones, McGraw-Hill
7	Refrigeration and Air Conditioning by Ameen Ahmadul, PHI India
8	Automobile Air conditioning by Crouse and Anglin, McGraw Hill Publications
9	Automotive Air-Conditioning by Paul Weiser, Reston Publishing Co.
10	Automobile Engineering Volume VI Air Conditioning by Anil Chhikara, Satya Prakashan

Supplementary learning Material:	
1	NPTEL Resources

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Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment

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						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
20	20	25	15	15	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 the basic concepts, applications, service and maintenance of refrigeration and air conditioning.	**20**
CO-2	Understand the types of refrigerants and psychrometric chart.	**20**
CO-3	Understand types of air conditioning systems.	**20**
CO-4	Understand analysis and load calculation of air conditioning systems.	**20**
CO-5	Understand air conditioning control and human comfort.	**20**

Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2027

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