

<b>Devi Ahilya University, Indore, India</b>				<b>IV Year B.E. (Mechanical Engg.)</b>			
<b>Institute of Engineering &amp; Technology</b>				<b>(Full Time)</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>7MERC3</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
<b>REFRIGERATION AND AIR-CONDITIONING</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>5</b>
<b>Duration of Theory Paper:</b>							
<b>3 Hours</b>							

**Course Objectives:**

1. Realise the importance of science of Refrigeration and Air-Conditioning.
2. Understand the different Refrigeration and Air-Conditioning systems.
3. Able to apply the learning outcomes of prerequisites for design and selection of Refrigeration and Air-Conditioning systems for specific applications.
4. Learn latest trends in Refrigeration and Air-Conditioning.

**Prerequisite(s):** Applied Mathematics I/II/III/IV, Engineering Thermodynamics, Fluid Mechanics, Thermal Engineering, Heat Transfer.

**COURSE CONTENTS**

**UNIT -I**

**Introduction and Air Refrigeration Systems:** Introduction: Review of reversed Carnot Cycle, Coefficient of Performance, Types of Refrigeration Systems, Bell-Coleman cycle, Air-Refrigeration Cycles, systems for aircraft, Boot-strap type and simple evaporative systems, Applications of refrigeration systems

**UNIT -II**

**Vapour Compression Refrigeration (VCR) Systems:** Thermodynamic Cycle, T-s and P-h diagrams, Components and types: Compressor, Condenser, Expansion device and Evaporator, Analysis, effect of under-cooling and suction superheat, Limitations of VCR systems; Refrigerants: Classification, Properties and nomenclature, primary and secondary refrigerants, eco-friendly Refrigerants.

**UNIT-III**

**Unconventional Refrigeration Systems and Future Trends:** Vapor Absorption Systems: absorption cycle, Lithium-bromide system, heat-exchangers, analyzer and diffusers; The Electrolux system; Steam-Jet Refrigeration, Thermo-Electric Refrigeration. Low-temperature refrigeration: Cascade systems, Joule-Thompson effect, liquefaction of gases, application areas.

**UNIT -IV**

**Psychrometry and Load Estimation:** Psychrometry: Psychrometers, Terminology, Psychrometric Chart, Psychrometric properties and Processes, Apparatus Dew Point (ADP), By-pass factor; Thermal Comfort: metabolism and heat exchange by the human body, comfort charts, Current ASHRAE Standards; Air-conditioning Load Estimation: Heat Transfer fundamentals; Cooling and heating load estimation, Heat transfer across the building envelope, thermal insulation; Solar Heat Gain, ventilation and infiltration. Sensible heat factors: Room Sensible Heat Gain Factor (RSHF), Grand Sensible Heat Gain Factor (GSHF) Effective Room Sensible Heat Gain Factor (ERSHF) lines

**UNIT -V:**

**Air Conditioning Systems:** Air conditioning Systems: Basic Components, Types and selection, Air Systems, Water Systems, Room Air Conditioners – Window Type, Package Type, Split Type, Central Units. Air Supply Systems: Fans and Blowers, performance characteristics, heating and cooling coils, Flow through Ducts, Losses, Duct Design Methods. Air Distribution and control Devices.

**Note:** Refrigerant tables, Refrigeration and Air-conditioning Data Book and certified data tables are allowed in the examination hall.

**Course Outcomes:**

Upon Completing the Course, Student will able to:

1. Understand the design and working principles of Refrigeration and Air-Conditioning systems.
2. Select Refrigeration and Air-Conditioning system components.
3. Learn advance subjects of Refrigeration and Air-Conditioning .
4. Industry ready for Refrigeration and Air-Conditioning industry.

**BOOKS RECOMMENDED**

- [1] Stoeker and Jones, Refrigeration and Air-conditioning, McGraw-Hill Co, 2008.
- [2] Arora C.P., Refrigeration and Air-conditioning, TataMcGraw Hill, 2008.
- [3] Prasad M, Refrigeration and Air-conditioning. New Age Publishers, 9e, 2008.
- [4] Ameen Ahmadul, Refrigeration and AirConditioning, Prentice-Hall of India, 2006.
- [5] Arora R. C., Refrigeration and Air-conditioning, TataMcGraw Hill, 2008.

**LIST OF PRACTICAL ASSIGNMENT**

1. To find the coefficient of performance of Vapour compression Refrigeration (VCR) system.
2. To find the Refrigeration effect of Vapour compression Refrigeration (VCR) system.
3. To find coefficient of performance of Air-conditioner Trainer system.
4. To find Refrigeration effect of Air-conditioner Trainer system.
5. To find various psychrometric properties of Air.
6. To find the Refrigeration effect of Vapour Absorption Refrigeration (VAR) system.
7. Estimate cooling load of a building envelop.
8. To prove the relation between the coefficient of performance of a Heat Pump and a Refrigerator.

**Course Objectives:**

1. Realise the importance of science of Refrigeration and Air-Conditioning.
2. Understand the different Refrigeration and Air-Conditioning systems.
3. Able to apply the learning outcomes of prerequisites for design and selection of Refrigeration and Air-Conditioning systems for specific applications.
4. Learn latest trends in Refrigeration and Air-Conditioning.

**Course Outcome:**

Students earned credits will develop ability to

CO. No.	CO	PO
CO1	Understand the design and working principles of Refrigeration and Air-Conditioning systems.	PO1, PO3, PO7
CO2	Select Refrigeration and Air-Conditioning system components.	PO1, PO2, PO3, PO7
CO3	Learn advance subjects of Refrigeration and Air-Conditioning .	PO1, PO2, PO4, PO5
CO4	Industry ready for Refrigeration and Air-Conditioning industry.	PO1, PO5, PO11, PO12
CO5		

**CO-PO Relationship**

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3		3				3					
CO2	3	3	3				3					
CO3	3	3		3	3							
CO4	3				3						2	2
CO5												

\* CO (rows) mention nil/very small/insignificant contribution to the PO(column)

1 → relevant and small significance    2 → medium or moderate    and    3 →strong