Course Type	Course Code	Name of Course	L	T	P	Credit
OE	MEO302	Refrigeration & Air conditioning	3	0	0	9

Course Objective

- Refrigeration deals with cooling of bodies or fluids to temperatures lower than those of surroundings and air-conditioning is one of the major applications of refrigeration. Air-conditioning has made the living conditions more comfortable, hygienic and healthy in offices, work places etc.
- This course has been designed to make the students conversant with the fundamental as well as advanced cycles such as air cycles/ heat operated cycles for refrigeration.

Learning Outcomes

Upon successful completion of this course, students will:

- be able to know the difference between refrigeration and cooling and the various applications of refrigeration .
- be able to understand the fundamentals of various advanced thermodynamic cycles related to air refrigeration , vapor compression as well as vapor absorption refrigeration systems.
- be able to know the need of multi pressure and multi evaporator systems and also be able to analyze and design the same.
- be able to know the important properties of an ideal refrigerant and be capable of choosing suitable refrigerant for particular refrigeration unit depending on its thermo-physical properties and the environmental effects.
- be able to estimate the cooling and heating load and design of various refrigeration and air conditioning systems for comfort and industrial applications.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Introduction and Review:** Brief history, definition, applications and unit of refrigeration, heat engine, heat pump and refrigerator, methods for producing low temperature.	4	This unit will make the student understand the basic need of refrigeration and different methods to produce low temperature.
2	**Gas Cycle Refrigeration:** Air cycle refrigeration systems, cold air standard assumptions, Limitation of Carnot cycle, Ideal and actual reversed Brayton Cycle, Aircraft cooling- necessity and different methods, Performance, Merits and limitations	6	This unit will help the students to understand and analyze the simple air refrigeration cycle and its modifications with reference to application in aircraft.
3	**Vapor Compression Systems:** Vapour as a refrigerant in a reversed Carnot cycle, Analysis of simple vapour compression refrigeration cycle and its modifications, T-s, p-v and p-h plot, superheat and throttling losses, effect of superheating and sub-cooling, use of liquid suction heat exchanger. actual vapour compression cycle	6	This unit will make the student conversant with simple VCRS and its modifications. Effects of various operating and design parameter on system performance will be expounded.
4	**Multi-Pressure Systems:** Multi-Stage Compression Systems, Removal of flash gas, inter-cooling, sub-cooling multi-evaporative systems, cascade systems.	6	Upon successful completion of this chapter student will know the need of multi pressure and multi evaporator systems, and will be able to analyze such systems.
5	**Vapor Absorption Systems:** Principle of Vapour absorption systems, Li-Br & NH_3-H_2O system. and Electrolux refrigeration system, Comparison of vapor compression and absorption system	5	This chapter will help the student understand the fundamental principles of vapor absorption systems, its advantages and disadvantages.

6	**Refrigerants:** Primary and secondary refrigerants, Designation, comparative study of Refrigerants and their selection, chemical and physical requirements, substitute of refrigerants, leak detection. ODP and GWP	5	Upon successful completion of this chapter student will be able to know the important properties of an ideal refrigerant and accordingly he/she can decide the refrigerant for any system.
7	**Psychrometry:** Psychrometric properties, relations and chart, Psychometric processes, Summer and winter air-conditioning systems, requirement of comfort air conditioning, comfort chart.	5	This chapter will make the students conversant with various psychrometric property and processes.
8	**Design of Air-Conditioning Systems:** Cooling load and heating load calculations, Different heat sources, Various air-conditioning systems, their advantages and drawbacks.	5	Upon successful completion of this chapter student will be able to calculate cooling load and heating load any building.

Text Book:

1. R. C. Arora: Refrigeration and Air Conditioning, PHI, 2nd Edition, 2012.

References:

2. C. P. Arora, Refrigeration and air conditioning, Tata McGraw-Hill, 3rd edition 2010.
3. Wilbert F. Stoecker and Jerold W. Jones, Refrigeration and air conditioning, McGraw-Hill Inc., US, 2nd Revised Edition, 1982.
4. Roy J. Dossat and Thomas J. Horan, Principles of refrigeration, Pearson, 5th Edition, 2001.
5. Manohar Prasad, Refrigeration and Air Conditioning, New Age International, Revised 2nd Edition, 2009.
6. Anantha Narayana, Refrigeration & Air Conditioni