REFRIGERATION AND AIR CONDITIONING

(Elective – IV)

Course Code:13ME1151

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Pre requisites: Thermodynamics and Heat Transfer

Course Educational Objectives:

To enable the student

- ✤ Understand the principles of refrigeration and air conditioning.
- ✤ Calculate the cooling load for different applications.
- ✤ Select the suitable equipment for a particular application.
- ✤ Design and implement refrigeration and air conditioning systems using standards.

Course Outcomes:

The student will be able to

- ✤ Differentiate between various refrigeration systems
- ✤ Apply refrigeration and air conditioning principles
- ✤ Design refrigeration and air conditioning systems

UNIT-I **(10 Lectures)**

REVIEW ON REFRIGERATION:

Methods of refrigeration-refrigeration by expansion of air-refrigeration by throttling of gas-vapor refrigeration system-steam jet refrigeration system-unit of refrigeration and cop –mechanical refrigeration – types of ideal cycles of refrigeration.

AIR REFRIGERATION:

Bell-Coleman cycle and Brayton Cycle, open and dense air systems – actual air refrigeration system problems – air craft refrigeration -simple,

bootstrap, regenerative and reduced ambient systems – problems based on different systems.

UNIT-II (16 Lectures)

REFRIGERANTS: TYPES, PROPERTIES AND SELECTION

REFRIGERATION SYSTEM COMPONENTS:

Compressors – general classification – comparison – advantages and disadvantages. Condensers and Cooling towers – classification – working principles evaporators – classification – working principles expansion devices – types – working principles.

VAPOR COMPRESSION REFRIGERATION:

Working principle and essential components of the plant – simple Vapor compression refrigeration cycle – COP – representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – methods to improve the COP – Use of p-h charts – numerical Problems.

UNIT-III (10 Lectures)

VAPOR ABSORPTION SYSTEM:

Calculation of max COP – description and working of NH3 – water system and Li Br –water (Two shell & Four shell) System. Principle of operation, three Fluid absorption systems (Domestic Electrolux Refrigerator).

STEAM JET REFRIGERATION SYSTEM:

Working principle and basic components, advantages and disadvantages.

Non conventional refrigeration systems: Thermoelectric refrigerator – Vortex tube or Hilsch tube.

UNIT-IV (12 Lectures)

AIR CONDITIONING:

Psychrometric properties -air conditioning processes- need for ventilation, consideration of infiltration – load concepts of RSHF, GSHF- Problems, concept of ESHF and ADP. Requirements of human comfort and concept of effective temperature- comfort chart –comfort air conditioning – requirements of industrial air conditioning, air conditioning load calculations.

UNIT-V (12 Lectures)

Air conditioning systems: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers fans and blowers.

Heat pump – heat sources – different heat pump circuits.

Design of air conditioning systems: Cooling load calculations-Bypass Factor (BF)-Effective Sensible Heat Factor (ESHF)-cooling coils & Dehumidifying Air Washers.

TEXT BOOK:

Arora, S.C. and Domkundwar, *"A Course in Refrigeration and Air conditioning"*, Dhanpatrai, 8th Edition, 2012.

REFERENCES :

1. Arora, C.P., *"Refrigeration and Air Conditioning"*, TMH, 3rd Edition, 2011.
2. Manohar Prasad., *"Refrigeration and Air Conditioning"*, New Age International Ltd., 2nd Edition. 2006.
3. Ananthanarayanan, *"Basic Refrigeration and Air-Conditioning"*, TMH, 3rd Edition, 2012.