

REFRIGERATION AND AIR CONDITIONING

(Elective – IV)

Course Code:13ME1151

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Pre requisites: Thermodynamics and Heat Transfer

Course Outcomes:

At the end of the course, the student will be able to

- CO 1** Explain different refrigeration systems, refrigeration cycles, and air refrigeration systems.
- CO 2** Explain different refrigerants, refrigeration components and analyze simple vapor compression refrigeration systems.
- CO 3** Explain different vapor absorption, steam jet and non-conventional refrigeration systems.
- CO 4** Outline psychrometric properties, explain comfort air conditioning.
- CO 5** Design air conditioning systems and discuss heat pump.

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, GSHP- 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. (Simple problems).

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.

