REFRIGERATION AND AIR-CONDITIONING
(Elective – I)

Course Code: 13ME2305

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Pre- requisites: Thermodynamics and Heat transfer

Course Educational Objectives:

To enable the student

1. understand the principles of refrigeration and air conditioning.
2. calculate the cooling load for different applications.
3. select the suitable equipment for a particular application.
4. design and implement refrigeration and air conditioning systems using standards.

Course Outcomes:

The student will be able to

1. differentiate between various refrigeration systems
2. apply refrigeration and air conditioning principles
3. design refrigeration systems
4. design air conditioning systems

UNIT – I

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.

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.

UNIT-II

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 – wet versus dry compression.

Multi-evaporator and compressors -methods of improving COP, sub-cooler heat exchanger, optimum inter stage pressure for two stage refrigeration system –single load systems-multi load systems with single compressor-multiple evaporator and compressor system - dry ice system-cascade systems.

Vapor absorption system – simple absorption system –practical ammonia absorption system – Electrolux Refrigerator- comparison of VARS COP with Carnot COP- Domestic Electrolux Refrigerator-Lithium–Bromide system-actual analysis of ammonia absorption system-advantages of VARS over VCRS.

UNIT-III

Steam jet refrigeration system - analysis-components of plant-advantages, limitations and applications –performance.

Non-conventional refrigeration systems - thermoelectric refrigerator - Vortex tube or Hilsch tube

Methods of defrosting - automatic periodic defrosting–solid absorbent system- water defrosting-defrosting by reversing cycle-automatic hot gas defrosting-thermo bank defrosting-electric defrosting -electric air switch defrosting system-two outdoor unit system-multiple evaporators defrosting system.

Applications: Food processing and storage by refrigeration.

UNIT-IV

Air-conditioning- psychometric properties-psychrometric processes-summer air-conditioning systems-winter air conditioning systems-year around air –conditioning-requirements of comfort air-conditioning-thermodynamics of human body- comfort chart-design considerations-need for ventilation.

Air conditioning systems -classification of equipment - filters, grills and registers, fans and blowers, humidifiers, dehumidifiers-central station air-conditioning system-unitary air-conditioning system-self-contained air-conditioning units.

UNIT-V

Design of air conditioning systems -cooling load calculations - different heat sources-bypass factor (BF) - effective sensible heat factor (ESHF) - cooling coils and dehumidifying air washers.

TEXT BOOK:

1. S.C. Arora and S. Domkundwar, "*A Course in Refrigeration and Air Conditioning"*, 8th Edition, DhanpatRai & Co., 2012.

REFERENCES:

1. C.P.Arora, "*Refrigeration and Air Conditioning"*, 2nd Edition, Tata McGraw-Hill, 2008.

2. W.P. Stoeker, "*Refrigeration and Air Conditioning"*, Tata McGraw-Hill, 1989.

3. R.J. Dossat, "*Principles of Refrigeration"*, John Willey and sons, John Wiley (SI Version), 1989.