REFRIGERATION AND AIR CONDITIONING

Course Code	20ME4501E	Year	III	Semester	I
Course Category	Professional Elective-I	Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Pre-requisites	Basic Thermodynamics Advanced Thermodynamics
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes: Upon successful completion of the course, the student will be able to

CO	Statement	Skill	Blooms	Units
CO1	Understand the basic concepts of Refrigeration and Air Conditioning	Understand	L2	1,2,3,4,5
CO2	Apply the basic concepts on solving problems of various Refrigeration systems	Apply	L3	2,3
CO3	Analyze various Air conditioning systems	Analyze	L4	4,5

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: High, 2: Medium, 1: Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						2				3	1	3	1
CO2	2	2					2				2	1	3	1
CO3	2	3					2				2	1	3	1

Syllabus

UNIT	Contents	Mapped CO
I	**INTRODUCTION TO REFRIGERATION:** Necessity of refrigeration and air conditioning, applications, unit of refrigeration Refrigeration: Carnot cycle, Bell Coleman cycle and Brayton Cycle, Open and Dense air systems, Actual air refrigeration system –numerical problems. Refrigeration needs of aircraft's, methods of air refrigeration systems	CO1
II	**VAPOUR COMPRESSION REFRIGERATION SYSTEM:** Cycles and performance Simple Vapour compression refrigeration cycle -working principle, essential components, COP, representation of cycle on T–S and p-h charts, effect of sub cooling and super heating– cycle analysis. Actual cycle, Influence of various parameters on system performance - numerical Problems Components Compressors – classification –single stage reciprocating compressors-Working Principle, work done with and without clearance volume, capacity control. Condensers –classification– Working of evaporative condensers Evaporators– classification–Working of flooded and dry expansion evaporators Expansion devices–Types–capillary tube, automatic expansion valve, thermostatic expansion valve. Refrigerants: Desirable properties– classification refrigerants	CO1, CO2
III	**PERFORMANCE OF VAPOR ABSORPTION REFRIGERATION SYSTEM:** Calculation of max COP, description and working of NH3–water system and Li Br–water (Two shell & Four shell) System. Principle of operation of three fluid absorption system, salient features. Steam jet refrigeration system: Working Principle and Basic Components Nonconventional refrigeration methods: Principle and operation f(i)	CO1, CO2

	Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.	
IV	**INTRODUCTION TO AIR CONDITIONING:** Psychometric Properties & Processes–Characterization of Sensible and latent heat loads. Need for Ventilation, Consideration of Infiltration, Load concepts of RSHF, GSHF, ESHF and ADP	**CO1, CO3**
V	**HUMAN COMFORT AND LOAD CALCULATIONS** Requirements of human comfort and concept of effective temperature-Comfort chart– Com fort Air conditioning –Requirements of Industrial air-conditioning, Air-conditioning Load Calculations. 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	**CO1, CO3**

Learning Resource
Text books:
1. A Course in Refrigeration and Air conditioning / SC Arora & Domkundwar / Dhanpatrai 2. Refrigeration and Air Conditioning / CP Arora / TMH.
Reference books
1. Refrigeration and Air Conditioning by R K Rajput, S K kataria & sons, 2010. 2. Refrigeration and Air Conditioning / Manohar Prasad / New Age. 3. Principles of Refrigeration, by Dossat ,Prentice Hall,1997. 4. Refrigeration and air conditioning, by Stoecker , Mc Graw hill Edu.,2004. 5. Basic refrigeration and air conditioning/PN Ananthanarayanan/Mc Graw hill education.
e- Resources & other digital material
1. https://nptel.ac.in/courses/112/105/112105129/ 2. https://nptel.ac.in/courses/112/107/112107208/ 3. https://nptel.ac.in/courses/112/105/112105128/
Data Books
1. Refrigeration and Air conditioning Data book, CP Kothandaraman /New age publishers. 2. Refrigeration and Air conditioning Data book-Domakundwar & Domakundwar / Dhanpathi rai &Co