

Branch Name:	Mechanical Engineering
Program Code:	ET101
Course Name:	Refrigeration and Air-Conditioning
Course Code:	2ET1010602T
Pre-requisite Course:	Engineering Thermodynamics, Fluid Mechanics and Heat Transfer

Course Objectives:

1. To familiarize with the terminology associated with refrigeration systems and air conditioning.
2. To understand the basic refrigeration processes.
3. To understand the basics of Psychrometry and practice of applied psychrometrics.
4. To acquire the skills required to model, analyze and design different refrigeration as well as air - conditioning processes and components.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
03	03	-	-	03	24	60	16	40	-	-	-	-	100

Subject Contents

Sr. No.	Topic	Total Hours	Weightage (%)
1.	Introduction: Basic Definitions of Refrigeration and Air-Conditioning; History of Refrigeration; Natural and Artificial Refrigeration Methods; Techniques to produce low temperatures; Applications of Refrigeration; Refrigerants- Classification, Nomenclature, Desirable Properties, Selection.	4	10
2.	Air Refrigeration: Air Refrigeration Cycles - reversed Carnot cycle; Bell-Coleman cycle analysis; various methods of Aircraft Refrigeration: Analysis, Merits and demerits.	4	10
3.	Vapor Compression Refrigeration System: Ideal VCR cycle (Working, Analysis and Limitations); Standard VCRS (Working and Analysis); Methods to improve performance of VCR; Multi-Stage VCRS; Cascade Refrigeration.	10	20
4.	Components of Refrigeration Systems: Compressors: Positive Displacement (Reciprocating and Rotary); Dynamic (Centrifugal and Axial) Compressors; Condensers and Evaporators (Both Natural and Forced Convection type); Expansion Devices and other components of the system.	4	10
5.	Vapor Absorption Refrigeration Systems: Working and Analysis; Absorbent - Refrigerant combinations; Water Ammonia	4	10

	Systems; Water-Lithium Bromide System; Modified Version of Aqua-Ammonia System with Rectifier and Analyzer Assembly.		
6.	Other Refrigeration Systems: Brief Discussion on (i) Steam-Jet refrigeration system; (ii) Vortex tube refrigeration; (iii) Thermoelectric refrigeration system; and (iv) Magnetic refrigeration.	2	5
7.	Psychrometry: Classification of Air-Conditioning Systems; ASHRAE Nomenclature; Applications of Air-Conditioning; Psychrometry - Air-water vapor mixtures; Psychrometric Properties; Psychrometric or Air-Conditioning processes; Psychrometric Chart.	8	20
8.	Air-Conditioning Systems: Classification of Air-Conditioning Systems; Psychrometry of Air Conditioning Systems; Thermal Comfort (Definition and Psychrometric Properties for Thermal Comfort); Mathematical Analysis of Air-Conditioning Systems; Cooling and Heating Load Estimation; a brief discussion on Ventilation.	4	15

Reference Books:

1. Singh, Sadhu., Refrigeration and Air-conditioning, Khanna Book Publishing Edition, 2021.
2. Monohar Prasad, Refrigeration and Air-conditioning, New Age Publishers, New Delhi, 2021.
3. Domkundwar, Refrigeration and Air-conditioning, Dhanpat Rai., 2018.
4. Gosney, W.B, Principles of Refrigeration, Cambridge University Press, 1982.
5. Stoecker, W.F. and Jones, J.W., Refrigeration and Air-conditioning, Tata McGraw Hill, 1986.
6. Arora, C.P., Refrigeration and Air-conditioning, Tata McGraw Hill, 2nd Edition, 2000.
7. Roy J. Dossat, Thomas J. Horan, Principles of Refrigeration, Pearson; 5th edition, 2001.
8. Kuehn, T.H., Ramsey, J.W. and Threlkeld, J.L., Thermal Environmental Engineering, 3rd Edition, Prentice Hall, 1998.
9. Rajput R. K., “Refrigeration and Air-conditioning”, S. K. Kataria & Sons., 2013.

E-Resources:

1. <https://nptel.ac.in/courses/112105128/>
2. <https://nptel.ac.in/courses/112107208/>
3. https://onlinecourses.nptel.ac.in/noc22_me135/preview

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Define basic concepts and terminology of refrigeration and air-conditioning.	1 Remembering
CLO2	Explain air refrigeration cycles and their applications.	2 Understanding
CLO3	Analyze vapor compression systems and performance improvement methods.	4 Analyze
CLO4	Identify components of refrigeration systems and their functions.	2 Understanding
CLO5	Compare different refrigeration methods and evaluate their suitability.	5 Evaluating
CLO6	Apply psychrometric principles to design basic air-conditioning systems.	3 Applying

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1	M											L	M	
CLO2		H	M											
CLO3	L					H	M	L					L	
CLO4		H	M		M									M
CLO5	M	M		L									L	
CLO6			M	L										H

H: High, M: Medium, L: Low