Lok Jagruti Kendra University
University with a Difference

Diploma in Mechanical Engineering

LJ Polytechnic

Course Code: 025060503

Refrigeration Systems

Programme / Branch Name			Diploma in Mechanical Engineering			
Course Name	Refrigeration Systems				**Course Code**	025060503
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week				**Evaluation Scheme**			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**TOTAL**
3	0	2	4	50	50	50	150

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisites

- ✓ Physics
- ✓ Thermodynamics
- ✓ Fluid Mechanics & Machines
- ✓ Basic Mathematics

3. Rationale

Basic understanding of refrigeration, refrigeration methods used in industry, and calculation of refrigeration capacity by using charts and tables. To acquire knowledge about refrigerants and instruments used in industry. To also impart knowledge about low-temperature applications, and methods of defrosting. To understand the basics of Psychrometry, Psychrometric processes, and human comforts. To acquire knowledge about cooling load calculations, duct design, and process calculation using a psychrometric chart.

4. Objectives

- ✓ Explain the working and construction features of Refrigeration and Air Conditioning systems
- ✓ Draw and interpret various Refrigeration Cycles & Calculate the heating and cooling load requirements of a room.
- ✓ Explain the latest developments in the field of refrigeration and air conditioning.
- ✓ Calculate the properties of air by using a Psychometric Chart.
- ✓ Detect faults in an Air-Conditioner/Refrigerator.
- ✓ Work on multi-disciplinary projects to enhance skills, make effective oral presentations, and prepare technical documents effectively. Possess knowledge of modern technological concepts, conduct in-depth studies and experiments, and apply specialized expertise practically.

5. Contents

Unit No.	Topics	Sub-Topics	Learning Outcome	% Weightage	Hours
1	**Introduction**	1.1. Introduction 1.2. Classification 1.3. Important Terms 1.4. Unit of Refrigeration and COP 1.5. Air Conditioning 1.6. Applications of Refrigeration. 1.7. Applications of Air Conditioning 1.8. Classification of Refrigeration System.	• To learn about Refrigeration and Air Conditioning. • To understand about application of it. • To understand of the unit of refrigeration.	15	6
2	**Refrigerant**	2.1. Introduction 2.2. Primary Refrigerant 2.3. Secondary Refrigerant 2.4. Classification of Refrigerant 2.5. Numbering System for Refrigerant 2.6. Properties of Refrigerant 2.7. Environmental Impacts of Refrigerant 2.8. Global Warming Impacts	• To learn about primary and secondary refrigerant. • To understand basic properties of refrigerant. • To aware of globally impact of refrigerant.	15	6
3	**Refrigeration System**	3.1. Introduction of Refrigeration System 3.2. Air Refrigeration System 3.2.1 Types of Refrigeration 3.2.2 Simple Air Cycle Refrigeration 3.2.3 Need for Refrigeration in Aircraft 3.2.4 Classification of Aircraft Refrigeration System (Simple, bootstrap, Regenerative, Reduce Ambient Air System) 3.2.5 Advantages of Air Cycle for Cooling in Aircraft. 3.2.6 Examples	• To understand about air cycle, VCRS and ACS • To understand how refrigerator and air condition works on these cycles. • To learn about the basic component of the system which help to understand well.	30	14

		3.3. Vapour Compression System. 3.3.1 Vapour Compression Cycle 3.3.2 P-h and T-s Diagram 3.3.3 Analysis of Vapour Compression Cycle 3.3.4 Components of VCR (Compressor, Condenser, Evaporator, Flow Control Device, Cooling Tower) 3.3.5 Examples 3.4. Vapour Absorption System. 3.4.1 Vapour Absorption Cycle working principle 3.4.2 Advantages, Disadvantages and Application of VAS 3.5. Comparison of VCRS and VAS.			
4	**Applied Psychrometry & Heat Load Calculation**	4.1. Introduction 4.2. Important Terms 4.3. Psychrometric Properties 4.4. Psychrometric Chart 4.5. Psychrometric Processes 4.6. Psychrometry 4.7. Heating and Cooling Load Calculation 4.8. Comfort Zone of Human 4.9. Examples	• To understand of properties of Psychrometric. • To learn about psychrometric processes which help to know about humidity, cooking and heating effect. • To learn about calculation of load.	15	6
5	**Air Conditioning System**	5.1. Introduction 5.2. Classification of System 5.3. Components of System 5.4. Window Air Conditioning System 5.5. Split Air Conditioning System 5.6. Central Air Conditioning System 5.7. Air Cooler 5.8. Difference between Air Conditioning and Air Coolar	• To understand the construction of an air conditioning system. • To learn about the air cooler and how it differ than air conditioning system. • To understand a difference between window and split air conditioning system.	25	10

		5.9. Insulation: Definition, Propreties, Materials			
				Total Hours	**42**

6. List of Practicals / Exercises

The practical/exercises should be properly designed and implemented in an attempt to develop different types of skills so that students can acquire the competencies/Programme outcomes. Following is the list of practical exercises for guidance.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	Demonstration of various Refrigeration tools and equipment.	To explain refrigeration tool and equipment step wise with sketches.	2
2.	Identify various parts of a Refrigerator and Window Air Conditioner.	Identify various parts	2
3.	To understand different components of VCR system and to determine its COP	Types of Components	6
4.	Charging of a Refrigerator/ Air Conditioner.	Explanation charging procedure of refrigerant in refrigerator and air conditioner.	2
5.	To detect faults in a Refrigerator/ Air Conditioner.	Fault detection methods	2
6.	To perform different Psychrometric Processes and analyze the same using Psychrometric Chart.	Analysis of processes	2
7.	Demonstration and working of Window type Air-Conditioner.	Types of Components	4
8.	Demonstration and working of Split type Air-Conditioner.	Types of Components	4
9.	Seminar Presentation	Prepare the seminar and make presentation on power point	4
		Total Hours	**28**

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Unit Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	U %	Ap %	C %	E %	An %
1.	Introduction	36	44	20	-	-	-
2.	Refrigerant	44	28	7	7	7	7
3.	Refrigeration System	28	40	16	7	9	-
4.	Applied Psychrometry & Heat Load Calculation	44	35	-	-	7	14
5.	Air Conditioning System	40	30	15	7	-	8

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

8. Textbooks

1) Refrigeration and Air Conditioning by R.S Khurmi and J.K. Gupta; S Chand and Company Limited, New Delhi.
2) Refrigeration and Air Conditioning by Domkundwar; Dhanpat Rai and Sons, Delhi.

9. Reference Books

1) Refrigeration and Air Conditioning by Dr. R.K Rajput; S.K. Kataria and Sons, Ludhiana
2) Refrigeration and Air Conditioning by CP Arora; Tata McGraw Hill, New Delhi.
3) Refrigeration and Air Conditioning by Dr.Harjeev Khanna; Dhanpat Rai and Sons, Delhi.
4) e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

10. Open Sources (Website, Video, Movie)

1) http://swayam.gov.in
2) http://nptel.ac.in/
3) https://www.youtube.com/watch?v=h5wQoA15OnQ
4) https://www.youtube.com/watch?v=PjcdqAkP0UA
5) https://www.youtube.com/watch?v=-Wj_MO4BqtA
6) https://www.sciencedirect.com/topics/engineering/refrigeration-system