FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Dairy Technology)**

Semester: **V**

Course Code: **202200501**

Course Title: **Dairy Refrigeration and Air Conditioning**

Course Group: **Professional Core Course**

Course Objectives: The course is designed to give fundamental knowledge of types of refrigeration, refrigeration cycles, refrigerants and their behavior under various conditions, air conditioning load calculation and designing of cold storage system.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50 / 18	50/ 17	25 / 9	25 / 9	150 / 53

* **J**: Jury; **V**: Viva; **P**: Practical

Sr. no.	Content	Hours
1	**Fundamentals of refrigeration** Brief history and need of refrigeration and air conditioning in dairy industry, Methods of producing cooling, Refrigerating effect, Units of refrigeration, Coefficient of performance.	**03**
2	**Refrigerants** Classification, nomenclature, desirable properties of refrigerants, Refrigerants used in dairy relevant refrigeration and air conditioning system, Thermodynamic, chemical and physical properties of refrigerants, Secondary refrigerants.	**04**
3	**Vapour Compression refrigerating system** Mechanism of vapour compression refrigeration cycle, Representation of Vapour compression Refrigeration cycle on P-V, T- S and P-h diagrams, Types of vapour compression cycles, factors affecting the performance of the cycle, Actual vapour compression cycle, Simple saturated cycle with flash chamber and accumulator.	**09**
4	**Compound vapour compression and Multiple Evaporating system** Applications, advantages of compound vapour compression system, Two stage compression with liquid intercooler, Two stage compression with liquid intercooler and water intercooler, Two stage compression with liquid	**10**

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	intercooler, water intercooler and liquid flash chambers. Multiple evaporators at the same temperature with single compressor, Multiple evaporators at the different temperature with single compressor, individual expansion valve and back pressure valve, Multiple evaporators at the different temperature with single compressor, multiple expansion valve and back pressure valve, types of expansion valves.	
5	**Vapour Absorption Refrigerating system** Simple vapour absorption refrigeration systems, Practical absorption system, Refrigerant absorbent combinations and absorption cycle analysis. advantages of vapour absorption refrigerating system over vapour compression refrigerating system	**04**
6	**Psychrometry** Properties of moist air, psychrometric chart and its application, psychrometric processes such as sensible heating and cooling, heating and humidification cooling and dehumidification,	**08**
7	**Cooling load calculations and Cold storage Design** Cooling Load Calculations, Cold Storage Design: Types of cold storage and types of loads, Construction of cold storage, insulating materials and vapour barriers.	**07**
	Total	**45**

List of Practicals / Tutorials:

1	To determine the co-efficient of performance (COP) of Vapor Compression refrigeration system
2	Study of different components of Refrigerator and water cooler
3	To analyze multi-evaporator systems with different configurations
4	To perform different service operations using tools of refrigeration like flaring, swaging, bending, brazing
5	Study on charging in the refrigeration system and also detection of leaks from system components.
6	Determine the COP of the Ice plant
7	Performance of Vapor Absorption Refrigeration System
8	To perform Sensible Heating process and to analyze the same using psychrometric chart
9	To perform Heating & Humidification process and to analyze the same using psychrometric chart
10	To perform cooling and dehumidification process and to analyze the same using psychrometric chart
11	Industrial Visit of Cold storage/Chilling Plant

Reference Books:

1	Refrigeration and Air Conditioning by C P Arora, McGraw-Hill India Publishing Ltd
2	Refrigeration and Air Conditioning by Manohar Prasad, New Age International Publisher
3	Principles of Refrigeration by Roy. J Dossat, Pearson Education

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4	Refrigeration and Air Conditioning by Jordon and Prister, Prentice Hall of India Pvt. Ltd.
5	ASHRAE Handbook, (1) Fundamentals (2) Refrigeration
6	Refrigeration and air conditioning by R K Rajput, S.K. Kataria & Sons.

Supplementary learning Material:	
1	NPTEL resources

Pedagogy:

- Direct Classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Interactive methods
- Seminar/Poster presentation

Internal Evaluation:
Teacher may consider some components for the continuous evaluation where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
15%	25%	20%	20%	15%	5%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

Course Outcomes (CO):

Sr. No.	**Course Outcome Statements**	**%weightage**
CO-1	Understand basics of refrigeration, types of refrigerants, their properties, and select appropriate refrigerant for different applications in dairy industry	**25**
CO-2	Understand and analysis of various refrigeration cycles	**30**
CO-3	Make basic calculation of psychometric properties and process	**30**
CO-4	To know the cooling load and able to design cold storage for dairy products	**15**

Curriculum Revision:	
Version:	1
Drafted on (Month-Year):	October-2022
Last Reviewed on (Month-Year):	-

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Next Review on (Month-Year):	Jun-25

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