



CVM UNIVERSITY

Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: Bachelor of Technology (Dairy Technology)

Semester: IV

Course Code: 202200402

Course Title: Heat and Mass Transfer in Dairy Industry

Course Group: Professional Core Course

Course Objectives: The course is prepared to provide the detailed understating of various modes of heat transfer and its applications in Dairy Industries. The course also provides the basic technical knowledge related to heat exchangers in dairy industries.

Teaching & Examination Scheme:

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

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

Detailed Syllabus:

Sr.	Contents	Hours
1	Introduction Heat Transfer, Importance of Heat Transfer, modes of Heat Transfer, Basic heat transfer process, thermal conductivity, convective film coefficient, Stefan Boltzmann's constant and equivalent radiation coefficient, physical properties related to heat transfer	06
2	Conduction Heat Transfer Fourier's law, effect of temperature on thermal conductivity of different solids, liquids and gases, generalized equation in Cartesian and cylindrical coordinates and its reduction to specific cases, One dimensional steady state conduction, heat conduction through plane and composite walls and cylinders, electrical analogy, Heat transfer from extended surface. Introduction to unsteady state heat conduction.	12
3	Convection Heat Transfer Newton's law of cooling, dimensional analysis applied to forced and free convection, dimensionless numbers and their physical significance, empirical correlations for free and forced convection, Continuity, momentum and energy equations, thermal and hydrodynamic boundary layer.	09



4	Heat Exchangers Classification, heat exchanger analysis, LMTD for parallel and counter flow exchanger, overall heat transfer coefficient, fouling factor, correction factors for multi pass arrangement, effectiveness-NTU method for parallel and counter flow heat exchanger, compact heat exchanger, Dimple Jet Heat Exchanger . Plate Heat Exchangers (PHEs): Basic features and development, Construction and Operation, Industrial application, single and multi pass flow arrangement. Condenser and Evaporator: Design, construction and operation. Applications.	12
5	Mass transfer Introduction, Fick's law of Diffusion, steady state diffusion of gases and liquids through solids, Equimolal diffusion, Mass Transfer Coefficients.	06
	Total	45

List of Practicals / Tutorials:

1	To determine the thermal conductivity of the given composite walls.
2	To calculate the overall heat transfer coefficient of shell and tube heat exchangers
3	Performance analysis on Plate type heat exchangers.
4	To determine the Overall Heat transfer coefficient in Parallel and Counter flow Heat Exchanger.
5	Performance on Pin Fin apparatus and calculate Fin efficiency and its effectiveness.
6	To evaluate the thermal conductivity of insulating powder in sphere.
7	To Determine the thermal conductivity of the insulating materials through Lagged Pipe apparatus.
8	Experimental analysis on Unsteady state heat transfer for determining the time required to reach the steady state condition.
9	To determine the heat transfer coefficient through Natural Convection.
10	To calculate the heat transfer coefficient through Forced Convection.

Reference Books:

1	Heat and Mass Transfer by P.K. Nag, McGraw Hill
2	Heat and Mass Transfer by Vishvjeet Hans
3	Heat and Mass Transfer by R K Rajput, S.Chand Publication
4	Heat and Mass Transfer: Fundamentals and Application by Yunus Cengel, McGraw Hill
5	Heat and Mass Transfer by Dr. D S Kumar Publisher: S K Kataria and Sons
6	Heat Transfer by J P Holman, McGraw Hill

Supplementary learning Material:

1	NPTEL Resources
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Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment



- Interactive methods
- Industrial/ Field visits

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

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

Distribution of Theory Marks in %						R: Remembering; U: Understanding; A: Applying; N: Analyzing; E: Evaluating; C: Creating
R	U	A	N	E	C	
10%	20%	30%	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 slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Apply Fourier's law to validate the theoretical over all heat transfer coefficient.	20
CO-2	Determine thermal properties of material by applying 1-D steady state heat transfer equation.	25
CO-3	To identify the type of convection problems and to apply concepts of natural and forced convection for related problems.	30
CO-4	To practice LMTD and effectiveness-NTU method for simple heat exchange device.	25

Curriculum Revision:

Version:	1
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	--
Next Review on (Month-Year):	June-2025