GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Chemical Engineering

Course / Subject Code : DI02005011

Course / Subject Name : Basic Chemical Engineering Calculations

w. e. f. Academic Year:	2024-25
Semester:	2nd
Category of the Course:	ESC

Prerequisite:	**NA**
Rationale:	Chemical engineering focuses on converting raw materials into valuable products through chemical reactions and physical processes, leveraging laboratory-developed reactions for the commercial production of various materials. The primary aim of this course is to help students analyze processes through calculations and cultivate systematic problem-solving abilities. In this course, students will learn key information about unit conversions, basic chemical engineering calculations, and the ideal gas law, while also focusing on how stoichiometric principles are applied in unit Operations. Students will acquire essential knowledge and skills that will be utilized throughout their future courses and professional careers.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Use unit conversions for solving chemical engineering problems.	R,U
02	Understand various chemical process variables.	U,A
03	Express composition of mixtures and apply ideal gas law	R,A
04	Correlate stoichiometry with unit operations	R,U,A

**Revised Bloom's Taxonomy (RBT)*

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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	0	3	70	30	0	0	100

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
Unit – I Units and Dimensions	1.1 Introduction to chemical engineering calculations. 1.2 Dimensions and systems of units 1.3 Fundamental quantities and Derived quantities 1.4 Definition and units of force, volume, pressure, work, energy, power and heat 1.5 Unit conversions of Fundamental and Derived quantities in FPS, MKS and SI systems.	08	20
Unit – II Chemical Process Variables	2.1 Definition and unit of: Solubility, Flow rate, Density, Velocity, Viscosity (Absolute and kinematic), vacuum, Kinetic energy, Potential energy. 2.2 Simple calculations related to Solubility, Flow rate, Density, and Velocity. 2.3 Vapor pressure definition and its determination using Chemical Engineering Handbook and Antoine equation.	10	18
Unit– III Basic Chemical Calculations	3.1 Definition and calculations of mole, atomic weight, molecular weight, equivalent weight, specific gravity and API gravity. 3.2 Expression of composition of mixtures and solutions and related calculations. 3.3 Molarity, Normality, Molality and related simple numerical.	10	25
Unit– IV Ideal Gas Law	4.1 Concept of ideal gas 4.2 Derivation of ideal gas law 4.3 STP and NTP conditions 4.4 Dalton's law, Amagat's law, Raoult's Law and Henry's	08	25

	Law. 4.5 Relation between mole%, volume% and pressure% for ideal gases 4.6 Calculation of average molecular weight, density, specific gravity, mole%, weight%.		
Unit– V Applied Stoichiometry in unit operations	5.1 Introduction of important unit operations 5.2 Correlation of stoichiometric calculations with unit operations 5.3 Basic Chemical Engineering calculations of various unit operations 5.3.1 Distillation, 5.3.2 Absorption, 5.3.3 Drying, 5.3.4 Extraction, 5.3.5 Leaching, 5.3.6 Evaporation, 5.3.7 Filtration, 5.3.8 Mixing, 5.3.9 Crystallization.	06	12
	Total	**42**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20%	**37%**	**43%**	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Stoichiometry and Process Calculations	K.V. Narayanan, B. Lakshmikutty	Prentice-Hall of India Pvt. Ltd., 2006.
2	Stoichiometry	B I Bhatt, S B Thakore	McGraw Hill Education; 5th edition (1 July 2017)
3	Introduction to Process Calculations (Stoichiometry)	Gavhane K. A.	Nirali Prakashan,2016, ISBN: 9788190639668, 9788190639668

4	Basic Principles & Calculations in Chemical Engineering	David M. Himmelblau, James B. Riggs	PHI Learing Pvt. Ltd, 7th edition, 2006.
5	Industrial Stoichiometry: Chemical Calculations of Manufacturing Processes	H.C.Lewis, W.K.Lewis, A.H.Radasch,	McGraw-Hill, 2nd edition, 1954.
6	Perry's Chemical Engineers' Handbook	Don W. Green, Robert H. Perry	The McGraw-Hill Companies, Eighth Edition, ISBN: 9780071422949

(b) Open source software and website:

1. https://nptel.ac.in/courses/103103165

Suggested Project List:

A suggestive list of projects is given here. This has to match the competency and the COs. Similar projects could be added by the concerned course teacher:

1. Prepare solutions of known Molarity, Normality, and Molality.
2. Use Different Chemical Engineering Handbook to find various properties of chemical compound.
3. Visit department laboratory and list out the molarity and normality of various chemicals.

Suggested Activities for Students:

1. Prepare tabular presentation that shows unit conversion factor for various parameters.
2. Prepare chart on Dimensions and systems of units.
3. Prepare chart on various methods to express composition of mixtures and solutions.

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