GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Chemical

Course / Subject Code :DI02C05011(Only for C to D Students)

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 is concerned with the transformation of raw materials into useful products making use of chemical conversions and physical operations. The reactions developed by the chemists in the laboratory are utilized by the chemical engineer for the commercial production of a wide variety of materials. The basic philosophy behind this course is to assist the student in the analysis of processes through calculations and develop in him/her systematic problem-solving skills. This course provides the fundamental information regarding unit conversions, basic chemical engineering calculations and ideal gas law. Through these calculations the students will gets equipped with fundamental information and skills that are repeatedly employed in subsequent courses as well as in professional life.

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, heat 1.5 Unit conversions of Fundamental and Derived quantities in FPS, MKS and SI systems.	09	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 Perry's Chemical Engineers' 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	10	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 material balance Equations of various unit operations 5.3.1 Distillation, Absorption, Drying, Extraction, Leaching, Evaporation, Filtration, Mixing, Crystallization.	06	12
	Total	**45**	**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 Perry's Chemical Engineers' 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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