B.Tech. Semester VI

Subject Name: Basic calculation and Operation in Chemical Industries **Subject Code:** BTCH15601
Type of course: Open Elective-2
Prerequisite (if any): Basics of Mathematics, Chemistry and Physics
Rationale: The main objective of course is to make a clear conceptualized knowledge regarding various unit operations carried out in Chemical Engineering. This will provide a background for applying these principles to industrial problems.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	0	3	60	25	15	0	0	100

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Dimensions and units: Dimensions and system of units, Fundamental and derived units, Dimensional consistency, Dimensional equations, Different ways of expressing units of quantities and physical constant, Unit conversion and its significance	5	11%
2	Basic chemical calculations: Calculations for mole, molecular weight, equivalent weight. Composition of gaseous mixtures, liquid mixtures, solid mixtures. Ideal gas law & other equations of state and their applications, Dalton law, Raoult's law, Henry's law, Solutions and their properties	7	15%
3	Material balance without chemical reactions: Process flow sheet, Degree of freedom, Introduction to unit operation in Chemical industries like absorber and stripper, distillation towers, extractors, dryers, evaporators. Material balance around equipments related to unit operations like absorber and stripper, distillation towers, extractors, dryers, evaporators. Material balance with and without recycle; Bypass and purge streams	12	27%
4	Material balance involving chemical reactions: Concept of limiting and excess reactants, percentage conversion, yield, selectivity. Material balance with chemical reactions - single and multiple reactions	12	27%
5	Energy balances: Thermo chemistry and 1st law of thermodynamics, Heat capacity of gases and gaseous mixtures, liquids & solids, Sensible heat change in liquids & gases, Enthalpy changes during phase transformation, Enthalpy changes accompanied by chemical reactions, Standard heat of reaction.	9	20%

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	20	20	5	0	0

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

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.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Stoichiometry	Bhatt B.I. and S B. Thakore	Tata McGraw Hill Company	2010	5th Edition
2	"Stoichiometry and Process Calculations"	K.V. Narayanan, B. Lakshmikutty	Prentice-Hall of India Pvt. Ltd.,	2006	4th Edition
3	Process Calculations	V Venkataramani and N Anantharaman	PHI Learning,	2011	2nd Edition
4	"Unit Operations of Chemical Engineering"	McCabe W L, Smith J C, Harriott P	Mc Graw Hill Publication	2005	7th Edition

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	To recognize different system of units and dimensions with conversion	7
CO-2	To differentiate concepts for expressing compositions and behaviour of different gases and solutions.	15
CO-3	To determine material balance in steady state unit operations with and out recycle.	30
CO-4	To evaluate Material balance involving Chemical reactions in fertilizer, petrochemicals, dyestuff and electrochemical industries.	25
CO-5	To define energy changes in liquid and gases accompanying various chemical reactions with terms used to associate energy changes in different phases.	13
CO-6	To identify the different unit operation of chemical industries.	10

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	3	3	1	1	2	2	3	3	3	2	2	2	2	2
CO-2	3	3	3	3	3	2	3	3	2	2	2	2	2	2	2

CO-3	3	3	3	3	3	2	3	3	2	2	2	2	2	2	2
CO-4	3	3	3	3	3	2	3	3	2	2	2	2	3	3	3
CO-5	3	3	3	3	3	2	3	3	2	2	2	2	3	3	3
CO-6	3	3	3	3	3	2	3	3	2	2	2	2	3	3	3
Rationale*	18	18	18	17	17	12	17	18	13	13	12	12	15	15	15

Rationale*: Explaining why it is matching this particular program outcome

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	"Basic Principles & Calculations in Chemical Engineering",	David M. Himmelblau, James B. Riggs	, PHI Learing Pvt. Ltd	2006	7th
2	"Chemical Engineering" Vol. I – Fluid flow, Heat Transfer and Mass Transfer	Coulson & Richardson's	, Butterworth – Heinemann Publication	2014	6th
3	"Chemical Process Principles Part-I: Material and Energy Balances"	O.A.Hougen, K.M.Watson, R.A.Ragatz	CBS Publishers New Delh	2004	2nd

List of Open Source/learning website:

- https://nptel.ac.in/courses/103/103/103103165/
  - Detail of coverage as per syllabus
- https://www.digimat.in/nptel/courses/video/103103165/L01.html
  - Detail of coverage as per syllabus
- https://onlinecourses.nptel.ac.in/noc20
  - Detail of coverage as per syllabus