SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Department of Biotechnology	LP: BT 22301 Rev. No: 00 Date:1.08.2023
~~B.E~~/B.Tech/~~M.E/M.Tech~~ : Biotechnology Regulation: 2022 PG Specialisation : NA Sub. Code / Sub. Name : BT22301/Stoichiometry and Process Calculations Unit : I	

UNIT I INTRODUCTION TO STOICHIOMETRY 6

Dimensions and system of units. Fundamental and derived units, Unit conversions and its significance. Balancing the equations. Basic unit operations.

OBJECTIVE: To recall different system of units and relate its conversions.

Session No *	Topics to be covered	Ref	Teaching Aids
1.	Dimensions and system of units.	T1- CH.1;Pg. 1-4	BB/LCD
2.	Fundamental and derived units,	T1- CH.1;Pg. 5-9	BB/LCD
3.	Unit conversions	T1- CH.1;Pg. 12-14	BB/LCD
4.	Unit conversions and its significance	R3- CH.1;Pg. 15-16	BB/LCD
5.	Balancing the equations	T1- CH.6;Pg. 380-387	BB/LCD
6.	Basic unit operations	T3- CH.3;Pg. 59-61	BB/LCD
Content beyond syllabus covered (if any):-			

* Session duration: 50 minutes

Sub. Code / Sub. Name : BT22301/Stoichiometry and Process Calculations
Unit : II

UNIT II BASIC CHEMICAL CALCULATIONS 10

Mole concept: atomic weight, molecular weight and equivalent weight. Molarity, molality, normality, ppm, mole percent, mass percent, and volume percent. Density, Viscosity, Specific gravity and Surface tension. Gases: Gas laws, Average molecular weight and density.

OBJECTIVE : To study about the basic chemical calculations and their applications.

Session No *	Topics to be covered	Ref	Teaching Aids
7.	Atomic weight, molecular weight	T1- CH.2;Pg. 30-31	BB/LCD
8.	Mole concept and equivalent weight	T1- CH.2;Pg. 31-32	BB/LCD
9.	Molarity, molality	T1- CH.2;Pg. 51-52	BB/LCD
10.	Normality	T1- CH.2;Pg. 52-53	BB/LCD
11.	ppm, mole percent	T1- CH.2;Pg. 53-54	BB/LCD
12.	mass percent, and volume percent	T1- CH.2;Pg. 54-55	BB/LCD
13.	Density, Specific gravity	T1- CH.6;Pg. 340-359	BB/LCD
14.	Viscosity and Surface tension	T1- CH.6;Pg.381-385	BB/LCD
15.	Gas laws	T1- CH.5;Pg.194,205	BB/LCD
16.	Average molecular weight	T1- CH.6;Pg.340-345	BB/LCD
Content beyond syllabus covered (if any): ideal and non ideal gases			

* Session duration: 50 mins

Sub. Code / Sub. Name	: BT22301/Stoichiometry and Process Calculations
Unit	: III

UNIT III MATERIAL BALANCE WITHOUT CHEMICAL REACTIONS 9

Process flowsheet, Degree of freedom, Material balance with and without recycle; Bypass and purge streams, Material balance without chemical reactions: Dryer, Evaporator, Extractor, and Distillation column.

OBJECTIVE: To explain the concept of material balance and relate its outcomes.

Session No *	Topics to be covered	Ref	Teaching Aids
17.	Process flowsheet, Degree of freedom	T3- CH.4;Pg. 84	BB/LCD
18.	Material balance without recycle	T1- CH.3;Pg. 64-72	BB/LCD
19.	Material balance with recycle	T1- CH.3;Pg. 64-72	BB/LCD
20.	Bypass	T3- CH.4;Pg. 110	BB/LCD
21.	Purge streams	T3- CH.4;Pg. 110	BB/LCD
22.	Dryer	T1- CH.3;Pg. 64-65	BB/LCD
23.	Evaporator	T1- CH.3;Pg. 65-66	BB/LCD
24.	Extractor	T1- CH.3;Pg. 66-68	BB/LCD
25.	Distillation column.	T1- CH.3;Pg. 68-72	BB/LCD
Content beyond syllabus covered (if any):- Mixing			

* Session duration: 50 mins

Sub. Code / Sub. Name : BT22301/Stoichiometry and Process Calculations
Unit : IV

UNIT IV MATERIAL BALANCE WITH CHEMICAL REACTIONS 10

Concept of limiting and excess reactants, percentage conversion, yield, selectivity, Material balance with chemical reactions - single and multiple reactions, Application of material balance in bioprocesses.

OBJECTIVE: To apply the concept of material balance in various unit operations.

Session No *	Topics to be covered	Ref	Teaching Aids
26.	Material balance with chemical reactions	T1- CH.3;Pg. 58-60	BB/LCD
27.	Limiting reactant	T1- CH.3;Pg. 60-63	BB/LCD
28.	Excess reactants	T1- CH.3;Pg. 60-66	BB/LCD
29.	Percentage conversion	T1- CH.3;Pg. 63-69	BB/LCD
30.	Yield	R1- CH.3;Pg. 63-67	BB/LCD
31.	Selectivity	T1- CH.3;Pg. 71-75	BB/LCD
32.	Material balance with single reaction	T3- CH.4;Pg. 116-125	BB/LCD
33.	Material balance with multiple reactions	T3- CH.4;Pg. 125-142	BB/LCD
34.	Application of material balance	R2- CH.4;Pg. 52-55	BB/LCD
35.	Application of material balance in bioprocesses	R2- CH.4;Pg. 55-65	BB/LCD
Content beyond syllabus covered (if any): -			

* Session duration: 50 mins

Sub. Code / Sub. Name : BT22301/Stoichiometry and Process Calculations
Unit : V

UNIT V CONCEPTS IN ENERGY BALANCES 10

Law of conservation of energy and Energy balance equation, Heat capacity of solids, liquids and gases, Sensible and latent heat, Hess's law, Laws of thermodynamics, Standard heat of reaction: formation and combustion, Enthalpy determination, Thermodynamic aspects of Biological processes.

OBJECTIVE: To explain the concept of energy balance and relate its outcomes.

Session No *	Topics to be covered	Ref	Teaching Aids
36.	Law of conservation of energy	T2- CH.3;Pg. 121-136	BB/LCD
37.	Energy balance equation	T4- CH.8;Pg. 237-239	BB/LCD
38.	Heat capacity of solids, liquids and gases	R2- CH.12;Pg. 416-422	BB/LCD
39.	Sensible and latent heat	T4- CH.9;Pg. 345-347	BB/LCD
40.	Hess's law	T2- CH.3;Pg. 144-154	BB/LCD
41.	Laws of thermodynamics and Enthalpy determination	T4- CH.9;Pg. 301-305	BB/LCD
42.	Standard heat of reaction	T4- CH.8;Pg. 276-277	BB/LCD
43.	Standard heat of formation	T4- CH.8;Pg. 277-279	BB/LCD
44.	Standard heat of combustion	T4- CH.8;Pg. 277-279	BB/LCD
45.	Thermodynamic aspects of biological processes.	R2- CH.5;Pg. 101-107	BB/LCD
Content beyond syllabus covered (if any): -			

* Session duration: 50 mins

Sub Code / Sub Name: BT22301/Stoichiometry and Process Calculations

TEXT BOOKS:

1. "Stoichiometry", B.I. Bhatt, S.M. Vora, McGraw Hill Publishing Company Limited, 4th edition, 2004.
2. "Basic Principles & Calculations in Chemical Engineering", David M.Himmelblau, James B. Riggs, PHI Learing Pvt. Ltd, 7th edition, 2006.
3. "Elementary Principles of Chemical Processes", Richard M. Felder, Ronald W.Rousseau, Wiley, 3rd edition, 2004.
4."Chemical Process Principles Part-I: Material and Energy Balances",O.A.Hougen, K.M.Watson, R.A.Ragatz, CBS Publishers New Delhi, 2nd edition,2004.

REFERENCES:

1. "Stoichiometry and Process Calculations", Narayanan, K.V. and Lakshmi Kutty PHI, 2006.
2. "Bioprocess Engineering Principles", Doran M Pauline, 2nd Edition, Elsevier,2012.
3. "Unit Operations of Chemical Engineering", McCabe, W.L., J.C. Smith and P.Harriot, 6th Edition, Mc Graw Hill, 2001.

	Prepared by	Approved by
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Date	1.08.2023	1.08.2023
Remarks *: The Same lesson plan will be followed in the subsequent year		
Remarks *: -		

1/8/23

* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD.