Vallabh Vidyanagar, Gujarat (Reaccredited with 'A' Grade by NAAC (CGPA 3.25) Syllabus with effect from the Academic Year 2022-2023 Master of Science, Industrial Chemistry **M.Sc. Industrial Chemistry, Semester - III**

Course Code	PS03CICH51	Title of the Course	New Seperation Techniques
Total Credits of the Course	4	Hours Per Week	4

Course	1.	The objective is to provide the concept of various unit operations like		
Objectives:		pressure swing adsorption, short parth distiration.		
	2.	It is aimed to get the idea about the latest separation techniques that can		
		be used to separate the mixture.		
	3.	It is aimed to study about the different memberance separation		
		techniques like Reverse osmosis, per vaporization etc.		

Course	Course Content			
Unit	Description	Weightage*		
		(%)		
1.	(a) Short path Distillation:-	25%		
	Concept & working of short path Distillation Unit (SPDU),			
	Difference between short path Distillation & molecular distillation,			
	applications of SPDU, Economics of short path distillation.			
	(b) Pressure Swing Distillation:-			
	Concept & Working, Advantage & Disadvantages of PSD over			
	azeotropic and Extractive Distillation, Applications			
2.	(a) Pressure Swing Adsorption:-	25%		
	Concept & Working, Advantages & Disadvantages of PSA over			
	cryogenic distillation, four step PSA, six step PSA, Purification of			
	hydrogen, oxygen, Nitrogen & other commercial applications of PSA.			
	(b) Reactive & Catalytic Distillations-			
	Concept & and History, Advantage & Disadvantages, Various			
	methods of applications, Manufacturing of MTBE, Manufacturing of			
	ETBE and other commercial applications, BALE & KATMAX			
	packing, etc.			
3.	Super Critical Extraction-	25%		
	Working Principle, Advantage & Disadvantages of supercritical solvents			
	over conventional liquid solvents, Advantage & Disadvantages of			
	supercritical extraction over liquid- liquid extraction, Decaffeination,			
	ROSE process, extraction of aromatic from spice and other commercial			
	applications of supercritical extraction, Applications under research			
4.	Membrane Separation Techniques:-	25%		
	a. Reverse Osmosis (R.O.)			
	Concept of Osmosis & Reverse Osmosis, Different types of			
	Membrane modules and membrane material used for R.O.,			
	Advantages & Disadvantages, and Commercial applications of R.O.			
	b. Ultra filtration:-			

Concept & working principle, Commercial applications.	
c. Per vaporization:-	
Working principle, Advantages & Disadvantages, Production of	
absolute alcohol and other commercial applications.	
d. Membrane Reactor-	
Concept & working, Various modules of membrane used for	
membrane reactor, Advantages & Disadvantages, applications under	
research.	

Teachi	ng 1. To approach the effective teaching methodology. It comprises			
Learni	Learning discussion, group learning, problem solwing, focusing on the s			cusing on the self
Metho	dology:-		confidence among the students, team work as we	ell as encouraging
			the students to critical thinking & searching.	
		2.	The students often get an opportunity to ask	questions in the
			middle of lecture. It should be maintained as a dis	cussion pattern as
			well as self learning approach.	_
Evalua	tion Patter	n		
Sr.	Details of the Evaluation Weightage*			
No.	(%)			
1.	Internal Written/ Practical Examination (As per CBCS R 6.8.3) 15%			
2.	Internal Continuous Assessment in the form of Practical, Viva- 15%			
	Voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS			
	R. 6.8.3)			
3.	University	Examin	nation	70%

Course	Course Outcomes: having completed this course, the learner will be able to				
1.	Understand advanced mass transfer techniques such as Pressure Swing distillation,				
	Reactive & Catalytic distillation, super critical Extraction etc.				
2.	Understand Membrane Separation Techniques that can be used in different chemical				
	industries such as milk industry, food industry.				
a					

Sr.	References
No.	
1.	"Membrane Separation Processes" by Kaushik Nath, PHI pvt.Ltd., 2008
2.	"Introduction to Process Engineering & Design" by S.B.Thakore & B.I.Bhatt,Tata
	McGraw-Hill Ltd.,2007
3.	Perry Chemical Engineers Handbook' 7thEdition by R.H.Perry and D.Green.
4.	Ullman's Encyclopedia of Industrial Chemistry.
5.	"Encyclopedia of Chemical Engineering " by Kirk & Othmer.
6.	"Natural Extracts using supercritical carbon dioxide" M.Mukhopadhyay

Online- Resources

On-line Resources:- From time to time are many online resources, including websites, databases, e-books, bibliographies and platforms that offer educational videos, lectures on a range of topics can be suggested or displayed to he students.

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Course Code	PS03CICH52	Title of the Course	Spectroscopy- I
Total Credits of the	4	Hours Per Week	4
Course			

Course	1.	To impart the knowledge of UV, IR, Atomic, Microwave, Molecular		
Objectives:		Spectroscopy & their applications.		
-	2.	Be able to describe what happens to a compound when it absorbs		
		infrared radition & ultraviolet radiation.		
	3.	Be able to use of a chart of functional group IR absorptions & vissible		
		light absorptions. Also able to identify the struttre of compound.		
	4.	Be able to use of experimental technique that measures the relative		
		energies of electronics in atoms & molecules.		

Course	Course Content			
Unit	Description	Weightage*		
		(%)		
1.	Atomic Spectroscopy	25%		
	Energies of atomic orbitals, vector representation of momenta, &			
	vector coupling, spectra of hydrogen atom & alkali metal atoms.			
	Molecular Spectroscopy			
	Energy levels, molecular obritals, virbonic transitons, vibrational			
	progressions & geometry of the excited state, Frank- condon			
	principle, electronic spectra of polyatomic molecules. Emission			
	spectra-change transfer spectra.			
2.	Microwave Spectroscopy	25%		
	Basic concepts, rotation spectra of simple inorganic compounds,			
	classification of molecules, rigid rotor model, effect of isotopic			
	substitution on transition frequencies & intensities non-rigid rotor			
	stark effect nuclear & electron spin interaction & effect of external			
	field.			
	Photoelectron & Photo acoustic spectroscopy.			
	Introduction, principle, instrumentation & applications of following			
	techniques photo acoustic spectroscopy (PAS), photo electron			
	spectroscopy (PES), Koopman's theorm, ESCA & chemical			
	informations obtained from it. Auger electron spectroscopy (AES)			
3.	UV Spectroscopy:-	25%		
	Introduction, origion of UV band specturm, types of electronic			
	transition, selection Rules, presentation of UV spectra, solvents			

	effects on UV absorption, chromophores & auxochrome, effect of conjugation, conformation & geometry on UV absorption of polymes Wood Word Fieser rules for dienes, axial haloketone rule, ketones, unsaturated aldehyde, the UV spectra of benzenoids, polynuclear aromatic hydrocarbon & heterocycles.	
4.	IR Spectroscopy:- Introduction principles of IR spectroscopy sample, handling, various modes of virbation, presentation of spectra, Functional group & finger print region, combination & overtones, Fermi resonance, bond properties & absorption trends, Factors influencing vibration-frequencies, interpretation of IR Spectra. Characteristic Vibrational frequencies of common functional groups (alkanes, alkenes, alkynes, ethers, aromatic compounds, alcohols, phenols & amines) study of vibrational frequencies of carbonyl compounds ketones, aldehyeles, estres, amides & acids	25%

Teachi	ng - In the course of spectroscopy aims to make the students have the			
Learning knowledge of spectroscopy			students have the	
Metho	Mothodology: This program is desinged to encourage the learning strate			ning strategies to
Micino	have the knowledge shout recent technologies rel			ated to industrial
	point of view.			lated to industrial
		• A variety of approac	h to teaching methods like so	eminars, lectures,
		power point presenta	tion etc.	
		• A problem solving m	ethodology is also used.	
Evalua	tion Patter			
Sr.	Details of the Evaluation Weightage*			
No.	(%)			
1.	Internal W	tten/ Practical Examination (As per CBCS R 6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva- 15%			15%
	Voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS			
	R. 6.8.3)	-	-	
3.	University	xamination		70%

Course Outcomes: Understand the basic concept of spectroscopy. 1. Will be able to interpret various types of spectroscopy like UV, IR, atomic, molecular, microwave, photoelectron & photoacoustic spectroscopy etc. 2. Recognize spectroscopy in microwave, Rotational spectra of rigid diatomic molecules, sleection Rule, interaction of spectral lines. 3. Study of vibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic & anharmonic oscillator. 4. Understand principles & Applications of Mossbauer spectroscopy.

Suggested References

Sr.	References
No.	
1.	Modern spectroscopy: J.M. Hollas: Johnwilley
2.	Introduction of Molecular Spectroscopy G.M. barrow; McGraw Hill.
3.	Basic Principles of Spectroscopy: Rchang Mcgraw Hill.
4.	Theory & Application of UV Spectroscopy H.H. Jaffe & M. Orchin's BH Oxford.

5.	Introduction to Photoelectron Spectroscopy P.K. Ghosh, John Wiley.
6.	Fundamentals of Molecular Spectroscopy C.N. Banwell & E.M. Mc.Cash; McGraw
	Hill.
7.	Mo0lecular Spectroscopy by I.N. Levine, Willey Interscience.
8.	Organic Spectroscopy William kemp, John Wiley & Sons.
9.	Spectroscopy of Organic Compound, P.S. Kalsi Wiley Edstem, New Delhi.
10.	Absorption Speatroscopy of Organic Molecules (D. Van Nostrand), V.M. Parikh
11.	Organic Spectroscopy- Principles & Application Jag Mohan, 2nd Edition (Narosa
	Publishing House.

Online- Resources

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range of topics can be suggested or displayed tot he students. **Major websites used for chemical education such as:-** Swayam, e-pg Pathshala, Swayam Prabha, NDLI, E-Sodh Sindhu, NPTEL, Virtual Labs, Process Oriented Guided Inquiry Learning (POGIL) etc.

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Course Code	PS03CICH53	Title of the Course	Green Chemistry
Total Credits of the	4	Hours Per Week	4
Course			

Course	To learn about the environmental status, public awareness in evolution		
Objectives:	principles involved in green chemistry, bio-catalytic reactions, & its control		
-	measures, availability of green analytical methods.		

Course	irse Content			
Unit	Description	Weightage*		
1		<u>(%)</u>		
1.	Introduction to Green Chemistry What is Green Chemistry? Need for Green Chemistry, Cools of Green	25%		
	what is Green Chemistry? Need for Green Chemistry. Goals of Green			
	Chemistry. Limitations/Obstacles in the pursuit of the goals of Green			
2	Principles of Crean Chamistry and Designing a Chamical	25%		
۷.	synthesis	2370		
	Twelve principles of Green Chemistry with their explanations and			
	Designing a Green Synthesis using these principles: Prevention of			
	Waste/byproducts: maximum incorporation of the materials used in			
	the process into the final products (Atom			
	Economy);Prevention/minimization of hazardous/toxic products;			
	designing safer chemicals ;Energy requirements for synthesis			
	Selection of appropriate solvent; Selection of starting materials; Use			
	of protectings groups; Use of catalyst; Products Designed should be			
	Biodegradable; Designing of manufacturing plants; Strengthening of			
	analytical techniques.			
3.	Green reagents and Green catalysts	25%		
	Green reagents: Dimethyl carbonate ;Polymer supported reagents			
	like Polymer supported Peracids ; Polymer supported chromic acid			
	;Polymeric Thioanisolyl Resin; PNBS; Polymer cabodiimide ;			
	Polystyrene Anhydride; Sulfonazide.			
	Green catalysts: Acid catalysts; Oxidation Catalysts; Basic Catalyst;			
	Polymeric Super Acid catalysts IRE Polystylene-Atuminum chloride,			
	Polymer supported photosensitizers Polymer supported phase			
	transfer catalysts.			
4.	Examples of Green Synthesis/Reactions	25%		
	(a) Ultrasound assisted reactions: Esterification, saponification,			
	substitution reactions, Alkylations, oxidation, reduction,			
	coupling reaction, Cannizaro reaction, Strecker synthesis,			
	Reformatsky reaction.			
	(b) Microwave assisted reactions in water: Hofmann Elimination,			
	Hydrolysis (of benzyl chloride, benzamide, n-phenyl			

benzamide, methylbenzoate to benzole acid), Oxi	dation (of
toluene, alcohols). Microwave assisted reactions	in organic
solvents: Esterification, Fries rearrangement,	Orthoester
Claisen Rearrangement, Diels Alder	Reaction,
Decarboxylation.	

Teaching	The presence of faculty members to provide advice academic advice &
Learning	academic guidance to the student in need within the six hours a week
Methodology:-	available to all students.

Evalua	Evaluation Pattern				
Sr.	Details of the Evaluation	Weightage*			
No.		(%)			
1.	Internal Written/ Practical Examination (As per CBCS R 6.8.3)	15%			
2.	Internal Continuous Assessment in the form of Practical, Viva-	15%			
	Voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS				
	R. 6.8.3)				
3.	University Examination	70%			

Course	Course Outcomes:			
1.	To understand the environmental status & evolution.			
2.	To know about the pollution & its prevention measures.			
3.	To familiarise the green chemistry.			
4.	To learn about bio-crtalytic reaction.			
5.	To learn about ultrasound assisted relations, Microwave assisted reactions in water &			
	Microwave assisted reactions in organic solvents.			

Sr.	References
No.	
1.	V.K. Ahluwalia & M.R. Kidwai:- New Trends in Green chemistry, Anamalaya
	Publishers (2005)
2.	A.S. Matlack:- Introduction to Green Chemistry Marcel Deckkar (2001)
3.	P.T. Anastes & J.K. Warmer:- Oxford Green Chemistry Theory & Practical University
	Press (1998)
4.	M.C. Cann & M.E. Connely:- Read World Cases in Green Chemistry American
	Chemical Society, Washington (2000)
5.	M.A. Ryan & M. Tinnes and, Introduction to green Chemistry, American Chemical
	Society, Washington (2002)

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Course Code	PS03CICH54 PS03CICH55	Title of the Course	Practical's
Total Credits of the Course	8	Hours Per Week	16

Course	1.	Describe how to design experiments, execute experiments and
Objectives:		investigate and infer the the observations yielded.
-	2.	synthesis of organic compounds.
	3.	Identifications and separation of organic mixture.
	4.	The second part of the course covers the manufacturing technology of
		soap and detergent.
	5.	It includes the topic related to the role of various parameters in the
		development of a particular chemical process.

Course Code	PS03CICH54	Title of the Course	Industrial Organic
			Chemistry- I
Total Credits of the	4	Hours Per Week	8
Course			

1.	Sepration and iidentification of Teritary Organic Mixture (5 Practicals)		
2.	Synthesis and Application of Name Reactions and Polymer		
	1. Connizzaro Reaction		
	2. Esterification Reaction		
	3. Preparation of Bakelite		
	4. Diel- Alder Reaction.		
	5. Kolbe- Schmidt Reaction		

Course Code	PS03CICH55	Title of the Course	Chemical Process
			Industries
Total Credits of the	4	Hours Per Week	8
Course			

1.	Preparation of Soap.
2.	Preparation of Caustic Soda.
3.	Determine the acid value of given oil sample
4.	Determination of Sodium carbonate in washing Soda.
5.	To produce biodisel from vegetable oil
6.	Preparation of liquid soap from glycerine
7.	To determine free fatty acids in crude and refine edible oil.
8.	Determination of Saponification value of an oil
9.	Determination of the critical Soln Temperature of phenol/ Water System.
10.	To determine the percentage of calcium carbonate in a given toothpaste.
11.	To determine the total phosphorous as P_2O_5 in detergent.

Teaching	Demonstration / Hands on training of various types of analysis with or
Learning	without instruments.
Methodology:-	

Evalua	Evaluation Pattern			
Sr.	Details of the Evaluation	Weightage*		
No.		(%)		
1.	Internal Practical Examination (As per CBCS R. 6.8.3)	30%		
2.	University Examination	70%		

Course	Outcomes:
1.	Understand technology of hydrogenation and saponification.
2.	Basic information about edible and non edible oil.
3.	Understand the detergent and soap manufactirng
5.	The students acquired laboratory skills to handle the identificationa nd separation of
	organic compound.
6.	They have practical approach in synthesis of molecules based upon name reactions like
	esterification, cannizzaro, Diel- Alder etc.

Sr.	References
No.	
1.	Comprehensive practical organic chemistry Preparationa nd quantitative. Analsys. By
	V.K Ahluwalia and Renu Agarwal
2.	Comprehensive practical organic chemistry Qualitative Analysis By V.K. Ahluwalia
	and Renu Agarwal.
3.	Biodiesal Labs, Teacher Manual with Student Documets. By Loyola University of
	Chicago, Institute of Environmental Sustainiability Biodiesel program.
4.	Instrumental Analysis of Chemical Compound By Gurdeep R. Chatwal
5.	Vogel's Textbook of Quantitative chemical/ Analysis (5th Ed.) G.H. Jeffrey, J. bassette
	J. Mendhan, 1999.

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Course Code	PS03CICH56	Title of the Course	Comprehensive Viva
Total Credits of the	1	Hours Per Week	1
Course			
Course 1	To accord the overall k	nowladge of the student	in the relevant subjects

Course	1.	To assess the overall knowledge of the student in the relevant subjects
Objectives		covered in core as well as elective courses.

Vallabh Vidyanagar, Gujarat (Reaccredited with 'A' Grade by NAAC (CGPA 3.25) Syllabus with effect from the Academic Year 2022-2023 Master of Sciene, Industrial Chemistry

M.Sc. Industrial Chemistry, Semester - III

Course Code	PS03EICH51	Title of the Course	Processing of Oils & Fats to Utility
			Products
Total Credits of the Course	4	Hours Per Week	4

Course	1.	The fundamental concepts would reflect the latest understanding of the
Objectives:		field.
	2.	The learner are expected to know the basics of deterget, soaps, oil and fat industries.
	3.	The learners expected to be equipped with problem solving in allied industries.
	4.	Understanding new frontiers of knowledge in industrial chemistry for professional development.

Course	Course Content		
Unit	Description	Weightage*	
		(70)	
1.	Processes and plants employed for hydrogenation of oils, chemisry of	25%	
	hydrogenation of oils, catalyst for hydrogenation of oils, hydrogen		
	production for hydrogenation of oils.		
2.	Raw materials and technology of peanut butter and edible oil blends.	25%	
3.	Raw material for soap industries, plant & process employed in soap	25%	
	manufacturing.		
4.	Raw materials for detergents, plants & processes employed for	25%	
	detergents detergent additives.		

Teaching	To meet the effective teaching & the learning requirements, teaching-
Learning	learning methodology comprises classrom teaching use of e-resources,
Methodology:-	library books, IT-tools, encouraging students to participate in seminars/
	workshops, presentation by students, assigning work based upon subject
	requirement etc.

Evalua	Evaluation Pattern		
Sr.	Details of the Evaluation	Weightage*	
No.		(%)	
1.	Internal Written/ Practical Examination (As per CBCS R 6.8.3)	15%	
2.	Internal Continuous Assessment in the form of Practical, Viva-	15%	
	Voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS		
	R. 6.8.3)		
3.	University Examination	70%	

Course	Outcomes:
1.	To build a basic knowledge of the process carried out in soap, detergent & oil
	industries.
2.	To review the practical importance & relevance of process take place in soap,
	detergent & oil industries.
3.	To study about the salient features of the processes.
4.	To build a bridge between theoratical & practical concept used in industry.

Sr.	References
No.	
1.	Continuous processing of fats, M.K. Schwitzer, Chem Pub Comp., New York.
2.	Baileys Industrial Oils & Fats products, Vol 1-5, John Wiley & Sons.
3.	Manufacture of soaps, detergents & glycerine, edgar, Norwwod Limited
4.	Treaties on fats, fatty acids & oleo chemicals, O.P. Narulla, Indl Constultants India
	Ltd., New Delhi.
5.	Soaps & Detergents, Parsuram K.S., Tata McGraw Hill Pub, New Delhi.
6.	Soaps, their chemistry & technology, J.G. Kane, Indian Central oil seeds comp.
	Hyderabad.

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M.Sc. Industrial Chemistry, Semester - III

Course Code	PS03EICH52	Title of the Course	Chemical Analysis in
			Agro Food and
			Pharmaceutical
			Industires
Total Credits of the	4	Hours Per Week	4
Course			

Course	1. 7	To demonstrate a systematic, extensive and coherent knowledge and
Objectives:	ι	understanding of academic field of study as a whole and it's application in
	t	he various industry.
	2. 7	The subject provides knowledge about the basics of chemical processes
	t	ake place in chemical industries and allied industries.
	3. I	It gives the knowledge about the clinical, Drug, Food and Fuel Industries.

Course	Content	
Unit	Description	Weightage*
		(%)
1.	Analysis of soil: Moister, pH, total nitrogen, phosphorous, silica,	25%
	lime, Magnesia, Manganese, sulfur and alkali salts.	
	Fuel analysis: Solid, liquid and Gas, ultimate and proximate analysis	
	heating values, grading of cool, liquid fuels , flasks points , aniline	
	point, octane number and carbon residue, gaseous fuels - producer	
	gas and water gas - calorific value.	
2.	Clinical Chemistry: Composition of blood collection, and	25%
	preparation of samples, clinical analysis - serum electrolytes, blood	
	glucose, blood urea nitrogen, uric acid, albumin, globulin,	
	barbiturates, acidic and alkaline phosphates, Immunoassay, principals	
	of radiimmunoassy and applications. The blood- gas analysis -trace	
	elements in the body.	
3.	Drug analysis: Narcotics and dangerous drugs, classification of	25%
	drugs, screening by gas m thin layer chromatography and	
	spectrophotometric analysis.	
	Introduction to Fluorescence, instrumentation and its application in	
	Biological, Medical and Drug Development.	
4.	Food analysis : Moister, ash, crude protein, fat, crud fiber,	25%
	carbohydrate, calcium, potassium, sodium, and phosphates, food	
	adulteration - common adulteration in food, contamination of food	
	stuffs, microscopic examination of foods for adulterants, Pesticide	
	analysis in food products, Extraction and purification of sample,	
	HPLC, gas chromatography for organo -phosphates, thin layer	
	chromatography for identification of chlorinated pesticides in food	
	products.	

Teaching	1.	It possess minimum standards of communication skills. They are
Learning		expected to read and understand documents with in depth analyses
Methodology:-		and logical arguments.
	2.	They are trained to be equipped with problem solving
		philosophical approaches as well as analytical reasoning.
	3.	The teaching and learning process involved class lecture, Seminars,
		Questions, preparation, field based learning as well as peer
		teaching & learning.

Evalua	Evaluation Pattern		
Sr.	Details of the Evaluation	Weightage*	
No.		(%)	
1.	Internal Written/ Practical Examination (As per CBCS R 6.8.3)	15%	
2.	Internal Continuous Assessment in the form of Practical, Viva-	15%	
	Voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS		
	R. 6.8.3)		
3.	University Examination	70%	

Course	Course Outcomes:		
1.	To build a basic knowledge of the process carried out in chemical industry.		
2.	To be able to utilize the technological methods in problem solving in process plant.		
3.	To study about the salient features of the process.		
4.	To build a bridge between theoretical and practical concepts used in industry.		

Sr.	References
No.	
1.	Fundamentals of analytical chemistry by D.A. Skoog, D.M. West and F.J. Honer,
	W.B. Saunders.
2.	Chromic Phenomenon, The Technological application of colour chemistry peter,
	Bamfield.
Onling	Decouvers

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