

Sardar Patel University
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25))
Syllabus with effect from the Academic Year 2021-2022
Master of Science, Industrial Chemistry
M.Sc. Industrial Chemistry, Semester-I

Course Code	PS01CICH51	Title of the Course	Introduction to Chemical Engineering -I
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	<ol style="list-style-type: none"> 1. The Objective is to be able to understand concept of entropy and equilibrium and effect of various factors on entropy and equilibrium. 2. It helps to understand the rate of various reaction. 3. It is aimed to have the knowledge of stoichiometry. 4. It is aimed to study about material science including metals & alloys corrosion & corrosion resistance. 5. To study the various instruments used for temperature, pressure, vacuum, flow and level in chemical industry.
--------------------	--

Course Content		
Unit	Description	Weightage* (%)
1.	<p>Chemical Engineering-</p> <p>a) Thermodynamics Entropy, thermodynamic definition, molecular interpretation, variation of entropy with pressure, volume and temperature, Trouton's rule, Gibb's energy, (Maxwell relations) equilibrium constants and their calculation, Effect of pressure and temperature on equilibrium, van't Hoff equation, solutions, nonideality, and partial molar properties.</p> <p>b) Chemical Kinetics: Kinetics of complex reactions (Equilibrium, Parallel, sequential with examples), Enzyme Catalysis, Kinetics, rate law, turnover number and examples</p>	25%
2.	<p>Unit-II Material and energy balance:</p> <p>a) Material balance: Process classification, Choice of system and basis of molecular processes with chemical reactions, Material balance calculations, Multiple unit processes, Recycle and bypass</p> <p>b) Energy balance: Forms of energy, Energy balance, Energy changes in physical processes, Energy changes in reactions, Energy balance Calculations</p>	25%
3.	<p>Unit-III Equipment Design:</p> <p>a) Material of constructions: Mechanical properties, Corrosion resistance. Plastics, Ceramics, Metals and alloys, Stainless steel, Special material for food and pharmaceutical equipment Protective coatings, Surface treatment to metals for corrosion resistance</p>	25%

	b) Design of Vessels: Classification of chemical reactors, pressure vessels for internal or external pressure, Maintenance, Storage vessels for liquids and gases. Design of chemical reactors, Reactors with chemical addition, agitation, heating, removal of vapours, gas addition	
4.	Unit-IV Industrial Instrumentation: I) Measurement of temperature, Thermo couples and pyrometers, High temperature thermometers, Optical pyrometers II) Measurement of pressure and vacuum, Manometric and Bourdon gauges, Vacuum gauges, Ionization and pirani gauges. Flow measurement, Pitot tube, Rotameters ii) Liquid level indicators. Hook Type, Sight glass, Float type, Capacitance level indicator, Radiation level indicator,	25%

Teaching Learning Methodology:-	<p>Problem based learning is a cyclic learning process composed of many different stages, starting with asking questions and acquiring knowledge that in turn leads to more questions in a growing complexity cycle. Putting this methodology into practice does not only mean the exercise of inquiry by students but convert it into useful data and information. The four great advantages with the use of this methodology are.</p> <ul style="list-style-type: none"> - The development of critical thinking creative skills. - The improvement of problem solving abilities. - Increased student motivation. - Better knowledge sharing in challenging situations.
---------------------------------	--

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

Course Outcomes: having completed this course, the learner will be able to	
1.	Solve material and energy balance problems involved in the chemical process.
2.	Understand the construction and working of various equipments such as pilot tube, Rotameter for flow measurement.
	- Thermocouple, optical pyrometer for temperature measurement.
	- Bourdon gauge, Pirani gauge, Ionization gauge for pressure & Vacuum measurement.
3.	Do the process and mechanical design of chemical reactors & storage vessels.
4.	Under various concepts of thermodynamics & its implementation in chemical engineering

Suggested References	
Sr. No.	References
1.	F. A. Henglein; Chemical technology (Pergamon)
2.	J. M. Coulson, J. F. Richardson: Chemical Engineering, Vol. I, II, III (Pergamon)
3.	R. N. Shreve: The Chemical Process Industries (MGH)
4.	W. L. Badger and J. T. Bandchero: Introduction to Chemical Engineering (MGH)
5.	O. A. Hougen, R. M. Watson and R. A. Ragatz: Chemical Process Principles (Vol. I, II (JW))
6.	P. H. Groggins: Unit processes in organic synthesis (MGH)
7.	A. A. Frost and R. G. Pearson: Kinetics and Mechanism
8.	P. W. Atkins and Julio de Paule: Physical Chemistry, VIIth Edn. (Oxford University Press, 2002)
9.	S. Glasstone: Textbook of Physical Chemistry, Htted Edn. (McMillan India LTD. 1996)
10.	W. J. Moore: Physical Chemistry, XIth Edn (Orient Longmans, 1993)
11.	Thermodynamics, A core course, by R. C. Srivastava, S. K. Saha, A. K. Jain Prentice Hall of India Pvt. Ltd, 2004
12.	Industrial Instrumentation and Control by S. K. Singh Tata McGraw-Hill Publishing Company Limited, New Delhi.
13.	Chemical Kinetics by K. J. Laidler
14.	Chemical Kinetics by G. L. Agarwal

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 the students.

Major websites used for chemical education such as:- Swayam, e-pg Pathshala, Swayam Prabha, NDLI, E-Shodh Sindhu, NPTEL, Virtual Labs, Process Oriented Guided Inquiry Learning (POGIL) etc.

Sardar Patel University
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25))
Syllabus with effect from the Academic Year 2021-2022
Master of Science, Industrial Chemistry
M.Sc. Industrial Chemistry, Semester-I

Course Code	PS01CICH52	Title of the Course	General Chemical Technology-1
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	<ol style="list-style-type: none"> 1. To be able to understand the difference between unit operation and unit process in chemical industries. 2. To clarify the concept of different industrial equipment and its technique. 3. To develop and understanding of kinetics and mechanism for nitration, sulphonation, halogenation, oxidation and esterification. 4. To be able to use the methods of nitration, sulphonation, halogenation, oxidation and esterification or synthesis of its related compounds. 5. To give the basic concepts of the typical industrial manufacturing process like Batch and continuous process.
--------------------	--

Course Content		
Unit	Description	Weightage* (%)
1.	Unit-I. a. Introduction to Unit Processes b. Nitration: Nitrating agents, Kinetics and mechanism of nitration of aromatic compounds, Nitration of paraffinic hydrocarbons, Nitrate esters, N-nitro compounds, Process equipment. Typical industrial manufacturing processes	25%
2.	Unit-II Sulphonation: Sulphonating agents, Kinetics and mechanism. Desulphonation. Work-up procedures. Industrial equipment and technique, Batch and continuous processes, Manufacturing processes for detergents, dye intermediates, turky red oil etc.	25%
3.	Unit-III a. Halogenation: Kinetics and mechanism Survey of methods, Catalytic chlorination, photohalogenation, Manufacturing processes for chlorobenzene, BHC, Chlorinated methanes, monochloroacetic acid, chloral, Vinyl chloride b. Oxidation: Oxidising agents with typical applications of each. Liquid phase oxidation with oxidising compounds, Typical manufacturing processes.	25%
4.	Unit-IV. Esterification: Kinetics and mechanism. Esterification of carboxylic acid derivatives, Esters by addition to unsaturated systems, Industrial esterifications, Ethyl acetate, butyl acetate, Vinyl acetate, methyl methacrylate, cellulose acetate, xanthate and nitroglycerin.	25%

Teaching Learning Methodology:-	<ol style="list-style-type: none"> 1. To approach the effective teaching methodology it comprises chalk-duster. Discussion, group learning, problem solving, focusing on the self-confidence among the students, team work as well as encouraging the students to critical thinking and searching. 2. The students often get an opportunity to ask questions in the middle of lecture. It should maintain a discussion pattern as well as self-learning approach.
---------------------------------	---

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

Course Outcomes: having completed this course, the learner will be able to	
	At the completion of this course, students should be able to.
1.	Understand the basic concept of unit operation and unit process.
2.	Understand the reaction mechanism, kinetics and thermodynamics of unit operation.
3.	Gain knowledge about raw material agents and reaction condition required for carry out the specific unit process.
4.	Knowledge of material construction.
5.	Understand the safety and hazard criteria related to unit process.

Suggested References	
Sr. No.	References
1.	P. H. Groggins: Unit Processes in Organic Synthesis (MGH)
2.	F. A. Henglein: Chemical Technology (Pergamon)
3.	M. G. Rao and M. Sittings: Outlines of Chemical Technology (EWP)
4.	Clausen, Mattson: Principles of Industrial Chemistry
5.	H A. Lowenheim and M. K. Moran: Industrial Chemicals
6.	Kirk and Othmer: Encyclopedia of Chemical technology.
7.	Kent, Riegel's Industrial Chemistry (N-R).
8.	S. D. Shukla and G, N. Pandey: A Textbook of Chemical Technology, Vol-II
9.	J. K Stille: Industrial Organic Chemistry (P.I L).

Online -resources

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

Major websites used for chemcial education such as:- Swayam, e-pg Pathshala, Swayam Prabha, NDLI, E-Shodh Sindhu, NPTEL, Virtual Labs, Process Orientaiated Guided Inquiry Learning (POGIL) etc.

Sardar Patel University

Vallabh Vidyanagar, Gujarat

(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)

Syllabus with effect from the Academic Year 2021-2022

Master of Science, Industrial Chemistry

M.Sc. Industrial Chemistry, Semester-I

Course Code	PS01CICH53	Title of the Course	Selected Topics in Organic Chemistry
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	<ol style="list-style-type: none"> 1. To learn name-reactions and their mechanism. 2. To understand the role of chemical reagents in the oxidation reduction and transformation of various organic functional groups. 3. Recognize and draw structural isomers, stereoisomers including enantiomers and diastereomers, racemic mixture and meso compounds.
--------------------	---

Course Content		
Unit	Description	Weightage* (%)
1.	Unit-I. a Introduction to Reaction Mechanism b. Study of the following reagents: Lithium diisopropylamide (LDA), Dicyclohexyl carbodiimide (DCC), Lead tetraacetate (LTA), Tributyltin hydride (TBTH), Polyphosphoric acid (PPA), Trimethyl silyl iodide (TMSI), Lithium dialkyl cuprate (LDC)	25%
2.	Unit II Applications of following in synthesis: Birch reduction, Clemmensen reduction, Wolff-Kishner reduction, Sodium borohydride (NaBH ₄), Lithium aluminium hydride (LiAlH ₄), Oppenauer oxidation, MVP reduction, use of sodium and ethanol, Phase transfer catalysts, Polymeric reagents, Electro-organic synthesis, Hydroboration.	25%
3.	Unit - II Designing of Organic Synthesis: Disconnection approach, Introduction to synthesis, synthetic equivalent, types of disconnections Regio-selectivity, Chemoselectivity, Protection of groups, reversal of the polarity (Umpolung), retrosynthesis involving synthesis of hydrocarbons, alkenes, alcohols, ethers, aldehydes, ketones, acids, esters, monocyclic, bicyclic compounds, examples of pharmaceuticals, agrochemicals, perfumery chemicals, examples	25%

4.	Unit IV a. Rearrangements: Beckmann, Hofmann, Benzidine, Fries, Baeyer-Villiger, Berizilic Acid, Favorskii, Claisen, Pinacol-pinacolone, Dienone-phenol b. Stereochemistry: Concept of chirality, optical isomerism. R & S- nomenclature, Resolution of racemic mixtures, geometrical isomerism, E & Z- nomenclature, stereoselective synthesis	25%
----	--	-----

Teaching Learning Methodology:-	<ol style="list-style-type: none"> 1. The goal is to develop students self study ability by applying project teaching according to the blended learning module. 2. The learning strategies that could be incorporated in a comprehensive approach which deliver information, ideas and theories to a large number of students. 3. In the classroom we use chalk-duster method, some powerpoint presentation if need we also provide audiovisual resources in the virtual lab. 4. This method tends to increase the self-confidence among the students, increase the ability of providing and convincing.
---------------------------------	--

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

Course Outcomes: having completed this course, the learner will be able to	
1.	Get oneself familiarize with useful chemical transformations with regard to chemo-selectivity using hydroboration reaction to convert olefins to variety of useful derivatives.
2.	Understand the chemistry involved in oxidation- reductions by employing numerous reagents to appreciate chemo-selectivity of the reagents.
3.	Understand to use chemical reagents in organic synthesis CDA, DCC, LTA, TBTH, PPA, TMS, LDC etc.
4.	To understand the concept of stereochemistry.
5.	Know about the basics of two group (x) disconnection approach
6.	Design and write the synthetic steps based on two-group (x- disconnection approach molecules.

Suggested References	
Sr. No.	References
1.	E. S. Gould: Structure and Mechanism in Organic Chemistry (Holt-Reinhart Winston)
2.	Peter Sykes: A guide book to Mechanism in Organic Chemistry (Orient-Longman)
3.	R L. Eliel: Stereochemistry of Carbon compounds (McGraw Hill)
4.	P. S. Kalsi: Organic Stereochemistry (Wiley Eastern)
5.	R.T. Morrison and R. N. Boyd: Organic Chemistry (Prentice Hall)
6.	H.O. House: Modern Synthetic reactions (Benjamin)
7.	K. K. Carey and R. J. Sundbarg: Advanced Organic Chemistry Vol. I & II.
8.	Fieser and Fieser: Reagents for Organic Synthesis (J.W.)
9.	R. E. Ireland: Organic Synthesis (Prentice Hall)
10.	R. Adams: Organic Reactions : Various volumes I.I.S. Warren: Designing Organic Synthesis
12.	J. Fuhrhop and G. Penzlin: Organic Synthesis (VCH)
13.	J. March: Advanced Organic Chemistry

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 the students.

Major websites used for chemical education such as:- Swayam, e-pg Pathshala, Swayam Prabha, NDLI, E-Shodh Sindhu, NPTEL, Virtual Labs, Process Oriented Guided Inquiry Learning (POGIL) etc.

Sardar Patel University
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25))
Syllabus with effect from the Academic Year 2021-2022
M.Sc. Industrial Chemistry, Semester-I

Course Code	PS01EICH51	Title of the Course	Water Pollution Control Technology
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	<ol style="list-style-type: none"> 1. Aim is to clear concepts of water quantity demand of water and water with different aspects. 2. Able to understand different source of water. 3. Different methods of water treatment are studies. 4. To understand the requirement of minimization of wastage of water.
--------------------	--

Course Content		
Unit	Description	Weightage* (%)
1.	Water quantity: water and its properties, necessity of water, water demand, factors affecting water demand, population forecast by different methods. Water quality: sampling, sample preservation, physical characteristics, chemical characteristics and biological characteristics, drinking water standards, pathogens and disease, nuisance organisms	25%
2.	Supply of water: sources of water and their characteristics: water from precipitation, surface water, ground water & saline intrusion. Sewerage collection and distribution system (types of sewer, types of traps, types of sewerage system etc.)	25%
3.	Water treatment: Basic of unit operations: Aeration, limitation of aeration, types of aerators, chemical handling and feeding, coagulation and flocculation, rapid mixing, slow mixing, filtration slow sand, rapid sand pressure. Disinfection: criteria for good disinfection, factors affecting efficiency of disinfection. Chlorination: chlorine chemistry, chlorination practices in India. Introduction to advanced water treatments: Ion exchange, water softening, membrane technology, control of colour, odour, taste	25%
4.	Waste water minimization by different methods: Recycle, reuse, process modification, product/raw material substitutions, technology change etc. Water conversion by pinch technology	25%

Teaching Learning Methodology:-	<ol style="list-style-type: none"> 1. The students are given activity or tasks and engages students to learn through this way. Hence it is an activity based or commission based students are offered or asked to take part in classroom interaction through these interactive activities. 2. One characteristic defines the modern teaching method by very interactive the teacher asks the students to form small group or work as individuals to perform the learning tasks and come up with the desired results.
---------------------------------	--

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

Course Outcomes: having completed this course, the learner will be able to	
1.	It includes importance to reduce demands of water and study of water with different aspects.
2.	Study of different source of water and distribution system.
3.	Involves different water treatment to get usable water.
4.	Understand different gestures to make minimum wastage of water.

Suggested References	
Sr. No.	References
1.	Water supply and sanitary engineering ,G. S. Birdie & J. S. BirdieDhanpatipub.Co. Ltd.
2.	Ground water assessment and management.K. R. Karanath,TataMc Graw hill
3.	Advance in waste water treatment tech.vol - 2,R. K. Trivedy& N. S. Roman Globalscience
4.	Sewage disposal and air pollution engineering volume - 2 ,Garg S. K.
5.	Water supply engineering volume - 1 ,Garg S. K.
6.	Environmental Engineering, Howard Peavy

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 the students.

Major websites used for chemical education such as:- Swayam, e-pg Pathshala, Swayam Prabha, NDLI, E-Shodh Sindhu, NPTEL, Virtual Labs, Process Oriented Guided Inquiry Learning (POGIL) etc.

Sardar Patel University
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25))
Syllabus with effect from the Academic Year 2021-2022
Master of Science, Industrial Chemistry
M.Sc. Industrial Chemistry, Semester-I

Course Code	PS01EICH52	Title of the Course	Technology of oleo chemicals & surfactants
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	<ol style="list-style-type: none"> 1. Study of oil and its constitution of vegetable oil and its analysis. 2. Oil chemical are introduced. 3. Able to understand chemistry of fatty acid provide information of Application of oil chemicals to be able to understand. 4. To be able to understand classification and properties of surfactants.
--------------------	--

Course Content		
Unit	Description	Weightage* (%)
1.	Introduction to Oils, The constitution of vegetable oils and other components in vegetable oils, Constitution of fatty acids, Chemical properties of oils, Analysis of Oils, Refining of Oils Introduction to Oleochemicals, Overview of basic oleochemicals: Fatty acids, Fatty esters, Fatty alcohols, Fatty amines & Nitriles, Glycerol, Dibasic acid, Dimeric acid	25%
2.	Chemistry of fatty acids, Technology of fat splitting & hydrolysis, Separation of fatty acids, Fatty acid distillation, Fractionation of fatty acids, Fatty Alcohols, Fatty acid methyl esters, Fatty amines.	25%
3.	Applications of Oleochemicals as: Bio fuels , Agrochemicals and lubricants	25%
4.	Introduction to Surfactants, Classification, Physicochemical properties of surfactants, practical importance , of surfactants in various fields, manufacturing technology of various industrial surfactants.	25%

Teaching Learning Methodology:-	<ol style="list-style-type: none"> 1. Real life scenarios that involve case studies and ways of analyzing current problem peer to peer teaching, which involves students in their own education. Hands- on activities that engage students beyond the lecture and teach useful scientific concepts. Science project, which teach the scientific method of inquiry and experiment. Field research journals which are notes and other documentation of trusted science experiment or from the students in your classroom.
---------------------------------	--

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

Course Outcomes: having completed this course, the learner will be able to		
1.	Understand different components & properties of oil & different oil chemicals we studied.	
2.	Technology of fat splitting and fractionation of fat.	
3.	Understand the application of Bio Fuel.	
4.	Understand importance of surfactant in various field.	

Suggested References		
Sr. No.	References	
1.	Treatise on Fats, Fatty acids & Oleochemicals (vol.1 & 2), Edited by O. P. Narulla, Published by: Industrial Consultants(India), New Delhi.	
2.	Oleochemical manufacture and Applications, Edited by Frank D. Gunstone & Richard J. Hamilton, Published by: Sheffield Academic Press, England.	
3.	Handbook of Surfactants by Porter, McGraw Hill Publishers	
4.	Chemistry and Technology of Surfactants, Edited by, Richard J. Farn, Blackwell Publishing.	
5.	Surface coatings: Raw materials and their usage(Vol 1), Chapman and Hall publishers, London	
6.	Manufacture of Soaps, detergents and glycerine, Edgar, Norwood Pub.	
7.	Soaps and Detergents, By K S Parsuram, Tata McGraw Hill Pub.	
8.	Soaps their chemistry and Technology, J G Kane, Indian Central Oil seeds Co., Hyderabad.	

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 the students.

Major websites used for chemical education such as:- Swayam, e-pg Pathshala, Swayam Prabha, NDLI, E-Shodh Sindhu, NPTEL, Virtual Labs, Process Oriented Guided Inquiry Learning (POGIL) etc.

Sardar Patel University
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25))
Syllabus with effect from the Academic Year 2021-2022
Master of Science, Industrial Chemistry
M.Sc. Industrial Chemistry, Semester-I

Course Code	PS01CICH54 & PS01CICH55	Title of the Course	Practical
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	<ol style="list-style-type: none"> 1. Synthesis and quantitative analysis of organic and inorganic compounds. 2. Students are trained for the sampling, sample preparation and its standardization. 3. Describe how to use industrial equipments like Rotameter, Orifice meter etc. 4. Identification and quantitative analysis of alloy and ore. 5. The student supervised opportunities to experience the essential practical tasks emphasised in their professional study.
--------------------	--

Course Code	PS01CICH54	Title of the Course	<i>Industrial Analysis-I</i>
Total Credits of the Course	4	Hours Per Week	4

Course Content	
Unit	Description
	<i>Industrial Analysis-I</i>
1.	Preparation of Methly Orange from sulphanilic acid (Diazotization & Coupling)
2.	Preparation of P-Bromoanline from acetanlide (Halogenation)
3.	P. Bromonitrobenzene from Bromobenze (NItration)
4.	Preparation of 1,25 Tribromobenzen from Anline (Bromination)
5.	Preparation of 2, 4, 6- Tribromophene from phenol (Bromination)
6.	Prepration of picric acid from phenol (Nitration)
7.	Preparation of m-nitroniline from Nitrobenzene (Nitration & Selective Reduction)
8.	Preparation of P-Idonitrobenzene from p- nitroniline (Sand- mayer Reaction)
9.	Preparation of Terephthalic acid from p-xylene (Oxidation)
10.	Preparation of 2,5 dimethyl - benzene Sulfonic acid (Sulphonation)
11.	Benzalacetophenone from acetophenone (Claisen-schmidt reaction)
12.	Benzanilide from benzophenene oxime (Beckmann rearrangement)

Course Code	PS01CICH55	Title of the Course	<i>Chemical Engineering</i>
Total Credits of the Course	4	Hours Per Week	4

Course Content	
Unit	Description
	<i>Chemical Engineering</i>
1.	Determine of molecular weight of a polymer by using ostwald's viscometer.
2.	Determination of Dissociation constant of weak Acid using pH- Meter.
3.	To determine the conc ⁿ of strong Acid and weak acid in a mixture by a

	conductometric titration using a strong base.
4.	To determine Hardness of water sample by EDTA method.
5.	Determination of Alkalinity in given water sample by volumetric method.
6.	Electrolysis of Aqueous Sol ⁿ
7.	Flow measurement:- Rotameter.
8.	Orifice meter/ Venturic meter
9.	Alloy Solder
10.	Alloy Brass/ Bronze
11.	Determination of the amount of iron in an iron ore sol ⁿ by KMnO ₄ .
12.	Determination of dissolved oxygen in the given sample of water.

Teaching Learning Methodology:-	1. We have forged over the last few years traditional and some of the innovative approaches as teaching learning methodologies such as:- Direct instruction and performance of experiments in the laboratory.
---------------------------------	--

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

Course Outcomes: having completed this course, the learner will be able to	
1.	Synthesize different dye and drug molecules.
2.	Perform different types of chemical reaction like Bromination, Nitration, diazocoupling, sulphonation, oxidation and partial Reduction.
3.	Analyze water sample.
4.	Determine percentage of metal ion using complexometric titration.

Suggested References	
Sr. No.	References
1.	Text book of Chemistry Analysis A.I Vogel
2.	Elementary practical organic chemistry (Part-1 to 3) By A.I. Vogel.
3.	Water Quality- An Introduction Second edition, Calude E. Boyad.
4.	Advanced Practical Inorganic chemistry Gurdeep Raj Goel Publishing House, Meerut.
5.	Instrumental Method of Analysis By Gurdeep Chatwal and Anand Edition- 2018 by Himalya Publishing
6.	Industrial Instrumentation and Control by S.K. Singh Tata McGraw Hill Publishing Company Limited, New Delhi.
7.	Online Resources to be used if available as reference material- (Same)
8.	Soaps their chemistry and Technology, J G Kane, Indian Central Oil seeds Co., Hyderabad.

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 the students.

Major websites used for chemical education such as:- Swayam, e-pg Pathshala, Swayam Prabha, NDLI, E-Shodh Sindhu, NPTEL, Virtual Labs, Process Oriented Guided Inquiry Learning (POGIL) etc.

Sardar Patel University
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25))
Syllabus with effect from the Academic Year 2021-2022
Master of Science, Industrial Chemistry
M.Sc. Industrial Chemistry, Semester-I

Course Code	PS01CICH56	Title of the Course	Comprehensive Viva
Total Credits of the Course	1	Hours Per Week	1

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

* * * *