Sardar Patel University

Programme- M.Sc.
(Under Choice Based Credit Scheme)
Semester- II
Structure with effect from: 2021-22
M.Sc. Industrial Chemistry

Course Type	Course Code	Name of Course	T/P	Credit	Exam Duration in hrs	Component of Marks		
						Internal	External	Total
						Total/ Passing	Total/ Passing	Total/ Passing
Core Course	PS02CICH51	Polymers	T	4	3	30/12	70/28	100/40
	PS02CICH52	Chemistry in Industrial Process-II	T	4	3	30/12	70/28	100/40
	PS02CICH53	Common Chemicals in Industires	T	4	3	30/12	70/28	100/40
	PS02CICH54	Industrial Analysis-II	P	4	3	30/12	70/28	100/40
	PS02CICH55	Chemical Engineering Practicals-II	P	4	3	30/12	70/28	100/40
	PS02CICH56	Comprehensive Viva-Voce	-	1	-	-	50/20	50/20
Any one Elective	PS02EICH51	Modern Instrumental Methods of Analysis	T	4	3	30/12	70/28	100/40
	PS02EICH52	Environment, Health and Safety Measures	T	4	3	30/12	70/28	100/40

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-II

Course Code	PS02CICH51	Title of the Course	**Polymers**
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	1. Provide the students with fundamental principles of polymers, classification, preparation, structure and properties. 2. Provide students with an opportunity to identify different types of polymers in our surrounding. 3. The students will be able to differentiate between natural and man-made polymers, explain polymerization methdos, and understand polymerization kinetics and uses of polymers. 4. To study the fundamental concepts of polymer chemistry.

Course Content		
Unit	**Description**	**Weightage* (%)**
1.	***Unit-1*** Brief history of inacromolecular science General characteristics of polymers in comparison with organic compound, Nomenclature, Distinction between plastics, Elastomers, Fibres and liquid resins, classification of polymers. **TYPES OF POLYMERS AND POLYMERISATION:** Homoplastics and thermosetting, funnctionality concept, Concept of cross-linking-linear, Branched and cross-linked polymers. Addition, Condensation, Ionic, Co-ordination, Addition-Polymerieation Mechanism (Initiation, propagation and termination processes), Initiators, Inhibitors, Mechanism of Ionic polymerization. **METHODE OF POLYMERISATION:** Bulk, Suspension, Emulsion, Solution. Necessity of co-polymers and co-polymerization, blocks and grapht co-polymers.	25%
2.	***Unit- II*** Molecular weight and molecular weight distribution-number, weight and Viscosity average molecular weights of polymers, Methods of determining, Molecular weight. **PROPERTIES OF POLYMERS:** Viscosity, Solubility, Optical, Electrical, Thermal and mechanical properties of polymers. **POLYMER PROCESSING:** Compression, Moulding, causting, Extrusion, Fibre spinning, Injection moulding, Thermoforming, Vulcanisation of elastomers.	25%
3.	***Unit- III*** Introduction, concepts of kinetics of polymerization and car other's relation, Glassy state, Glass transition temperature, TGA, Factor's affecting GTT, Ciystallinity in polymers.Degradation of polymers by thermal, oxidative, Mechanical and chemical methods. Detailed study of the fallowing thermosetting polymers with respect to synthesis, Chemistry properties and applications:	25%

	(i) Phenol formaldehyde resins. (ii) Amino resins- urea-formaldehyde and molomine-formaldehyde reaction, polyurethanes. (iii) Epoxy resins -gr ades of epoxy resins, curing process and its importance with mechanism. (iv) Polycarbonates and silicones. (v) Elastomers- polyisoprene, Polybutadiene, Neoprene.	
4.	***UNIT- IV*** Detailed study of the following thermoplastic polymers with respect to synthesis, chemistry, properties and applications: (i) Polyolefms- Polyethylenes, Polypropylene, Ethylene-Propylene Copolymers. (ii) Polyvinyl Chlorides- Grades of PVC, Teflon, Polyvinyl acetates and polyacetals. (iii) Polyestyrene- Homopolyners, copolymers such as SBR, ABS, SAN. (iv) Polyamines- Nylon-6, Nylon-66 and other Nylons. (v) Polyethers and polyesters- Terephthatates, Crown ethers. (vi) Cellulosics such as esters, ethers, acetates, butyrates, nitrates, CMC Regenerated celluloses.	25%

Teaching Learning Methodology:-	The presence of faculty members to provide advice, academic advice and academic guidance to the student in need within the six hours a week available to all students. The course consists of classroom lessons, the resolution of numerical example relating to the issues addressed and discussions with students. Video projection of the lessons is used in classroom. The students are also able to obtain directly the above material form the Department/ Univeristy/ Digital Library Service.

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	
1.	Explain the step-growth and chain-growth polymerization with respect to synthesis mechanisms and kinetics.
.2	Explain the cystalline melting temperature and glass transition temperature including the influence of kinetics.
3.	Explain the flow properties of polymer melts and polymer solutions with respect to both temperature and Mol. Wt.
4.	Distinguish between enthalpic and entropic contributions to polymer cystalization and evaluate factor such as polymer structure, Molecular weight, branching and dilution on cystallinity.

Suggested References	
Sr. No.	**References**
1.	"Heterocyclic Chemistry" Vol, 1-3 R.R. Gupta, M. Kuinar and V. Gupta, Springer, Verlag
2.	The Chemistry of Heterocycles, T. Eicher and S. Hauptmann, Thieme.
3.	Heterocyclic chemistry, J.A. Joule, K. Mills and G.F.Smith, Chapman and Hall.
4.	Heterocyclic chemistry, T.L. Gilchrist, Longmane Scientific Technical
5.	Contemporary Heterocyclic chemistry. G.R. Newkome and W.W. Poaudler, Wiley-Inter Science.
6.	An Introduction to the Heterocyclic Compounds, R.M. Acheson, John Wiley.
7.	Comprehensive Heterocyclic Chemistry, A. R. Katritzky and C.W. rees. Eds. Pergamon Press.

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
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Syllabus with effect from the Academic Year 2021-2022
Master of Science, Industrial Chemistry
M.Sc. Industrial Chemistry, Semester-II

Course Code	PS02CICH52	Title of the Course	**Chemistry in Industrial Process-II**
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	1. The objective of this course is to introduce the basic concept of chemical engineering to students. 2. To introduce the concepts of mass transfer operations like distination, drying, leadhing, extroction, cystalization & gas absorption to students. 3. To make them understand about heat transfer operations carried out in chemical industry.

Course Content		
Unit	**Description**	**Weightage* (%)**
1.	***Unit -I*** **Distillation:** Boiling and distillation, vapor-liquid equilibria, Rault's law & Henry's law, relative volatility, azeotropic mixtures, flash distillation, steam distillation, vacuum distillation, fractional distillation, plate columns (Bubble cap, Sieve plate & Valve plate). **Extractions:** Liquid equilibria, Extraction with reflux, Extraction with agitation, equipment, it's use and performance, continuous contact equipment, agitator extractors, packed spray extractors, Leaching, flow sheets of solid-liquid extraction, continuous leaching, counter current extraction.	25%
2.	***Unit -II*** **Filtration:** Classification of filters, Sand filters, filter press, plates & frame press, filter aids, principles of leaf filters. **Flow of Heat:** Introduction, Conduction (Fourier law, Thermal conductivity, thermal insulation & problems), Convection (rate of heat transfer and heat transfer coefficients), Radiation (Absorptive, Reflectivity, & Transmissivity, Kirchoff s law concept of black body & examples) Heat Exchange Equipments: Introduction, Double Pipe, Shell& tube, Fixed tube, U tube heat exchangers.	25%
3.	**Unit -III** **Crystallization:** Growth of Crystal, saturation, nucleation supersaturation, (Mier's theory), Caking of crystals, effect of impurities, Classification of ciystallizers, Agitated tank, Swenson walkers, Kiystal, Oslo, continuous vaccum crystallizers. **Drying:** General Principles (Significance, moisture content), Rate of drying (Constant & falling rate period, factors affecting drying), Drying equipments, Tray diyers, Rotary dryers, Single Drum diyer & Spray dryers.	25%
4.	***Unit IV*** **Evaporation:** Types of evaporators, jacketed, horizontal and vertical tube evaporators, forced circulation evaporations, enttainment separators	25%

	(upturned, deflector type, tangential type), effect of scale formation, multiple effect evaporators. ***Gas Absorption:*** Definition, examples, comparison of absorption and distillation, conditions of liquid- gas equilibrium, solution criteria for gas absorption, mechanically agitated vessels. Packed columns, and plate columns, (Characteristics of tower packing, Types of packing) merits of plate & packed tower.	

Teaching Learning Methodology:-	Design thinking applied stems from industrial designers and their unique method to solve problems and satisfy the needs of their clients. Applied to education this model makes possible to identify with greater accuracy the individual problems of each studnet and generate in their educational experience the creation and innovation towards the satisfaction of others which then become symbiotic.

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	
1.	Understand the construction and working of various equipments used for distillation, gas absorption, vaporation, drying, crytalization, extraction and leaching.
.2	Analyse various mass transfer systems.
3.	Design common heat exchanges like shell & tube heat exchanger, double pipe heat exchanges with design parameters.
4.	Understand the three modes of heat transfer.
5.	Understand filtration operation that is carried out in chemical industry.

Suggested References	
Sr. No.	**References**
1.	F. A. Henglein: Chemical Technology (Pergamon).
2.	J. M. Coulson, J. F. Richardson: Chemical Engineering, Vol. I, II, IE (Pergamon).
3.	R.N. Shrove: The Chemical Process Industries (MGH).
4.	WX. Badger and J.T. Bandchero: Introduction to Chemical Engineering (MGH).
5.	A. Hougen, K.M. Watson andRA. Ragetz: Chemical Process Principles, Vol. I, II (JW).
6.	P.H. Groggins: Unit Processes in Organic Synthesis (MGH)
7.	G.H. Morrison & H. Freiser: Solvent extraction in Analytical Chemistry (John Wiley)
8.	K.A. Gavhane: Unit operations II (Nirali Prakashan, Pune)

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.

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Sardar Patel University

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Syllabus with effect from the Academic Year 2021-2022
Master of Science, Industrial Chemistry
M.Sc. Industrial Chemistry, Semester-II

Course Code	PS02CICH53	Title of the Course	**Common Chemicals in Industries**
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	1. Imparting knowledge and technical skills for better processing and value adition of Food and Agro-products. 2. Cultivating strong ethical values for sustainable modern and safe food to society. 3. To make the students understand chemistry various intermediates used for chemical industry in general and Dyestuff industry in particular. 4. To make them undersand the unit process and their relevance in chemical industries.

Course Content		
Unit	**Description**	**Weightage* (%)**
1.	***Unit-I:*** **Dairy Chemistry:** Milk and milk products, composition and structure of milk, milk proteins, enzymes, vitamins, minerals, density and viscosity of milk, effect of heat on milk, milk processing, basic milk categories, butter, ghee and clarified butter- **Leather Chemistry:** Introduction, constituents of animal skin, manufacture and preparation of hides, cleaning, soaking, limiting and degreasing, finishing and sharing, tanning; leather, vegetable, chrome, tanning effluents; pollution and control. **Phosphorus industries:** Calcium phosphate, manufacture of phosphoric acid, single and triple superphosphate, baking powder and DAP. **Sulphur and Sulphuric acid:** Mining and manufacture of sulphur and manufacture of sulphuric acid by contact process. **Nitrogen Industries:** Manufacture of Urea, calcium cyanamide, ammonium nitrate, nitric acid.	25%
2.	***Unit-II*** ***Dyes and Pigments:*** Classification of Dyes, Methods of preparation of commercial dyes of different classes with suitable examples. Typical manufacturing processes of few dyes, Fluorescent brightening agents, Photosensitive dyes, dyes as food additives, natural dyes. Oils, Soaps and Detergents: Refining of edible oils, Manufacturin g of soaps, Detergents, Liquid Soaps. Manufacturing of fatty Acids and glycerol, greases from fatty acids, turkey -red oil ***Soil Chemistry:*** Introduction, formation, classification and reactions of soil, soil acidity, alkalinity, productivity and fertility, chemical fertilizers and then effect, organic manures, micronutrients, bio-fertilizers.	25%
3.	***Unit-III*** **Food Chemistry:** Classification, chemical composition and nutritional value of common food stuffs, properties of foods, food preservation and processing, food deterioration, methods of preservation and processing by	25%

	heat, cold, chill storage, deep freezing, drying, concentration, fermentation, and radiation, Food quality; senoiy evaluation, objective methods, non-nutritional constituents and food safety. Permitted food additives and their role; Antioxidants, coluring agents, flavours, emulsifiers, curating agents, non-curative sweeteners, flour improvers, leavening agents, stabilizers, thicckners and preservatives. **Glass and Refractory materials:** Raw materials, Soda glass, borosilicate glass, Lead Glass, Colored Glass, Refractory: Raw materials, clay pots, Zeolites.	
4.	***Unit-IV*** ***Agrochemicals:*** **Organophosphorus pesticides:** Malathion, Monoerotophos, dimethoate, chloropyriphos, Dichlorpyriphos, Dichlororous, phentlioate. **Carabamates:** Carbonyl, Bygon, Zirman, Zineb, Maneb, Alaicarb. **Pyrenthroids:** Natural pyrenthrins, Isolation and structures, synthetic Pyrethroids; Allethrin, cypennethriiL Phenvalerate. **Insect Pheromones and Repellants:** Pheromones, general introduction and applications in integrated pest management (No Synthesis). **Repellents: Survey and synthesis of the repellents:** N,N, Diethyl - 3methyl- Benzamide, N,N-Diethyltohiamide, 2 - Ethyl -1,6- hexanedial, Butopytranexyl, Dimethylcabonate, Dhnethylteiphthalate, Use Pheromones in pest management.	25%

Teaching Learning Methodology:-	The development of skills in problem solving, critical thinking and analytical reasoning as applied to scientific problms. Syllabus includes classroom teaching, e-resources, demonstration discussion, group learning, focusing on the self-confidence among the students, brain storming or combination of all. It is used to stimulate students in reflection and help them improvement of technical skills and social relations.

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	
1.	Students will learn about shelf life of different dairy products.
.2	Understand the important industrial process for surfactnat.
3.	Understand the importance of vegetable and animal fats and oil as renewable source of chemicals.
4.	Understand the basic rules of glas formation, chemical compopsition of glass and the process steps.
5.	Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.

Suggested References	
Sr. No.	**References**
1.	N.N. Melnikow: Chemisfty of Pesticides, Springer
2.	M. B. Green, G. S. Hartley West: Chemicals for Crop Protection and Pest Management, Pergamon.
3.	R. Cremlyn: Pesticides
4.	K.H. Buchel: ChemisUy of Pesticides.
5.	H.B. Scher: Advances in pesticides formulation Technology (ACS)
6.	K. Venkatraman: The Chemistiy of Synthetic Dyes Vol. 1-7 (A.P)
7.	Abranart: Dyes and Their intermediates (Pergainan).
8.	Beech: Fiber reactive Dyes (Logos Press).
9.	Frig and David - Dyes intermediate.
10.	Allan: Color Chemistry
11.	Kent-Riegels: Industries Chemistry.
12.	M Ash & I Ash: A formulaiy of paints & other coatings.
13.	L. W. Aurand, A. E. Woods, Food Chemistiy, AVI Publishing Inc.
14.	L. H. Mayer, Food ChemisUy, Affiliated East-West Press Ltd., New Delhi.
15.	N. Shakuntala Manay, M. Shadakhsara Swamy, Foods-Facts and Principles.
16.	JohnM. deMan, Principles of Food Chemistiy.
17.	F A Henglein: Chemical Technology (pergamon).
18.	R.W. Thomas and P. Farago: Industrial Chemistry (HEB).
19.	K. Bhogavathi Somdavi: Applied ChemisUy, MJP Publications, 2006.
20.	C.K. Sharma: Industrial Chemistry, Goel Publishing House, Meemt, 2011

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.

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Master of Science, Industrial Chemistry
M.Sc. Industrial Chemistry, Semester-II

Course Code	PS02EICH51	Title of the Course	**Modern Instrumental Methods of Analysis**
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	1. It helps to understand the concept of errors and types of errors and also help to evaluate data without error. 2. Study of electircal activity of chemical compound through Polarography technique. 3. Concepts of thermogravimetric analysis, differential scanning and thermal scanning are covered. 4. Clear the Fundamental of chromatography, HPLC, GEL permeation chromatography and Ion exchange chromatography.

Course Content		
Unit	**Description**	**Weightage* (%)**
1.	***Unit-I*** **Errors and Evaluation:** Definition of terms mean and median, precision, standard deviation, relative standard deviation, accuracy, absolute error, relative error, types of error in experimental data, determinate (systematic), indeterminate (random) and gross, sources of errors and their effects upon the analytical results, statistical evaluation of data-nonnal distribution, interval estimation, methods of least squares.	25%
2.	***Unit-II*** ***Polarographic Techniques and Voltammetry:*** Polarography; Theory, Instrumentation mid itn working; Advantages of using dropping mercury electrode, Derivation of Ilkovic equation, Factor* iiffecling the limiting current, The half wave potential, Criterion of reversibility, Applications of polarography, Square-wave polarography, Differential pulse polarography and cyclic voltammetry showing cyclic voitmiimetric excitation.	25%
3.	***Unit-III*** **Thermal Methods:** Thennogravimetric analysis, Instrumentation and Applications, Diftbrcntml thermal analysis, General principles and applications with special reference to polymers; DUTorential scanning calorimetiy, Theory and different types of thermal scanning calorimetry, Instruments, Power compensated DSC instrument, Heat flux DSC instrument and modulated DSC instrument, SC data analysis and applications.	25%
4.	***Unit-TV*** **Chromatography:** Chromatographic mechanism, Classification of chromatography, ptitioipleH, typos, techniques of colnmn chromatography and techniques of elution, dun layer chrwnatogniplіy, Gas chromatography, Applications of gel permeation and ion exchange chromatography. Introduction of 11 PLC, instrumentation, reverse phase HPLC, industrial applications of HPLC..	25%

Teaching Learning Methodology:-	The study activities are supposed to be spread over the period which gives significant results. Students are encouraged to do distributed practice in which they learn the subject throughout the term. Some brainstorming sessions are included in the classroom. E-learning is also included so that students can imagine the instruments properly.

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	
1.	Able to conclude chemical evaluation without error.
2.	Easily compute electrical activity of chemical compound using polarographic technique.
3.	One can easily conclude data analysis through thermal gravimetric method.
4.	Will have complete theoretical knowledge of chromatography and HPLC.

Suggested References	
Sr. No.	**References**
1.	Fundamentals of Analytical chemistiy, Douglas A, Skoog, Donald M. West, F. JamoH Holler, 7th edition, Harcourt college publications.
2.	Principles and practice of analytical chemistry, F. W. Fifteid, D. Keatey, 5 ih edition, Blackwull publication.
3.	Analytical chemistry, Gary D. Christian, 6thedition, Wiley and sons publication.
4.	Handbook of instrumental techniques for analytical chemistry, Frank A Settle, Prentice I lall Publication. Analytical chemistiy- Instrumental Techniques (Vol II) - Mahindu Singh, Dominant publishers.
5.	Basic concepts of analytical chemistry, S. M. Kopper, New Age International Publishers
6.	Analytical chemistry, D. Kealey, PJ.Haines, Viva books Pvt Ltd.

Online -resources

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Master of Science, Industrial Chemistry
M.Sc. Industrial Chemistry, Semester-II

Course Code	PS02EICH52	Title of the Course	**Environment, Health and Safety Measures**
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	1. Demonstrate knowledge of chemical and biochemical principles of fundamental environmental processes in air, water etc. 2. To recognize different types of toxic subcutaneous & responses and analyze toxicological information. 3. To Apply basic chemical concepts to analyze chemical processes involved in different environmental problems. 4. To describe water purification and waste treatment processes and the practical chemistry inovlved. 5. To make the students aware about GLP for understanding of uniformity, consistency, reliability, reproducibility, quality and integrity of chemical non-clinical safety tests, from physio-chemical properties through acute to chronic toxicity tests.

Course Content		
Unit	**Description**	**Weightage* (%)**
1.	***UNIT I:*** **Air Pollution, Analysis & Control Methods:** Qualitative study of environmental segments, air pollutants, prevention & control, Green house gases & acid rain. Carbon monoxide, industrial sources & tranportation sources. SOx-sources, control techniques-scrubbing, limestone injection process. Ozone hole & CFCs.Photochemical smog & PAN. NOx -Sources, NO*,control techniques. Particulates: Size distribution, particulate collection-settling chambers, centrifugal separators, wet scrubbers, electrostatic precipitators & fabric filters. Analysis of air pollutants, Dispersion of air pollutants-weather, wind speed and acidity	25%
2.	***UNIT II:*** **Water, Waste Water Treatment and Analysis:** Hydrologic cycle, sources, criteria & standards of water quality- safe drinking water, maximum contamination levels of inorganic & organic chemicals, radiological contaminants, turbidity, microbial contaminants. Public health significance & measurement of colour, turbidity, total solids, acidity, fluoride, alkalinity, hardness, chloride, residual chlorine, sulphate, fluoride, phosphate 8l different forms of nitrogen in natural & polluted water.	25%
3.	***UNIT III:*** **Quality Control and Quality Assurance:** Role, Government standards like ISI, MINAS, Agmark, I.P., ASTM. Concepts of quality and quality control, the nature of variabilities. Specification and tolerances, sampling inspection, cost reduction and quality improvement experiments. Optimization. Basic concepts of quality assurance, quality acceptance, sampling,	25%

	reliability, cost aspects of quality decisions. Quality control in raw materials, production (in process) and finished product, Current trends in quality control, ISO 9000 and ISO 14000 series. Laws related to quality control. ISO 17025. **Chemical Warfare Convention:** Definitions and schedules. Toxic chemicals, remote control systems, tear gas, chemical weapons, ocean dumping of chemical weapons.	
4.	***UNIT -IV:*** ***Good Laboratory Practices:*** Safety equipments, personal protective equipments, compressed gas safety, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals. Emergency response-Chemical spills, radiation spills, biohazard spills, leaking compressed gas cylinders, fires, medical emergency accident reporting.Safety rulesof laboratory acquaintance of experimental set up and instruments, intellectual property and intellectual property rights. Data management, importance of safety and security of data.	25%

Teaching Learning Methodology:-	It is a teaching strategy generally adopted to promote team-work and develop critical thinking, analytical abilities and positive attitude among learners. The environmental issues to be discussed by the students could be presented through slide shows or explain by teacher. The syllabus is designed on the method of acquisition of knowledge on the development of skills and the establishment of work habits as their main goals.

Evaluation Pattern		
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1.	Internal Written/ Practical Examination (As per CBCS R.6.8.3)	15%
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3.	University Examination	70%

Course Outcomes: having completed this course, the learner will be able to	
1.	Have knowledge of key themes, theories and problems and describe important chemical reactions in connection with smog formation ozone chemistry and acid rain chemistry.
2.	Studnets able to know about air pollution and its effects group and scale air pollution sources, plan measurement and monitoring of air pollutatnts.
3.	Students are familiar with application of safety in good laboratory and field practices.
4.	To make aware about the concepts and requirements necessary for compliance with good laboratory practice. (GLP)
5.	To understand the principles of GLP and it's regularity basis, and provide guiodeliness & better control for maintanance of instruments, environment control, preservation of test records etc.

Suggested References	
Sr. No.	**References**
1.	Environmental Chemistry, A.K. Dey, Wiley Eastern.
2.	Environmental Chemistry, S.K.Baneqi, Prentice Hall India, 1993.
3.	Chemistry of Water Treatment, S.D. Faust and O.M. Aly, Butterworths,1983,
4.	Environmental chemistry, Ahluwalia V K, Anne Books India, 2008.
5.	Chemistry for Environmental Engineering, Sawver and McCarty, McGraw Hill, 1978,
6.	Evnironmental Chemistry, I Williams, John Wiley, 2001.
7.	Staistical Quality Control, 2nd Edn., Manohar Mahajan Dampat Rai and Sons. 1995.
8.	Quality Management Process improvement approach, Fryman Mark A, Cengage Larning, 2002.
9.	Quality Control, Paranthaman D, Tata, McGraw Hill, 1987.
10.	Gupta R.N. Chmecial Warfare and Causility management 2011.
11.	Vyas M.N. Safety and Hazards Managemnet in Chemical Industries 2013. Atlantic Publication.
12.	Dikshith T.S.S. Safety Evaluation of Environment Chemicals. New Age International, 1996.
13.	Chemical Safety Matters- IUPAC - IPCS, Cambridge Univ. Press, 1992.

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Syllabus with effect from the Academic Year 2021-2022

Master of Science, Industrial Chemistry

M.Sc. Industrial Chemistry, Semester-II

Course Code	PS02CICH54 & PS02CICH55	Title of the Course	**Practicals**

Course Objectives:	1. Introduce students to the practical application of polymers. 2. Introduction of heat-transfer concepts and mass-transfer cocnepts to students. 3. Introduction about chemistry fundamentals involved in dairy industry to the students. 4. The students will be exposed to and will apply the basic principles involved in the study of critical micelle concentrations (CMC) and surface active parameters of surfactants by surface tension method. 5. Introduction of the quantities involved in water analysis.

Course Code	PS02CICH54	Title of the Course	**Industrial Analysis-II**
Total Credits of the Course	4	Hours Per Week	4

Course Content		
Unit	Description	
1.	***Industrial Analysis -II*** 1. Determination of fat in Milk by Gerber method. 2. Detection of Adulterants in Milk by odified Seliwanoffs method. 3. Detection of Sodium Chloride in Milk. 4. Turbidity test for checking Efficiency of Sterilization in liquid milk. 5. Determination of CO3 and HCO3 in water. 6. Determination of the CMC and Surface active parameters of surfactoants by Surface tension method. 7. To deterime the chloride content of give water sample. 8. Interfacial polycondensation of PA using hexymethylenediamine and Sebacic acid chloride 9. Synthesis of Isotactic PMMA (Polymethy / Methacrylate) 10. Synthesis of Syndiotactice Polymethyl Methacrylate (PMMA)	

Course Code	PS02CICH55	Title of the Course	**Chemical Engineering Practical - II**
Total Credits of the Course	4	Hours Per Week	4

Chemical Engineering Practical - II

1. Single stage teaching
2. Multistage teaching
3. Single stage extraction.
4. Humidifiction.
5. Drying
6. Batch distillation
7. Steam distillation
8. Multicomponent distilation
9. Filtration

Teaching Learning Methodology:-	It is a teaching strategy generally adopted to promote team-work and develop critical thinking, analytical abilities and positive attitude among learns. The environmental issues to be discussed by the students could be presented through slide shows or explain by teacher. The syllabus is designed on the method of acquisition of knowledge on the development of skills and the establishment of work habits as their main goals.

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.	Demonstrate an ability to quickly acquire knowledge in new polymerrelated applications and to acquire new knowledge for the innovation and development of polymer materials and related process also with respect to sustainability considerations.
2.	Learning about basic concept of design in dairy plant in milk and other products.
3.	Current awareness of quality and safety of dairy farm.
4.	Students would get the knowledge about teaching, filtration, distilation and Extraction instruments.
5.	They will have an exposure to chemical industry on a lab scale.

Suggested References	
Sr. No.	**References**
1.	Mass- Transfer Operations by Robert E. Treybal, 3rd Edition Mc.Graw Hill International Edition.
2.	Unit- Operation of Chemical Engineering, 7th Edition by Warren L. McCabe, Julian C. Smith and Peter Harriott, Mc.Graw Hill Internaional Edition.
3.	Unit- Operation (II) Heat and Mass Transfer by. K.A. Gavahane, Nirali Publication.
4.	Polymer Science by V.R. Gowariker, N.V. Viswanathan and Jaydev Sreedhar, new Age International Publishers.
5.	The Elements of Polymer Sciecne and Engineering- Second Edition by Alfred Rudin

6.	Milk- Analysis, a Practical Treatise on the Examination of Milk and It's derivatives, Cream, Butter and Chese. By James Alfred.
7.	Water- Analysis: A Practical Treatise ont he Examination of Potable Water by James Alfred Wanklyn, Ernest Theophron Chapman.
8.	Water Quality - An Introduction, Second Edition, Claude E- Boynd.

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-II

Course Code	PS02CICH56	Title of the Course	**Comprehensive Viva**
Total Credits of the Course	1	Hours Per Week	01

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

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