



**SARDAR PATEL UNIVERSITY**  
**Vallabh Vidyanagar, Gujarat**  
**(Reaccredited with 'A' Grade by NAAC (CGPA 3.25))**  
**Syllabus with effect from the Academic Year 2022-2023**

**PROGRAMME STRUCTURE**  
**Master of Science in Chemistry**  
**MSc (Analytical Chemistry) Semester: IV**

<p>Programme Outcome (PO) - For MSc Chemistry Programme</p>	<p>Master of Science program provides extended theoretical and practical knowledge of different science subjects. Master of Science programme at Sardar Patel University is designed keeping the overall back ground preparation in mind for the student to either seek a job or to become an entrepreneur. The students, after completion of Bachelor of Science can select the master's programme in the subject they have had at the final year or in a related discipline (depending upon eligibility criteria prescribed by university).</p> <p><b>Programme outcomes: At the end of the program, the students will be able to</b></p> <ol style="list-style-type: none"><li>1. Have a deep understanding of both the theoretical and practical concepts in the respective subject.</li><li>2. Understand laboratory processes and use scientific equipments and work independently.</li><li>3. Develop research temperament as a consequence of their theory and practical learning.</li><li>4. Communicate scientific information in oral and written form.</li><li>5. Understand the issues related to nature and environmental contexts and think rationally for sustainable development.</li><li>6. The students are able to handle unexpected situations by critically analyzing the problem.</li></ol>
<p>Programme Specific Outcome (PSO) - For MSc Chemistry Semester - IV</p>	<p>Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Analytical Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Chemistry and Industrial polymer Chemistry.</p> <p>After completing M.Sc. chemistry program, students will be able to:</p> <ul style="list-style-type: none"><li>■ Demonstrate and apply the fundamental knowledge of the basic principles in various fields of Chemistry.</li><li>■ Apply knowledge to build up small scale industry for developing endogenous product.</li><li>■ Collaborate effectively on team-oriented projects in the field of chemistry or other related fields.</li><li>■ Communicate scientific information in a clear and concise manner both orally and in writing.</li><li>■ Inculcate logical thinking to address a problem and become result oriented with a positive attitude.</li><li>■ Enhance the scientific temperament among the students so as to develop a research culture and implementation of the policies to tackle the burning issues at global and local level.</li></ul>



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	<ul style="list-style-type: none"> <li>■ Apply the knowledge to develop the sustainable and eco-friendly technology.</li> <li>■ Take up global level research opportunities to pursue Ph.D programme targeted approach and specific competitive exams conducted by service commission</li> <li>■ Accept enormous job opportunities at all level of chemical industries, pharmaceutical industries and placements in R &amp; D.</li> </ul>
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<b>To Pass</b>	At least 40% Marks in the University Examination in each paper and 40% Marks in the aggregate of University and Internal examination in each course of Theory, Practical & 40% Marks in Viva-voce.
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Course Type	Course Code	Name of Course	Type of Course	T /P	Credit	Hours per Week	Exam Duration in hrs	Component of Marks		
								Internal	External	Total
								Total/Passing	Total/Passing	Total/Passing
Core Course	PS04CANC51	Spectroscopy-II	EM & EN	T	4	4	3	30/10	70/28	100/40
	PS04CANC52	Elements of Analytical Chemistry	EM	T	4	4	3	30/10	70/28	100/40
	PS04CANC53	Analysis of Industrial Products	EM& EN	T	4	4	3	30/10	70/28	100/40
Core Course (Any One)	PS04CANC54	Practicals <b>OR</b>	EM&SD	P	4	8	6	30/10	70/28	100/40
	PS04CANC55	Project work*	EM&SD	P	4	8		30/10	70/28	100/40
Core Course (Any One)	PS04CANC56	Practicals <b>OR</b>	EM&SD	P	4	8	6	30/10	70/28	100/40
	PS04CANC57	Project work*	EM&SD	P	4	8		30/10	70/28	100/40
Core Course	PS04CANC58	Comprehensive Viva		-	1	1			50/20	50/20
Elective Course (Any one)	PS04ECHE51	Environmental Chemistry and analysis	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE52	Analysis of Pharmaceuticals drugs	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE53	Selected Topics in Advanced Inorganic Chemistry-II	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE54	Inorganic Polymers and Inorganic Materials	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE55	Selected Topics in Polymers-III	EM& EN	T	4	4	3	30/10	70/28	100/40



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	PS04ECHE56	Selected Topics in Polymers- II	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE57	Surface Chemistry and Catalysis	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE58	Introduction to Different Materials	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE59	Topics in Organic Chemistry	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE60	Applied Organic Chemistry	EM& EN	T	4	4	3	30/10	70/28	100/40
					25					650
Add-on Course		MOOCs course from Swayam Portal								

**EMPLOYABILITY = EM, ENTREPRENEURSHIP = EN and SKILL DEVELOPMENT = SD**

\* **Project work** (as optional) in place of practicals; to be offered to some of the students, based on their merit, interest and placement with the teachers (Marks : 200). The project shall have to be carried out under the allotted teacher(s) and a dissertation shall be submitted and will be assessed for internal (60 marks) and external (140 marks), in the usual manner.



**Master of Science, Analytical Chemistry**  
**M. Sc. Analytical Chemistry, Semester – IV**

Course Code	PS04CANC51	Title of the Course	Spectroscopy-II
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	<p>From this course students may get to know the following:</p> <ol style="list-style-type: none"><li>1. Understand the systems and technology that drive atomic absorption/-emission spectrometry and also learn which type of samples can be analyzed by AAS/AES and the requirements of good sample preparation along with recognize and correct for factors that interfere with accurate data analysis.</li><li>2. The fundamental physics of emission of light; various processes for emission of light from materials exposed to different external energy sources; Rules to understand the emission of light.</li><li>3. To understand the transitions through electronic spectroscopy.</li><li>4. Microscopic methods provides the student with theoretical knowledge of advanced techniques of microscopy, microanalysis and image analysis as tools for investigating.</li></ol>
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Course Content		
Unit	Description	Weightage* (%)
1.	<b>Atomic Absorption/Atomic and Flame Emission Spectroscopy:</b> Absorption of radiation by atoms; equipment: radiation sources (Hollow cathode lamps and electrode less discharge lamps); atomizers (Flame and carbon); wavelength selector and detectors; interferences in atomic absorption spectroscopy; applications and problems: qualitative and quantitative analysis. Introduction to plasma, arc and spark emission spectroscopy; equipment: inductively coupled plasma spectrometer and flame photometer; applications and problems.	25
2.	<b>Molecular Luminescence Spectroscopy:</b> Introduction to molecular luminescence (fluorescence, phosphorescence and chemiluminescence); theory of luminescence; instruments for measuring fluorescence (fluorometer and spectrofluorometer); application and problems.	25
3.	<b>Electron Spectroscopy:</b> Introduction to electron spectroscopy (ESCA Auger and UPS); principle and theory of ESCA; instrumentation; chemical shifts, satellite peaks and spectral splitting; application and problems. Principle and electron transition of Auger electron spectroscopy; equipment; applications and problems.	25
4.	<b>Microscopic Techniques:</b> Introduction to Scanning electron microscopy (SEM), Scanning tunneling	25





	microscopy (STM) and Atomic force microscopy (AFM); basic principles and theory; instrumentation and operating parameters and applications.	
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Teaching-Learning Methodology	Lectures (3 hours per week), Seminar (1 hour per week), Tutorial, Continuous evaluation by quizzes, Discussions, Questioning, Problem Solving, Demonstrations (Such as models, laboratory work, and Industrial visits )
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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.	Explain the spectroscopic data describing atomic structures from a quantum-chemical perspective and describe the theoretical background of spectroscopic techniques such as AAS, AES, FES and Electron spectroscopy along with Molecular luminescence and advanced microscopic techniques such as SEM, AFM and STM.
2.	Explain how different forms of energy in atoms and molecules change upon interacting with electromagnetic radiation
3.	Compare and contrast the advantages of flame, furnace and inductively coupled plasma atomization sources.
4.	Explain the general features of absorption and photoelectron spectra and their dependence on the sample properties
5.	Microscopic methods will also provide students with knowledge and information towards the most general electron microscopic techniques and the relevant areas they are presently used.

Suggested References:
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Sr. No.	References
1.	Principles of Instrumental Analysis, by Skoog, Holler and Neiman, Sanders College Publishers (USA).
2.	Undergraduate Instrumental Analysis, by James W. Robinson, Marcel Dekker, Inc. (Ny.)
3.	Introduction to Instrumental Analysis, by Robert D. Braun, Pharme Med Press Hyderabad-India.
4.	Instrumental Method of Analysis, Willard, Merritt, Jr., Dean and Settle Jr., CBS Publishers and distributors, New Delhi, India.
5.	Instrumental method of chemical analysis, B. K. Sharma. 28 <sup>th</sup> edition, GOEL Publishing house Meerut. 2012.
6.	Atomic spectroscopy, K. P. Rajappan nair, M.J.P. Publishers, Chennai.
7.	Spectroscopy, H. Kaur, 5 <sup>th</sup> edition, Pragati Prakashan, Meerut, 2009.
8.	Instrumental Methods of Analysis, B. Sivasankar, Oxford University Press, 2012.
9.	Microscopic and Spectroscopic Imaging of the Chemical State, Michael D. Morris, Marcel Dekker, Inc. (NY.).

On-line resources to be used if available as reference material

On-line Resources

RSC learning portal <http://www.rsc.org/learn-chemistry>

NPTEL: <http://nptel.iitm.ac.in>

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**Master of Science, Analytical Chemistry**  
**M. Sc. Analytical Chemistry, Semester – IV**

Course Code	PS04CANC52	Title of the Course	Elements of Analytical Chemistry
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<ol style="list-style-type: none"><li>1. To understand the fundamental aspects of analytical chemistry</li><li>2. Awareness of Basic of electronics and their function in analytical instruments</li><li>3. Automation and their Application</li><li>4. To extension knowledge of data interpretation, validation and verification of methods by statistical data treatment, beside this Good Manufacturing practices (GMD)</li></ol>
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Course Content		
Unit	Description	Weightage* (%)
1.	<b>Introduction to Chemical Instrumental Analysis:</b> Classification of analytical techniques, types of instrumental methods, instruments for analysis, performance characteristics of instruments, calibration of instrumental methods, sampling and its importance, designing of sampling plan and its implementation.	25%
2.	<b>An Overview Of Electrical Components, Simple DC And AC Circuits, Digital Electronics Computers And Micro Computers:</b> DC and AC current, voltage, resistance and impedance measurements, semiconductors and semi-conducting devices, definition of basic terms transducers, transistors, transformers, capacitor, power supplies, regulators and operational amplifiers. Digital electronics-- analog and digital signals, binary numbers and its conversion to decimal numbers, digital circuit components, digital to analog convertor (DAC) and analog to digital convertor (ADC) Computer terminology, components, operational modes of computerized instruments (Inline and On-line), computer software and programming, application of computer in analytical instruments (passive and active applications), computer networking.	25%
3.	<b>Automated Analysis:</b> Introduction, automated laboratory analyses, automated laboratory analyzers.	25%
4.	<b>Data Treatment:</b> Evaluating analytical data-- classification of errors, accuracy and precision, distribution of random errors, normal distribution curve, mean and standard deviation, confidence limits (CL), comparison of results (students-t-test, f-test) paired t-test, linear regression and correlation coefficient. <b>Verifying and Validating the Method</b> Single operator characteristic, blind analysis of standard sample, ruggedness	25%





	and equivalency testing, standards analysis and components of good manufacturing process (GMP), documentation and case study.	
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Teaching-Learning Methodology	Information and Communication Technology (ICT) enable teaching with digital library, online course materials repositories etc. As well as counterpart conventional teaching methodology are also use to effective teaching
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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 the types and classification of analytical techniques and instrumental methods
2.	• Perform calibration of instrument, sampling and designing of sampling plan and its implementation.
3.	• Get the knowledge of electrical components, simple DC and AC Circuits, digital electronics computers and micro Computers.
4.	• Understand the advantage and disadvantages of automated instruments.
5.	• Explain the continues analyser, elemental analyser, photometric analyser and centrifugal analyzer.
6.	• Understand the application of automated systems.
7.	• Evaluate the analytical data.
8.	• Understand the classification of errors, accuracy and precision confidence limits (CL), students-t-test, f-test and Outlier tests.







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| 9. | • Verifying and Validating the Method. |
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Suggested References:

Sr. No.	References
1.	Modern Analytical Chemistry, By David Harvey, Mc Graw-Hill (USA).
2.	Vogel's Textbook of Quantitative Chemical Analysis, By G. H. Jeffery, J. Bassett, J. Mendham and C. Denney, Longman Singapore Publisher Pte Ltd. (Singapore).
3.	Principles of Instrumental Analysis, by Skoog, Holler and Neiman, Sanders College Publishers (USA)
4.	Introduction to Instrumental Analysis, by Robert D. Braun, Pharmed Press Hyderabad- India.
5.	Instrumental Methods of Analysis, 7 <sup>TH</sup> Edition Willard, Merit, Dean, Settle, CBS, Publishers & Distribution.
6.	Analytical Chemistry by Gary D Christian 6 <sup>th</sup> Edition Wiley Interscience
7.	A Textbook of Analytical Chemistry, Y. Anjaneyulu Pharmed Publisher 81-88449-19-9

On-line resources to be used if available as reference material

On-line Resources

<https://edu.rsc.org/experiments/leaf-chromatography/389.article>

<https://home.asplib.org/>

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**Master of Science, Analytical Chemistry**  
**M. Sc. Analytical Chemistry, Semester – IV**

Course Code	PS04CANC53	Title of the Course	Analysis of Industrial Products
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<p>1. This course provides the skill to students for the analysis of various industrial products such as polymers, pharmaceuticals, agrochemicals and pesticides, Oil and fat.</p> <p>2. Beside this it also forensic analysis and their various applications</p> <p>...</p>
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Course Content		
Unit	Description	Weightage* (%)
1.	<p><b>Polymer analysis:</b> Introduction of polymer analysis, Theory of polymer analysis, Properties of polymer, Polymer analysis by various Instrumental such as GPC, VPO, electrophoresis, thermal methods (TGA, DTA, DSC) etc. and classical methods end group analysis etc.</p> <p><b>Forensic Analysis:</b> Introduction and Importance of forensic Analytical analysis, Drug Identification: overview, drug classes, Toxicology: ethanol, breath testing, headspace GC, Trace analysis: microscopy-hair, fiber, glass analysis AA and AE spectroscopy, IC, SEM, forensic pathologist.</p>	25%
2.	<p><b>Analysis of Agro-chemicals:</b> Introduction of pesticides and fertilizers, compositional and residual analysis, Classical and instrumental method of insecticides and pesticides analysis, ISI specification and analysis of BHC, Malanion, DDT....etc.</p>	25%
3.	<p><b>Pharmaceutical and Clinical analysis:</b> Introduction and overview of pharmaceutical analysis, Sulfa drugs, Antipyretic and Analgesics and antibiotics, Instrumental techniques use in pharmaceutical analysis; Clinical analysis: Introduction and overview of clinical analysis, Composition of blood, collection and preservation of samples and its analysis, GC &amp; MS in clinical analysis, Pharmacogenetic testing.</p>	25%
4.	<p><b>Oil and Fat analysis:</b> Introduction of oil and fat analysis, Chemical composition of oil and fat and its importance, Acid value, R. M. Value, P.V. Value, Saponification value, Iodine value, Ester value, Acetyl value, Peroxide value, thiocynogen number, Ratio of saturated and unsaturated fatty acids, Detection of adulterants.</p>	25%





<b>Soap And Synthetic Detergent Analysis:</b> Matter insoluble in alcohol, free alkali, free acid, combined alkali and total anhydrous soap, total fatty mater (TFM) silica present as alkaline silicate and its analysis.	
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Teaching-Learning Methodology	The conventional teaching methodology along with animation and PowerPoint presentation are also use to effective teaching
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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.	This course provides the skill for the analysis of various industrial products such as polymers, pharmaceuticals, agrochemicals and pesticides. After completing M.Sc. chemistry program, students will be able to:
2.	Analyzes polymer by various Instrument such as GPC, VPO, electrophoresis, thermal methods (TGA, DTA, DSC) etc. and classical methods end group analysis, spot test etc.
3.	Know the importance of forensic analytical analysis.
4.	Know the instrumental method of analysis of insecticides, pesticides and agrochemicals.
5.	Know the instrumental and classical techniques use in pharmaceutical analysis.
6.	Perform the clinical analysis
7.	Detect the adulterants in various oil and fat.

Suggested References:
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Sr. No.	References
1.	Commercial method of analysis By Foster Dec Snell, Frank M. Biffeu Taraporwak and sons
2.	Encyclopedia of Industrial chemical analysis Vol. I & II wil W. Scott
3	D. Van Nostrand Co. Inc. Princeton New Jersey, Toranto, N.Y.
4	Spectroscopy of Polymer IInd Edition By Jack L. Koenig , Elseveir Science Inc. 655 Avenue of Americas, New York USA.
5	Polymer science and technology By Joel R. Fried, Prentice – Hall of India private limited, New Delhi – 110 001.
6	Standard Methods of Chemical analysis Vol. I & II wil W. Scott D. Van Nostrand Co. Inc. rinceton New Jersey, Toranto, N.Y.
7	Food composition and analysis By Howard Triebold, Leonard W. Auranel D Van Nostrand Company, Inc. Prienceton, New Jersy, Toranto
8	Metallurgical analysis By B. C. Agrawal & S. P. Jain Khanna Publisher
9	Applied complexometry By Rudolf Pribrill and R. A. Chalmess Oxford N. Y.
10	W.G. Eckert, Introduction to Forensic Sciences, Second Edition, Elsevier, New York, 1992.
11	B.A. J. Fisher, Techniques of Crime Scene Investigation, Seventh Edition, CRC Press, Boca Raton, 2004.
12	Analytical Chemistry by Gary D Christion 6TH Edition,Willy India

On-line resources to be used if available as reference material

On-line Resources

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**Master of Science, Analytical Chemistry**  
**M. Sc. Analytical Chemistry, Semester – IV**

Course Code	PS04CANC54	Title of the Course	Practical
Total Credits of the Course	04	Hours per Week	8

Course Objectives:	<ol style="list-style-type: none"><li>1. These all experiment provides laboratory skill to the students and hands of training to analysis of various type of samples with variety of methods.</li><li>2. Beside this such laboratory work provide the handling of various samples and their safety measure.</li></ol>
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Course Content		
Unit	Description	Weightage 100%
	<b>Classical Methods of Analysis.</b>	
1.	To determine the neutralization capacity of given antacid.	
2.	To determine free fatty acid in crude and refined edible oils.	
3.	To determine the free phenol in phenol formaldehyde resin by Koppeschaar's method.	
4.	To determine the % of free formaldehyde in a given phenolic resin (Novolak or Resol).	
	<b>Analysis of Industrial Products.</b>	
1.	Determination of Saponification value of an oil.	
2.	Determination of Iodine value of an oil by Wij's method.	
3.	Determine the Reichert-Missal value (R.M value) and P.V value of given sample.	
4.	To determine the total phosphorous as P <sub>2</sub> O <sub>5</sub> in detergent.	
	<b>Instrumental Methods of Analysis.</b>	
1.	To determine Na , K , Ca in given sample by flame photometry.	
2.	To determine the amount of paracetamol in given pharmaceutical sample.	
3.	Fluorimetric determination of Riboflavin (Vitamin B2)	
4.	Determination of glucose by Potentiometric method.	
5.	To determine the amount of aspirin in a given tablet by	





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	Conductometrically.	
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Teaching-Learning Methodology	Hands of training and demonstration of experiments and instruments
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Practical Examination (As per CBCS R.6.8.3)	<b>30%</b>
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	This course includes variety of practicals which are classified in three groups A) Analysis based on Instruments B) Analysis of classical methods C) Industrial analysis.
2.	The course comprises all field of practical such as water analysis, food analysis, pharmaceutical analysis, organic, inorganic, polymers, metals etc.
3.	These experiments improve laboratory skill and fundamentals of theoretical aspect.
4.	The students are also able to perform some experiments sophisticated instruments. Such types of training are helpful to get job in industry as well as in research laboratory.

Suggested References:	
Sr. No.	References
1.	Food composition and analysis by howard & leonard D. Van Nostinol Comp. Inc. p.165.
2.	Chemical Analysis of Plastic, A. Krause and A. Lange, London Illiffe Book Ltd., p. 65.





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3	Official Methods of Analysis of the Association of official Analytical Chemists. 28, 029, p. 490, 12 <sup>th</sup> Ed. 1975.
4	Encyclopedia of Industrial methods of analysis, Vol. 14 & 19.
5	Text book of Quantitative Chemical Analysis by A. I. Vogel.
6	A Textbook on Experiments Calculation in Chemical Engineering By S. S. Dara, S. Chand & Company Ltd., New Delhi, 1997.
7	Vogel's "Textbook of Quantitative chemical analysis" by G. H. Jeffery, J. Basserr Edition. 1989.
8	Analytical Chemistry by G. D. Christian , 3 <sup>rd</sup> Edition.

On-line resources to be used if available as reference material

On-line Resources

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**Master of Science, Analytical Chemistry**  
**M. Sc. Analytical Chemistry, Semester – IV**

Course Code	<b>PS04CANC55</b>	Title of the Course	<b>Project Work</b>
Total Credits of the Course	<b>04</b>	Hours per Week	<b>08</b>

Course Objectives:	To provide exposure to research problem and carry out research in the novel and fascinating topics of research in analytical chemistry.
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Course Content	
Description	Weightage* (%)
Research work in laboratory on a topic given by the supervisor	100%

Teaching-Learning Methodology	Laboratory exercise and thesis writing
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Presentation and Viva-voce 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 proceed for literature survey, synthesis and characterization of compounds/ materials using modern analytical and spectroscopic techniques and their study for various applications. They will be trained in research for pursuing higher studies. They will get training for working in research in academic and industries.

Suggested References: Published research articles on given research topic.







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On-line resources to be used if available as reference material

Published papers by reputed publishers like American Chemical Society, Royal Society of Chemistry, Wiley, Elsevier, etc.

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**Master of Science, Analytical Chemistry**  
**M. Sc. Analytical Chemistry, Semester – IV**

Course Code	PS04CANC56	Title of the Course	Practical
Total Credits of the Course	04	Hours per Week	8

Course Objectives:	<ol style="list-style-type: none"><li>1. These all experiment provides laboratory skill to the students and hands of training to analysis of various type of samples with variety of methods.</li><li>2. Beside this such laboratory work provide the handling of various samples and their safety measure.</li></ol>
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Course Content		
Unit	Description	Weightage* 100 (%)
	<b>Classical Methods of Analysis.</b>	
1.	To determine the % of Aluminum in a given alloy.	
2.	Determination of % of amino group of given amine.	
3.	To determine % purity of given alcohol sample by iodometric titration.	
4.	To determine the % of nitrogen in a given sample of an organic	
	<b>Analysis of Industrial Products.</b>	
1.	Determination of the dissolved oxygen present in a water sample.	
2.	Estimation of Penicillin content of given pharmaceutical.	
3.	To determine the percentage of calcium carbonate in a given toothpaste sample.	
4.	Preparation of column chromatography (by Dry/Wet methods) and separation/estimation of organic compounds by column chromatography.	
5.	To determination of Ca in Ginger sample.	
	<b>Instrument Method</b>	
1	To determine the amount of aspirin in a given tablet by UV Spectrophotometry (calibration curve method ).	
2	To determine the amount of aspirin in a given tablet by UV Spectrophotometry (Standard addition method ).	
3	To determine % Fe in iron tablet by colorimetry as Fe (III)	





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4	Assay of iron in pharmaceutical preparation using potassium thiocyanate by colorimetry. Fe(II)	
5	To determine NO <sup>-</sup> nitrogen in water.	

Teaching-Learning Methodology	Hands of training and demonstration of experiments and instruments	
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	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.	This course includes variety of practicals which are classified in three groups A) Analysis based on Instruments B) Analysis of classical methods C) Industrial analysis.
2.	The course comprises all field of practical such as water analysis, food analysis, pharmaceutical analysis, organic, inorganic, polymers, metals etc. These experiments improve laboratory skill and fundamentals of theoretical aspect. The students are also able to perform some experiments sophisticated instruments. Such types of training are helpful to get job in industry as well as in research laboratory.

Suggested References:	
Sr. No.	References
1.	A Textbook on Experiments Calculation in Chemical Engineering By S. S. Dara, S. Chand & Company Ltd., New Delhi, 1997,  J. G. Dick, Analytical Chemistry, p.640, International student Edn., Mc Grow Hill,





	Kogaksusha Ltd., 1973.
2.	Analytical chemistry by S. Shapiro Ya., Gurvich Eng. Transition, Mir Publisher, Moscow 1975.
3	Quantitative Analytical Chemistry, P. 596, 15 Edition by James S. Fritz, George II. Schenk.
4	Experimental Physical Chemistry by R. C. Das and B. Behera. P. 27.
5	Quantitative Organic Analysis, Part-3 First Edition By A. I. Vogel (1958).
6	Encyclopedia of Industrial methods of analysis, Vol. 8, p. 166.
7	Analytical Chemistry by G. D. Christian , 3rd Edition, p. 278, p. 411.

On-line resources to be used if available as reference material

On-line Resources

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**Master of Science, Analytical Chemistry**  
**M. Sc. Analytical Chemistry, Semester – IV**

Course Code	<b>PS04CANC57</b>	Title of the Course	<b>Project Work</b>
Total Credits of the Course	<b>04</b>	Hours per Week	<b>08</b>

Course Objectives:	To provide exposure to research problem and carry out research in the novel and fascinating topics of research in analytical chemistry.
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Course Content	
Description	Weightage* (%)
Research work in laboratory on a topic given by the supervisor	100%

Teaching-Learning Methodology	Laboratory exercise and thesis writing
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Presentation and Viva-voce 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 proceed for literature survey, synthesis and characterization of compounds/ materials using modern analytical and spectroscopic techniques and their study for various applications. They will be trained in research for pursuing higher studies. They will get training for working in research in academic and industries.

Suggested References: Published research articles on given research topic.





**SARDAR PATEL UNIVERSITY**  
**Vallabh Vidyanagar, Gujarat**  
**(Reaccredited with 'A' Grade by NAAC (CGPA 3.25))**  
**Syllabus with effect from the Academic Year 2022-23**

On-line resources to be used if available as reference material

Published papers by reputed publishers like American Chemical Society, Royal Society of Chemistry, Wiley, Elsevier, etc.

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**Master of Science, Analytical Chemistry**  
**M. Sc. Analytical Chemistry, Semester – IV**

Course Code	<b>PS04CANC58</b>	Title of the Course	<b>Comprehensive Viva</b>
Total Credits of the Course	<b>01</b>	Hours per Week	<b>01</b>

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