



KADI SARVA VISHWAVIDYALYA
M.Sc Analytical Chemistry Syllabus

Kadi Sarva Vishwavidhyalaya

M.Sc. Chemistry

Syllabus

(Analytical Chemistry)

Sem III and Sem IV

w.e.f. June 2018





KADI SARVA VISHWAVIDYALYA M.Sc Analytical Chemistry Syllabus

KADI SARVA VISHWAVIDYALAYA M.Sc Analytical Chemistry Semester Syllabus Structure (W.E.F. June 2018)

	KADI SARVA VISHWAVIDYALYA					
	M.SC ANALYTICAL CHEMISTRY SEMESTER-3 SCHEME					
	Subject Code	Course	Instruction Hrs / week	Examination			Credit
Internal				University Exam	Total	
CH-AC 301	Analytical chemistry3	4	30	70	100	4
CH-AC 302	Analytical chemistry4	4	30	70	100	4
CH-AC 303	Analytical chemistry5	4	30	70	100	4
CH-AC 304	Analytical chemistry6	4	30	70	100	4
CC-301 A	Research Methodology I	2	15	35	50	2
CH-AC 305	Analytical chemistry Practicals - 1	16	0	200	200	8
Total		34	135	515	650	26

	KADI SARVA VISHWAVIDYALYA					
	M.SC ANALYTICAL CHEMISTRY SEMESTER - 4 SCHEME					
	Subject Code	Course	Instruction Hrs / week	Examination			Credit
Internal				University Exam	Total	
CH-AC 401	Analytical Chemistry 7	4	30	70	100	4
CH-AC 402	Analytical Chemistry 8	4	30	70	100	4
CC-401 A	Research Methodology II	2	15	35	50	2
CH-AC 403	Analytical Chemistry Practicals - II	8	0	100	100	4
CH-AC 404	Dissertation / Industrial Training	12	50	250	300	12
Total		30	125	525	650	26



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

Analytical Chemistry Semester-III

Paper :Analytical Chemistry-3 (CH-AC 301)

Credit 04

Course	Subject Title	Credit	Theory (hr/week)	Practical (hr/week)	External marks	Internal marks	Total marks
CH-AC-301	Analytical Chemistry3	4	4	--	70	30	100

Rationale of the Paper:To provide the basic knowledge of very important concepts of the Analytical chemistry. To provide overview of the applications of these concepts in applied field to the students is also an objective.

Learning Outcome:

- This study is useful to furnish students with the advanced technical skills and knowledge base that is required in the field of instrumental analysis and which will enable them to pursue careers as analysts in the chemical and/or pharmaceutical industry.
- Understand the essential concepts used in nanotechnology, syntheses and fabrication
- Appreciate the development of modern nanotechnology
- Discuss the application of nanotechnology in major scientific fields
- Discuss the challenges nanotechnology poses to our environment

Unit	Topics of Paper CH-AC-301	Marks	Teaching Hrs
Section A			
1	Pharmaceutical Analysis Instrumental and titrimetric assays for anti-diabetic, anti-cancer, anti-tuberculosis, anti- malarial, antihypertensive and anti-HIV drugs based on USP/BP/IP. Heavy metal ion, Dissolution, Loss on drying and Karl fisher analysis in pharmaceuticals. Importance of UVVisible spectrophotometry, IR spectroscopy and HPLC with UV, fluorescence and photodiode array detection in pharmaceutical industry, ELSD-Electron light scattering diode.(to detect UV inactive compounds by HPLC)	15	15
2	Introduction and Classification of Nanotechnology Define Nanotechnology,Classification of Nanostructured materialsNanoscale architecture. Synthesis of Nanomaterials: Top down – ball milling; Bottom up – co-precipitaion – sol-gel – electrodeposition – using natural nanoparticles – chemical vapor deposition. The Carbon Nanotube – New Forms of Cabon – Types of Nanotubes – Formation of Nanotubes – Uses for nanotubes – Biological Applications.	15	15
Section B			



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

3	Analysis of pesticides, soaps and detergents, fertilizers Classification of pesticides. Analysis of different pesticides by classical and instrumental methods. Classification of soaps and detergents with suitable examples. Characterization of soaps and detergents. Types of fertilizers and analysis of different elements like, nitrogen, phosphates, calcium, sodium, potassium and ammonia.	15	15
4	Food Analysis Introduction to food analysis, regulations and international standards related to food analysis, nutritional labeling, sample and sample preparation. Compositional analysis of foods for moisture, proteins, fat, fiber, ash, vitamins and minerals. Adulteration of fats and oils; milk and milk products	15	15
	Objectives from all units	10	

References:

1. NANOTECHNOLOGY: Basic science and emerging technologies, Mick Wilson, KamaliKannagara, Geoff Smith, Michelle Simmons, BurkhardRaguse, Overseas Press, 2005, First Indian Edition.
2. Nanoscale Science and Technology, Robert Kelsall, Ian Hamley, Mark Geoghegan, John Wiley & Sons, Ltd., 2005.
3. "Analytical Chemistry" by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey.
4. "Principles of Instrumental Analysis" by Douglas A. Skoog, 3rd Edition, HoltSaunders International Edition.
5. Flow injection analysis of pharmaceuticals: automation in the laboratory by Jose Martinez Calatayud, Taylor and Francis, 1996.
6. "Food Analysis" by S. Suzanne Nielsen, 3rd edition, Springer 2003.
7. "Food Analysis Laboratory Manual" by S. Suzanne Nielsen, 3rd edition, Springer 2003.
8. Quantitative Analysis of Drugs in Pharmaceutical Formulation, 3rd edition, P.D. Sethi, CBS Publishers, 2008.
9. "Handbook of Modern Pharmaceutical Analysis" by Satinder Ahuja and Stephen
10. Scypinski, Volume 3, Academic Press, 2001.
11. Standard Method of Chemical Analysis by F.J. Welcher, sixth edition, volume 1, 2 & 3, Part two, Van Nostrand Reinhold Company.



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

Paper: Analytical Chemistry-4 (CH-AC-302)

Credit 04

Course	Subject Title	Credit	Theory(hr/week)	Practical(hr/week)	External marks	Internal Marks	Total marks
CH-AC-302	Analytical Chemistry4	4	4	.....	70	30	100

Rationale of the Paper:

Separation techniques are the basis of instrumental analysis widely applied in industry, chemistry, biochemistry, environment science. These techniques are based on principles of chemistry. Therefore, in this module we shall study the principles on which these techniques are based and acquire the basic skills necessary to use the techniques. Studying this area depends on the understanding of the underlying chemistry principles making the learner better able to teach them.

Learning Outcome:

- Understanding the principles of chromatographic techniques, with the emphasis on the application in biochemistry.
- Students can be able to design, perform, and interpret chromatographic experiments for biochemical applications.

Unit	Topics of Paper CH-AC-302	Marks	Teaching Hrs
Section A			
1	Chromatography-1 Fundamentals of chromatography, Definition of resolution, capacity factor, selectivity factor, dead time and dead volume. Types of chromatography depending upon mobile phase, instrumentation and principle of separation.	15	15
2	Chromatography-2 TLC, HPTLC, Ion exchange. Types of resin, working methodology and application of TLC, HPTLC and Ion exchange.	15	15
Section B			
3	Chromatography-3 Instrumentation and working methodology and applications of HPLC & GC (Gas Chromatography), types of columns, packed columns, Capillary columns, Bonded phase columns.	15	15
4	Extraction Techniques Types of separation techniques, solid-liquid extraction (SLE), liquid-liquid extraction (LLE), factors influencing LLE, Technique for solvent extraction: batch extraction and continuous extraction, Extraction of lighter type or heavier type liquid, Working Methodology and Applications of extraction LLE, SPE, SPME, Protein precipitation	15	15



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

	Objective question from above four units	10	-----
--	---	----	-------

References Books:

1. Thin Layer chromatography, E. Stahi
2. Chromatography, Heptman
3. HPTLC, Dr. P.D. Sethi
4. High performance liquid chromatography, Dr. P. D. Sethi
5. Principles of Instrumental Analysis, D. A. Skoog and J. L. Loary, W. B. Saunders.
6. Fundamentals of Analytical Chemistry, D.A. Skoog, D. M. West and F. J. Holler, W. B. Saunders.
7. Principles of Instrumental analysis, D. A. Skoog and W. B. Saunders
8. Analytical Chemistry by G. D. Christian



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

Paper: Analytical Chemistry-5- (CH-AC 303)

Credit 04

Course	Subject Title	Credit	Theory (hr/week)	Practical (hr/week)	External marks	Internal marks	Total marks
CH-AC-303	Analytical Chemistry5	4	4	.....	70	30	100

Rationale of the Paper:

Oxidation & Reduction reactions occur in many chemical systems. In the different reactions involve the transfer of electrons from one chemical species to another. Because "electrons" are involved in all these reactions, these changes are described as electrochemical changes.

Learning Outcome:

At the end of his unit, the student should be able to:

- Draw and identify the basic components of a cell.
- Define: anode, cathode, oxidation, reduction.
- Draw and identify the basic components of an electrolytic cell.
- Define electrode selectivity and describe what makes it possible.
- Describe reference electrodes.
- Describe indicator or measuring electrodes.

Unit	Topics of Paper CH-AC-303	Marks	Teaching Hrs
	Section A		
1	Electroanalytical Measurements Introduction to the physico - chemical devices & their mode of working, Voltage, Impedance, The electric double layer, Electrocapillarity. Current, Diffusion transport.	15	15
2	Electrochemical and Bio-sensors Potentiometric sensors. Potentiometric biosensors. Amperometric sensors. Conductometric sensors. Applications of Field-Effect Transistors sensors.	15	15
	Section B		
3	Electrodeposition and Coulometry Electrolysis. Current-Voltage relation. Electrogravimetric analysis at constant current, constant potential and at controlled potential. Coulometric analysis	15	15



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

4	Electrophoresis Principles of electrophoresis, theory and applications of Poly acrylamide gel electrophoresis, capillary zone electrophoresis, micelles electrokinetic electrophoresis, Iso-electric focusing. Efficiency and resolution. Applications	15	15
	Objectives from all units	10	

Reference Books:

- (1) Peter T. Kissinger, William R. Heineman, "Laboratory Techniques in Electroanalytical Chemistry", Marcel Dekker Inc., New York.
- (2) Basil H. Vassos, Galen W. Ewing, "Electroanalytical Chemistry", John Wiley & Sons, New York.
- (3) Allen J. Bard, Larry R. Faulkner, "Electrochemical Methods – Fundamentals and Applications", John Wiley & Sons, New York.
- (4) Daniel C. Harris, "Quantitative Chemical Analysis", W.H. Freeman and Company, New York.
- (5) I. M. Kolthoff, and P.J. Elving, "Treatise on Analytical Chemistry", Wiley Interscience, New York.
- (6) Brian R. Eggins, "Chemical Sensors and Biosensors", John Wiley & Sons, New York
- (7) Skoog, D.A.; Holler, F.J.; Crouch, S.R "Principles of Instrumental Analysis" 6th ed. Thomson Brooks/Cole Publishing: Belmont, CA **2007**.
- (8) Skoog, D.A.; Holler, F.J.; Nieman, T.A. "Principles of Instrumental Analysis, 5th ed." Saunders college publishing: Philadelphia, **1998**.



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

Paper: Analytical Chemistry-6 (CH-AC-304)

Credit 04

Course	Subject Title	Credit	Theory (hr/week)	Practical (hr/week)	External marks	Internal marks	Total marks
CH-AC304	Analytical Chemistry6	4	4	.....	70	30	100

Rationale of the Paper:

The purpose of this lesson is for students to investigate the characteristics of matter. The students will investigate mixtures and spectroscopic methods. Students will understand the concepts of solute, solvent, compound, element, and mixture based on their chemical and physical properties.

Learning Outcome:

- Students can describe the principles of lasers
- Describe and explain the principle of operation of modern chromatographic instrumentation.
- Students can explain the principle and applications of atomic spectroscopy.

Unit	Topics of Paper CHE-AC-304	Marks	Teaching Hrs
Section A			
1	Lasers Principle of laser operation; Stimulated emission Population inversion, Single level and multi level laser systems, Properties of laser light and its general and analytical applications; ruby laser, nitrogen laser, dye laser, Use of laser radiation in absorption and fluorescence spectroscopic methods	15	15
2	Specialized chromatographic techniques Principle, separation process on special columns, instrumentation and applications of counter current chromatography. Flash chromatography	15	15
Section B			
3	Atomic Absorption Spectrometry Introduction, Basic Principles, Instrumentation, Interferences. Techniques for Quantification of Elements, Recent Developments Applications	15	15
4	ICP (Inductive coupled Plasma) ICP-AES(OES), ICP-MS, instrumentation, Operation, interference and Applications	15	15



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

	Objectives from all units	10	
--	----------------------------------	----	--

Reference Books:

- (1) Quantitative Chemical Analysis" by Daniel C. Harris, 5th Edition, W.H. Freeman and Company, New York.
- (2) Analytical Chemistry" by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey.
- (3) Chiral Separation Techniques: A Practical Approach, 2nd edition, edited by Ganapathy Subramanian, Wiley-VCH, 2001.
- (4) Chiral Separations by Chromatography by Satinder Ahuja, American Chemical Society, 2000.
- (5) Chiral Chromatography by Thomas E. Beesley, T.E. Beesley, R.P.W. Scott, John Wiley and Sons, 1999.
- (6) A Practical handbook of preparative HPLC by Donald Wellings, Elsevier, 2006.
- (7) Ion-pair chromatography: Theory and Biological and Pharmaceutical Applications (Chromatographic Science), Milton Hearn (editor), Marcel and Dekker Inc. (1985).
- (8) Advances in Electrophoresis (Volume 2) by Andreas Chrembach, Michael J. Dunn, Bertold J. Radola, Wiley-VCH, 1989.
- (9) High Performance Capillary Electrophoresis: An Introduction by David N. Heiger. Hewlett Packard GmbH, 1992.
- (10) High-speed counter current chromatography by Yoichiro Ito and Walter D. Conway, John Wiley and Sons, 1995.
- (11) Practical Aspects of Gas Chromatography/Mass Spectroscopy by Gordon M. Message, John Wiley & Sons, 1984.
- (12) Modern Practice of Gas Chromatography by Robert L. Grob and Eugene F. Barry, 3rd edition, Wiley-Interscience, 1995.
- (13) Basic Gas Chromatography by Harold M. McNair, James M. Miller, John Wiley and Sons, 2008.
- (14) Analytical gas Chromatography by Walter Jennings, Eric Mittlefehldt and Philip Stremple, second edition, Elsevier Science, 1997.
- (15) Modern HPLC for practicing scientists by Michael W. Dong, Wiley Interscience, 2006.



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

Paper: Research Methodology-I (CC-301A)

Credit 02

Course	Subject Title	Credit	Theory (hr/week)	Practical (hr/week)	External marks	Internal marks	Total Marks
CC-301A	Research Methodology-I	2	2	.....	50	-----	50

Rationale of the Paper: To provide the basic knowledge of Research & Methodology

Learning Outcome:

- Students can learn the basic Introduction of Objective of research.
- Student will learn to define a research problem.

Unit	Topics of Paper CC-301A	Marks	Teaching Hrs
1	Research Methodology: An Introduction Meaning of research, Objectives of research, motivation in research, Types of research, Research Approaches, significance of research, research method vs methodology, research and scientific method, importance of knowing how research is done, research process, criteria of good research, problems encounter by researchers in India.	25	15
2	Defining Research Problem: what is research problem? selecting the problem, necessity of defining the problem, Technique involved in defining a problem, an illustration, conclusion Research Design: Meaning of research design, need for research design, features of good design, important concepts relating to research design, different research designs, basic principles of experimental design	25	15

Reference Books:

1. Research Methodology: Methods & Techniques by C R Kothari, 2e, Wishwa Publication, New Delhi
2. Research Methodology by D K Bhattacharyya, 1 e, Excel Books, New Delhi, 2003
3. How to Research by Loraine Blaxter, Christina Hughes and Molcolm Tight, Viva Books Pvt.Ltd., New Delhi
4. Writing Your Thesis by Paul Oliver, VistaarPublication, New Delhi, 2006
5. The Research Student's Guide to Success by Pat Cryer, Viva Books Pvt Ltd., New Delhi



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

Laboratory Course Sem-III Analytical Chemistry

Course	Subject Title	Credit	Theory (hr/week)	Practical (hr/week)	External marks	Internal marks	Total
CH-AC 305	Analytical chemistry Practicals I	8	--	16	200	-----	200

Practical: (Minimum -15)

1. To determine Riboflavin from the given unknown sample by TLC method.
2. Determination of saponification, acid and Iodine value of given oil.
3. To determine the amount of Iron in milk.
4. To determine % purity of the given sample of Drugs (Aspirin, Paracetamol etc)
5. Detection of Caffeine in commercial products by TLC.
6. To synthesize metal nanoparticles (any two metal) and their characterization.
7. Estimation of blood glucose by Folin Wu method.
8. Soil analysis
9. Separation of chlorinated insecticides by Paper Chromatography.
10. Separate and estimate the amount of cadmium and zinc using ion exchange resin.
11. Separate and estimate the amount of nickel and zinc using ion exchange resin.
12. Estimation of potassium, calcium and sodium from given sample using flame photometric method.
13. Food analysis



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

Semester-IV

Paper: Analytical Chemistry- 7 (CH-AC-401)

Credit 04

Course	Subject Title	Credit	Theory(hr/week)	Practical(hr/week)	External marks	Internal marks	Total marks
CH-AC-401	Analytical Chemistry 7	4	4	-----	70	30	100

Rationale of the Paper:

Chromatography is the technique used to perform qualitative and quantitative analysis. From this technique students can explain how partition of an analyte between stationary phase and mobile phase effects separation.

Learning Outcome:

- Define and explain the theory underpinning chromatography.
- To be able to identify and explain the factors influencing chromatographic separation in terms of resolution and specificity.
- Identify the factors influencing different sample injection techniques and be able to discuss the advantages and disadvantages of each type.
- Identify the factors influencing different analyte detection systems and be able to discuss the advantages and disadvantages of each type.

Unit	Topics of Paper CH-AC-401	Marks	Teaching Hrs
	Section A		
1	Automation and Flow injection analysis Principles of automation, automatic and automated devices, Process control: off-line, at-line and on-line analysis. Continuous and discrete analyzers, feedback mechanism. Flow injection analysis, principles, dispersion coefficient, factors affecting peak height-sample volume, channel length, flow rate and channel geometry. Applications of FIA, stopped flow measurements and gradient FIA.	15	15
2	Clinical Chemistry Composition of blood, collection and preservation of samples, common determinations- serum electrolytes, blood glucose, blood urea nitrogen, uric acid, albumins and globulins, acid and alkaline phosphatases, barbiturates. Principles of immunoassays, radioimmunoassay, fluorescence immunoassay, enzyme immunoassay.	15	15
	Section B		



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

3	Forensic Analysis: Forensic Applications of Analytical Chemistry Analysis of Narcotic Drugs and Psychotropic Substances such as cocaine, cannabis, benzodiazepines, amphetamines, opiates and hallucinogens. Analysis of Beverages: Alcoholic and non-alcoholic beverages and their composition.	15	15
4	Method Validation and impurity profile Method development and validation parameters: sensitivity, selectivity, accuracy and precision, linearity (calibration curves), recovery matrix effect and stability, robustness, ruggedness and impurity profile(based on ICH Guidelines)	15	15
	Objective question from above four units	10	-----

ReferenceBooks:

- (1) "Analytical Chemistry" by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey.
- (2) "Principles of Instrumental Analysis" by Douglas A. Skoog, 3rd Edition, HoltSaunders International Edition.
- (3) Flow injection analysis of pharmaceuticals: automation in the laboratory by Jose Martinez Calatayud, Taylor and Francis, 1996.
- (4) "Quantitative Chemical Analysis" by Daniel C. Harris, 5th Edition, W.H. Freeman and Company, New York.
- (5) "Handbook of Modern Pharmaceutical Analysis" by Satinder Ahuja and Stephen Scypinski, Volume 3, Academic Press, 2001.
- (6) "Handbook of Modern Pharmaceutical Analysis" (Drug and the Pharmaceutical Sciences) by Lena Ohannesian and Anthony Streeter, Marcel Dekker Inc., New York, 2001.
- (7) Quantitative Analysis of Drugs in Pharmaceutical Formulation, 3rd edition, P.D. Sethi, CBS Publishers, 2008.
- (8) Bioanalytical Chemistry by S. Mikkelsen and E. Corton, John Wiley and Sons, 2004.
- (9) Clinical Chemistry: Principles, Procedures, Correlations, 4th edition by Michael L. Bishop, Janet L. Duben-Engelkrik, Edward P. Fody, Lippincott Williams and Wilkins, 2000.



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

Paper: Analytical Chemistry- 8 (CH-AC-402)

Credit 04

Course	Subject Title	Credit	Theory(hr/week)	Practical(hr/week)	External marks	Internal marks	Total marks
CH-AC 402	Analytical Chemistry 8	4	4	.....	70	30	100

Rationale of the Paper:

Chromatography is the technique used to perform qualitative and quantitative analysis. From this technique students can explain how partition of an analyte between stationary phase and mobile phase effects separation.

Learning Outcome:

- Define and explain the theory under pinning chromatography.
- To be able to identify and explain the factors influencing chromatographic separation in terms of resolution and specificity.
- Identify the factors influencing different sample injection techniques and be able to discuss the advantages and disadvantages of each type

Unit	Topics of Paper CH-AC-402	Marks	Teaching Hrs
Section A			
1	UHPLC and SFC Principle, theory, instrumentation and applications of ultrahigh performance liquid chromatography Principle, theory, instrumentation and applications of supercritical fluid chromatography (SFC). Comparison with HPLC.	15	15
2	LC-NMR & LC-MS Principle, theory, instrumentation and applications of liquid Chromatography –nuclear magnetic resonance (LC-NMR) and Comparison with NMR. Principle, theory, instrumentation and applications of liquid chromatography-mass spectrometry (LC-MS) and Comparison with Mass Spectroscopy.	15	15
Section B			
3	Thermal: Thermal Methods of Analysis Principle, theory, instrumentation and applications of TGA, DTA, DSC	15	15
4	Electro Analytical Techniques: Principle theory and Application of Polarography, AC, DC, voltammetry, differential pulse, square wave, anodic and cathodic stripping analysis, cyclic voltammetry.	15	15
Objective question from above four units		10	-----



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

Reference Books:

1. Handbook of Instrumental Techniques for Analytical Chemistry, Frank Settle, published by Prentice Hall PTR, New Jersey, 1997.
2. Spectrochemical Analysis by Atomic Absorption and Emission, Lajunen LHJ, Cambridge, UK: The Royal Society of Chemistry, 1992.
3. Advances in Atomic Spectroscopy II, Sneddon J, CT: JAI Press, Greenwich, 1992.
4. CRC Handbook of Inductively Coupled Plasma Atomic Emission Spectrometry, Varma A, FL: CRC Press, Boca Raton, 1991.
5. Multi-element Detection Systems for Spectrochemical Analysis II, Busch K W, Busch M A, Wiley, New York, 1990.
6. Principles and Practice of X-Ray Spectrometric Analysis II, 2nd edition, Bertin, Eugene, Plenum Press, New York, 1975.
7. An Introduction to X-Ray Spectrometry, Jenkins, Ron, Heyden & Sons, London, 1974.
8. Principles of Quantitative X-Ray Fluorescence, Tertian R, Claisse F, Heyden, London, 1982
9. Quantitative Chemical Analysis by Daniel C. Harris, 7th Edition, W.H. Freeman and Company, New York.
10. Analytical Chemistry by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey
11. On-line LC-NMR and related techniques, Klaus Albert (editor), John Wiley and Sons, 2002.
12. Practical Guide to ICP-MS by Robert Thomas, Marcel Dekker Inc., 2004.
13. Packed columns SFC by T.A. Berger, RSC Chromatography Monographs, RSC, 1995.
14. Introduction to Mass Spectrometry: Instrumentation, Applications, and Strategies for Data Interpretation by J. Throck Watson, O. David Sparkman, Wiley, 2007.
15. Interpretation of Mass Spectra by Fred W. McLafferty, Turecek University Science Book 1993.
16. Mass Spectrometry-Principles and Applications by Edmond de Hoffmann and Vincent Stroobant, John Wiley and Sons, 2007.



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

Paper: Research Methodology-II (CC-401A)

Credit 02

Course	Subject Title	Credit	Theory (hr/week)	Practical (hr/week)	External marks	Internal marks	Total Marks
CC-401A	Research Methodology-II	2	2	.....	50	-----	50

Rationale of the Paper: To provide the basic knowledge of Research & Methodology

Learning Outcome:

- Students can learn the methods to collect research data through different methods. Also understand role of computer in research
- Student will gain the knowledge of processing data and understand the guidelines of thesis writing.

Unit	Topics of Paper CC-401A	Marks	Teaching Hrs
1	Methods of Data Collection: collection of primary data, observation method, Interview method, collection of data through questionnaires, collection of data through schedules, difference between questionnaires and schedules, some other method of data collection, collection of secondary data, selection of appropriate method for data collection, role of computer in research.	25	15
2	Processing And analysing data: Processing operations, solving problems in processing, types of analysis, statistics in research, measures of central tendency, measures of dispersion, measures of asymmetry, measures of relationship, simple regression analysis, multiple correlation and regression, partial correlation, association in case of attributes, significance of writing thesis, different types of research writing, guidelines of writing good thesis.	25	15

Reference Books:

1. Research Methodology: Methods & Techniques by C R Kothari, 2e, Wishwa Publication, New Delhi
2. Research Methodology by D K Bhattacharyya, 1 e, Excel Books, New Delhi, 2003
3. How to Research by Loraine Blaxter, Christina Hughes and Molcolm Tight, Viva Books Pvt.Ltd., New Delhi
4. Writing Your Thesis by Paul Oliver, VistaarPublication, New Delhi, 2006
5. The Research Student's Guide to Success by Pat Cryer, Viva Books Pvt Ltd., New Delhi



KADI SARVA VISHWAVIDYALYA

M.Sc Analytical Chemistry Syllabus

Laboratory Course Sem-IV Analytical Chemistry

Course	Subject Title	Credit	Theory (hr/week)	Practical (hr/week)	External marks	Internal marks	Total
CH-AC 403	Analytical chemistry Practicals II	4	--	8	100	-----	100

Practical:(minimum 6)

1. To determine the amount of glucose in blood.
2. To determine sodium and potassium in blood serum and urine by flame photometer
3. Drug method development and validation by UV spectrophotometry. (With Extraction) (Any three Method validation parameters)
4. Drug method development and validation by UV spectrophotometry. (Without Extraction) (Any three Method validation parameters)
5. Determine Nitrogen from soil sample by Kjeldahl method.
6. To determine the percentage of ascorbic acid in a given sample.
7. Synthesis of nanomaterials.
8. IR spectral analysis of Different compounds.
9. Chromatography: ion exchange, column, TLC.

Analytical Chemistry- Dissertation / industrial training (CH-AC 404)

Credit 12

Course	Subject Title	Credit	Theory (hr/week)	Practical (hr/week)	External marks	Internal marks	Total Marks
CH-AC 404	Dissertation / industrial training	12	-----	-----	250	50	300