PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS)

KAKINADA - 533 001,

EAST GODAVARI, A.P.

Affiliated to Adikavi Nannaya University

NAAC Accredited with "A" Grade (3.17 CGPA)

BOARD OF STUDIES OF CHEMISTRY

M. Sc ANALYTICAL CHEMISTRY Under CBCS

Convened on 18 December 2023

AY 2023-24

DEPARTMENT OF CHEMISTRY

P. R. GOVT. COLLEGE (Autonomous)

Opp. Mc Laurin High School, Raja Ram Mohan Roy Road, Kakinada

www.prgc.edu.in e-mail: chemistry@prgc.edu.in

PROCEEDINGS OF THE PRINCIPAL, PITHAPUR RAJAHS GOVERNMENT COLLEGE(A), KAKINADA-A. P

Present: Dr. B. V. Tirupanyam, M.Sc.; Ph.D.

R.C.No.12A/A.C./BOS/2023-24, Dated: _____.

SUB: P.R. Government College(A), Kakinada-PG Board of Studies (BOS)-Program/Course-M.Sc. Analytical Chemistry/Chemistry, Nomination of Members-Orders issued.

REF: 1. UGC Guidelines for Autonomous Colleges-2018.

ORDERS:

The Principal, Pithapur Rajahs Government College(A), Kakinada is pleased to constitute P G Boards of Studies in Chemistry for framing the syllabi in Analytical Chemistry Subject for I, II Semesters duly following the norms of the UGC Autonomous guidelines.

S. No	Name of the Nominee	Designation
1	V. Sanjeeva Kumar	Chairman& Lecturer Incharge.
2	Dr. K. Deepthi	University Nominee Associate Professor Department of Chemistry Adikavi Nannaya University, Rajamahendravaram
3	Dr. D. Jaya Prashanti	Subject Expert Associate Professor Department of Chemistry Andhra University Visakhapatnam
4	Dr. G. Chandrasekhar Reddy Managing Director HIQ Pharma Pvt. Ltd Hyderabad	Representative from Industry
5	T.V.V. Satya Narayana	Member
6	P. Vijay Kumar	Member
7	V. Rambabu	Member
8	G. Pavani	Member
9	Dr. N. Bujji Babu	Member
10	Dr. Ch. Praveen	Member
11	V. Venkateswara Rao	Member
12	U.S.N. Prasad	Member
13	T. Pavan Kumar	Member
14	S. Abhisha	Member
15	S. Sirisha	Member
16	R. Ramya Sri	Member
17		Student Alumni Member
18		Student Member
19		Student Member
20		

The above members are requested to attend the BoS meeting on 18 December 2023 and share their valuable reviews, and suggestions on the following functionaries.

- Prepare syllabi for the subject keeping in view the objectives of the college, interest of the stake holders and National requirement for consideration and approval of the IQAC and Academic Council.
- Suggested methodologies for innovative teaching and evaluation techniques.
- Suggest the panel of Names to the academic council for appointment of Examiners.
- Coordinate research, teaching, extension, and other activities in theDepartment of the college.

PRINCIPAL
P. R. Government College(A),
Kakinada

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA
DEPARTMENT OF CHEMISTRY
MINUTES OF BOARD OF STUDIES (BOS) MEETING

2023-24 on 18 December 2023 Meeting of Board of Studies in M. Sc Analytical Chemistry is convened on 18 December 2023 through offline at Pithapur Rajah's Government College (A), Kakinada.

Venue: LCD Hall-I, Dt: 18 December 2023.

The Principal Dr. B.V. Tirupanyam, Chairman, Sri. V. Sanjeeva Kumar, Chairman and lecturer in charge, University Nominee, Dr. K. Deepthi, Industrialist, Dr. G. Chandrasekhar Reddy, Subject Expert, Dr. D. Jaya Prashanti, All the faculty members of Chemistry Department and student alumni attended the meeting.

Agenda:

1. To discuss the Semester System and revised Choice Based Credit System (CBCS) being implemented for the past 03 years, i.e., w.e.f. 2020-21.
2. To discuss and approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of I &II for 2023-24.
3. Grant of Extra credits for Online SWAYAM MOOCs etc.
4. Syllabus, Model Question Papers and Model Blueprints, POs, PSOs & COs mappingfor I and V Semesters.
5. Minimum of 60% integration of ICT into transaction of curriculum.
6. Minimum attendance of 75% for both I mid-term examination, and II mid- term examination under CIA component shall be the benchmark for attendance and itshall be approved in the BOS.
7. Teaching learning methodology by 75:25 (External: Internal) ratio w.e.f. 2017-18 admitted batches and continued it.
8. Remedial coaching for slow learners and project work, research, Conferences, etc., for advanced learners.
9. Panel of paper setters and examiners.
10. Proposals for project work in fourth semester for the benefit of students.
11. Department action plan for 2023-24. To discuss and resolve the minor modifications/refinement if any.
12. Any Other Proposal with the Permission of the Chairman.

The following paper setters are recommended.

1. Dr. V. Siddaiah, Department of Chemistry, Andhra University, Visakhapatnam
2. Dr. D. Jaya Prashanthi Department of Chemistry, Andhra University, Visakhapatnam
3. Dr. B. Mallikarjun, Department of Chemistry, GDC(A), Rajamahendravaram.
4. Dr. K. Deepthi, Department of Chemistry, ANUR Rajamahendravaram
5. Dr. B. Jagan Mohan Reddy, Department of Chemistry, ANUR Rajamahendravaram
6. Dr. Ravindra Babu, Department of Chemistry, GDC, Tanuku
7. Dr. A. Chandraleela, Department of Chemistry, Andhra University, Visakhapatnam

Resolution:

It is resolved to introduce the following new courses in the programme M. Sc Analytical Chemistry from the AY 2023-24

S. No	Course Code	Title of the new course	Programmes in which it is introduced
1		Nil	Nil

ADDITIONS/DELETIONS IN COURSES CHEMISTRY 2023-24

Year	Semester& Paper	Additions	Deletions
II	**III&I**	**Nil**	**Nil**
II	**III&II**	**Nil**	**Nil**
II	**III&III**	**Nil**	**Nil**
II	**III&IV**	**Nil**	**Nil**
II	**IV&I**	**Nil**	**Nil**
II	**IV&II**	**Nil**	**Nil**
II	**IV&III**	**Nil**	**Nil**
II	**IV&IV**	**Nil**	**Nil**

Course structure of M. Sc Analytical Chemistry (Final Year)

S. No	Semester	Title of the Paper	Theory/ Practical / Viva	Internal marks	External Marks	Total Marks	Credits
1	III	Separation Methods-I	T	25	75	100	4
2		Quality Control and Traditional methods of Analysis-I	T	25	75	100	4
3		Applied Analysis-I	T	25	75	100	4
4		Instrumental Methods of Analysis-I	T	25	75	100	4
5		Classical methods of Analysis-I	P	25	75	100	4
6		Instrumental methods of Analysis-I	P	25	75	100	4
7	IV	Separation Methods-II	T	25	75	100	4
8		Quality Control and Traditional methods of Analysis-II	T	25	75	100	4
9		Applied Analysis-II	T	25	75	100	4
10		Instrumental Methods of Analysis-II	T	25	75	100	4
11		Classical methods of Analysis-II	P	25	75	100	4
12		Instrumental methods of Analysis-II	P	25	75	100	4
13		Comprehensive Viva-voce	V	---	50	50	4
Total Credits							

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program &Semester II M.Sc. Chemistry Semester-III Paper-I**			
Course Code	TITLE OF THE COURSE **SEPARATION METHODS-I**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Adsorption, absorption, partition coefficient, polarity of the solvents.	**60**	**10**	**----**	**4**

Course Objective

Students will gain knowledge on principle, instrumentation and applications of different chromatographic techniques.

Course Outcomes:

	On Completion of the course, the students will be able to
CO1	Students will be able to know the chromatography introduction, Principles and development methods
CO2	Students will acquire knowledge on column chromatography, Gel exclusion Chromatography and Capillary electrophoresis
CO3	Understand the gas chromatography, GC-MS and Inorganic molecular sieves
CO4	Acquire knowledge on Liquid-liquid partition chromatography, LC-MS,HPLC

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			**Employability**			**Entrepreneurship**	

Syllabus

UNIT-1

CHROMATOGRAPHY–1

Chromatography: classification of different chromatographic methods, methods of development-Elution development, Gradient elution development, displacement development, and frontal analysis.

Principles of chromatography, adsorption phenomena, partition, adsorption coefficient, retardation factor, retention time and volume, column capacity, temperature effects, partition isotherm.

Dynamics of chromatography-efficiency of chromatographic column, High Equivalent

Theoretical Plate (HETP), Van Deempter equation, resolution, choice of column, length and flow velocity, qualitative and quantitative analysis.

UNIT-II
CHROMATOGRAPHY-2

Column chromatography (adsorption chromatography): principles, general aspects, adsorption isotherms, chromatographic media, nature of forces between adsorbent and solutes, eluents (mobile phase), column chromatography without detectors and liquid chromatography with detectors and applications.

Gel Exclusion chromatography or Gel filtration chromatography: principles, properties of xerogels, apparatus and detectors, resolution of gel type, applications to organic compounds.

Capillary Electrophoresis: Principle, Details of the Instrument, Applications to Inorganic and Organic compounds.

UNIT-III
CHROMATOGRAPHY-3

Gas chromatography: Theory, Instrument description of equipment and different parts, columns (packed and capillary columns), detector specifications-thermal Conductivity detector, flame ionization detector, electron capture detector, nitrogen phosphorus detector, photo ionization detector, programmed temperature gas
Chromatography; applications in the analysis of gases, petroleum products etc., other detectors used their Principles and Applications.

Inorganic molecular sieves: structure of zeolites, crystals, types of sieves, hydro carbons application in the separation of gases including, ion exclusion principles and applications,
Counter current chromatography-principles and application, Affinity chromatography principles and applications

GC-MS–Introduction

Instrumentation – GC – MS interface – Mass spectrometer (MS) Instrument operation, processing GC – MS data –ion chromatogram Library searching –Quantitative measurement – sample preparation Selected ion monitoring –Application of GC-MS for Trace constituents. Drugs analysis, Environmental analysis and others

UNIT- IV
CHROMATOGRAPHY-3

Liquid-liquid partition chromatography: principle, supports, partitioning liquids, eluents, reverse phase chromatography, apparatus, applications

High performance liquid chromatography: Theory, Instrument description of the different parts of the equipment, columns, detectors-UV detector, refracto metric detector, Fluorescence detector, Diode Array detector, applications in the separation of organic compounds, names of other detectors used their Principles and Applications.

LC-MS – Introduction – Instrumentation– liquid chromatograph – Mass spectrometer Interface – Instrumental details – Processing LC-MS data– ion chromatograms – Library searching – Quantitative measurements.

Sample preparation – selected ion monitoring. Application of LC-MS for Druganalysis, Environmental samples and others.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	--	--
II	--	--	--	--
III	--	--	--	--
IV	--	--	--	--

K_1= Remembering, K_2= Understanding, K_3= Applying, K_4= Analysing, K_5= Evaluating, K_6=Create

Text Books/Reference Books

S. No	AUTHOR	TITLE	PUBLISHER
1	R.P.W Scott	Techniques and practice of Chromatography	Marel Dekker Inc.,NewYork
2	M.N.Sastri	Separation methods	HimalayaPublishingCompany,Mumbai
3	E.Helfman	Chromatography	VanNostrand, Reinhold,NewYork
4	E.Lederer and M.Lederer	Chromatography	Elsevier,Amsterdam.
5	John A Dean	Chemical separation methods	Von Nostrand Reinhold, NewYork
6	H.M Mc Nair and J. M. Miller	Basic Gas Chromatography	John Wiley, NewYork
7	W.Jeumings	Analytical Gas chromatography	AcademicPress,New York
8	H.Eugelhardt(ed)	Practice of HPLC	SpringerVerrag,Berrin
9	R.P.W Scott	Techniques and practice of Chromatography	Marel Dekker Inc.,NewYork
10	M.N.Sastri	Separation methods	HimalayaPublishingCompany,Mumbai
11	E.Helfman	Chromatography	VanNostrand, Reinhold,NewYork

Web Links

1. https://youtu.be/XMtmSz_9umk
2. https://youtu.be/ZN7euA1fS4Y
3. https://youtu.be/cdRp8rTc75o?si=0LTebCrkHFKc6XQ
4. https://youtu.be/ZN7euA1fS4Y

CO-PO Mapping

	On Completion of the course, the students will be able to
CO1	Students will be able to know the chromatography introduction, Principles and development methods
CO2	Students will acquire knowledge on column chromatography, Gel exclusion Chromatography and Capillary electrophoresis
CO3	Understand the gas chromatography, GC-MS and Inorganic molecular sieves
CO4	Acquire knowledge on Liquid-liquid partition chromatography, LC-MS,HPLC

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	2	1	2	1	1	1	2	2	3	3	1
CO2	3	1	1	2	1	1	1	1	2	2	3	3	1
CO3	3	2	2	2	2	1	1	1	1	2	3	2	1
CO4	3	2	2	1	2	1	1	1	1	2	3	2	1
Avg.	3	2	1.75	1.5	1.75	1	1	1	1.5	2	3	2.5	1

Low =1 ; Moderate = 2 ; High = 3 ; No Correlation = 0

At the completion of the M.Sc. Chemistry program, the students of our department will be able to

(**PO1) Knowledge:** Apply the knowledge of Chromatographic techniques to the solution of separation of simple to complex molecules.

(PO2) Critical Thinking: Carry out experiments in the area of Chromatography for isolation of Natural products from Plant and animal extracts and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of Chromatography.

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments for Chromatographic analysis

(PO5): Communication: Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(PO6): Life-long Learning: Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

(PO7) Ethical Practices and Social Responsibility: Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

PROGRAM SPECIFIC OUTCOMES (PSO's)

At the time of Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of Chromatography

PSO2 - Demonstrate the knowledge of Chromatography in the domain of research, education and perspective entrepreneurship.

PSO3 - Evaluate distinct problems in the field of Chromatography data analysis, scientific interpretation, and reaction mechanisms with an understanding on basic tools to be employed.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA

PG Courses 2023-24

SYLLABUS FOR SEMESTER – III(MSC- CHEMISTRY)

Paper I (Separation methods-I)

Weightage to Content

S.No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC (EXAMINATION AT THE END OF III SEMESTER)

PAPER- I: SEPARATION METHODS-I

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer ALL questions. **4X15=60**

1. (a) Explain the different types of Chromatography techniques with examples

OR

(b) Explain the following 1)Van Deempter equation2)Resolution3)Elution development.

2. (a) Discuss about the principles of Electrophoresis.

OR

(b) Explain the principle and applications of Column chromatography.

3. (a) Discusss the Gas chromatography principle and application.

OR

(b) Explain the importance and application of GC-Ms in drug analysis.

4. (a)Explain about the HPLC principle and applications.

OR

(b) Explain the instrument and applications of LC-MS .

SECTION -B

Answer any FIVE Questions. 5x3=15M

5. Define frontal analysis

6.Define and explain Rfvalue of chromatography

7. Define Absorption isotherm

8. Define Gel filtration chromatography

9. Discusses the nitrogen phosphorus detector.

10. Explain the applications of GC-MS for Environmental analysis.

11. Define and explain fluorescence detector

12. Explain the sample preparation method of LC-MS

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program &Semester II M.Sc. Chemistry Semester-III Paper-II**			
Course Code	TITLE OF THE COURSE **QUALITY CONTROL AND TRADITIONAL METHODS OF ANALYISY-I**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Statistical analysis, ISO, GLP, analysis techniques of organic and inorganic compounds	**60**	**10**	**30**	**4+3**

Course Objectives:

Student will acquire knowledge on various types of analysis techniques

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Students will be able to know the characteristics of analysis, Evaluation and reliability of analytical data, Statistical analysis, Quality assurance and management systems and ICH guidelines
CO2	Students will understand the Decomposition techniques of Inorganic Compounds and Organic Compounds
CO3	Acquire the knowledge on Oxidant system of Inorganic Systems and Organic Systems analysis
CO4	Acquire Organic Functional group analysis

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

Syllabus

UNIT-I

(a) QUALITY CONTROL IN ANALYTICAL CHEMISTRY

(b) Characteristics of an analysis: quality of an analytical procedure, limit of detection, sensitivity, safety, cost measurability, selectivity and specificity, quality control principles of Ruggedness test, control charts, Youden plot, and ranking test.

(c) Evaluation and reliability of analytical data: limitation of analytical methods, accuracy,

precision, errors in chemical analysis, classification of errors, minimization of errors, significant figures, computations and propagation of errors.

(d) Statistical analysis: Mean deviation, Standard deviation, F test, T test, rejection of results, presentation of data.

(e) Quality assurance and management systems: elements of quality assurance, quality assurance in design, development, production and services, quality and quantity management system, **ISO 9000**and **ISO 14000** series-meaning of quality, quality process model, customer requirement of quality calibration and testing, statistical process control, process control tools, control chart, statistical quality control, acceptance sampling.

Good laboratory practices(GLP)–need for GLP, GLP implementation and organization, GLP status in India

(f) Brief outline of ICH guidelines on drug substances and products.

(g)

UNIT-II

DECOMPOSITION TECHNIQUES OF ANALYSIS

(a) Inorganic Compounds

Principle of decomposition and Dissolution. Difference between dissolution / decomposition of Organic and Inorganic substances.

Importance of Decomposition Techniques in Analysis. Principle of Dissolution of an inorganic substance.

Decomposition of samples with acids – H2O, HCl, HF, HNO3, H2SO4 and HClO4

Decomposition of samples by fusion, Principle and with two examples each Alkali Fusion---Na2CO3,NaOH,

Acidic Fusion--- Sodium Hydro Sulphate, Sodium Pyro Sulphate

Oxidation Fusion---Na2O2, Sodium Chlorate

Reductive Fusion Na2CO3+ Na4BO4

What is Sintering process, How is it different from Fusion.

Fusion with alkali carbonates, alkali hydroxides, Sodium Peroxide Decomposition of samples by sintering with sodium peroxide, sodium carbonate. Principles of decomposition at high temperatures,high pressures.

Principles of Microwave and ultra sonic decomposition techniques.

(b) Organic Compounds

Principles of solubility of organic compounds, non polar, polar solvents. Re crystallisation methods and application of solubility and Re crystallisation.

UNIT-III
OXIDANT SYSTEMS-PRINCIPLES AND APPLICATIONS IN ANALYSIS

Analytical chemistry of some selected oxidant systems – formal, standard and normal potentials in various media, species responsible for the oxidation properties, stability of the solutions, standardization, requirement for the selections of the oxidants, selection of suitable indicators for Oxidant systems.

a) Inorganic Systems Mn (III), Mn (VII), Ce (IV), Cr (VI), V (V), periodate, iodate

b)Organic Systemschloramine-T.

UNIT- IV
ORGANIC FUNCTIONAL GROUP ANALYSIS

Classification of functional groups with suitable examples. Determination of:

1) Functional groups imparting acidic nature – thiol, enediol, phenolic hydroxyl

.2) Functional groups imparting basic nature – Aliphatic and Aromatic primary, secondary and tertiary amines–hydrazine derivatives.

3) Functional groups which impart neither acidic nor basic nature – Aldehydes, Ketones, Nitro, Methoxy, Olefinic

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	--	--
II	--	--	--	
III	--	--	--	
IV	--	--	--	

K_1= Remembering, K_2= Understanding, K_3= Applying, K_4= Analysing, K_5= Evaluating, K_6=Create.

Reference Books/Text Books

S.NO	AUTHOR	TITLE	PUBLISHER
1	Griffin	Technical methods of analysis	Mc Graw Hill Book Co.
2	D.GPeterseti	Chemical Separation and measurements	John M.Haves SandersCo.
3	H.ALaitina	Chemical analysis	McGrawHillBookCo.
4	I.M Kolthoff and R. Belcher	Volumetric Analysis, Vol III	Interscience public, new york
5	J.Bassettetal	Vogel's Text Book of Inorganic Quantitative Analysis	ELBS
6	D.A Skoog, D.M West and F.J Holler	Analytical Chemistry	SandersCollege Publishing, NewYork
7	Prof. Y. Anjaneyulu	Quality Assurance and Good Laboratory Practices	In NowPublication,NewYork
8	J.Dolezal,P.Povondra	Decomposition Techniques in Inorganic Analysis	JohnWileyandSons, NewYork

Web links

https://youtu.be/KxhVj4NsaKs

https://youtu.be/YfRqtzkX6Kk

https://youtu.be /BAOITNYOPSA?si=v4wyEtuW5xpu4

https://youtu.be/yjesFiq_Oc4?si=Yb9pgrpyINODUM3f

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Students will be able to know the characteristics of ananalysis, Evaluation and reliability of analytical data, Statistical analysis, Quality assurance and management systems and ICH guidelines
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CO3	Acquire the knowledge on Oxidant system of Inorganic Systems and Organic Systems analysis
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	1	1	2	1	3	3	3
CO2	3	2	1	2	1	1	1	1	2	3	3	3	3
CO3	3	2	1	2	1	1	1	1	1	3	3	3	3
CO4	3	3	1	1	1	1	1	1	1	3	3	3	3
Avg.	3	2.75	1	1.5	1	1	1	1	1.5	2.5	3	3	3

Low =1 ; Moderate = 2 ; High = 3 ; No Correlation = 0

Programme Outcomes

At the completion of the M.Sc. Chemistry program, the students of our department will be able to:

(**PO1) Knowledge:** Apply the knowledge of Qualitative techniques to the solution of identification of simple to complex molecules.

(PO2) Critical Thinking: Carry out experiments in the area of Decomposition techniques for Organic and inorganic compounds and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of Oxidant systems.

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments for identification of organic compunds.

(PO5): Communication: Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(PO6): Life-long Learning: Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

(PO7) Ethical Practices and Social Responsibility: Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

PROGRAM SPECIFIC OUTCOMES (PSO's)

At the time of Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of Qualitative analysis

PSO2 - Demonstrate the knowledge of Oxidant system in the domain of research, education and perspective entrepreneurship.

PSO3 - Evaluate distinct problems in the field of Identification of Organic compunds, scientific interpretation, and reaction mechanisms with an understanding on basic tools to be employed.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA

PG COURSES 2023-24

SYLLABUS FOR SEMESTER – III (MSC- CHEMISTRY)

PAPER II (QUALITY CONTROL AND TRADITIONAL METHODS OF ANALYSIS-I)

WEIGHTAGE TO CONTENT

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC (EXAMINATION AT THE END OF III SEMESTER)

PAPER- II: QUALITY CONTROL AND TRADITIONAL METHODS OF ANALYSIS-I

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. a) Discusses the various statistical parameter relevant to data processing.

(OR)

(b) Write a note on ICH guidelines on drug and their products

2. (a) Discuss about the principles of solubility of organic compounds in non-polar and polar solvents.

(OR)

(b) Discuss the principles of Decomposition and Dissolution for inorganic substances

3. (a) Discuss the stability & standardization solutions of Ceric ammonium sulphate and Mn(III) explain experimental details

(OR)

(b) Explain the standardization mechanism mechanism and applications of Chloramine-T

4. (a) Discuss the following functional group analysis 1) Aromatic secondary amines 2)Aliphatic primary amines.

(OR)

(b) Explain the functional determination of Nitro, Methoxy and Olifinic groups.

SECTION: B

Answer any **FIVE** questions **5X3=15**

1. Define selectivity and sensitivity
2. Explain the Q-Test for rejection of data
3. Write about acidic and reduction fusion
4. Explain the principle of decomposition of sample by sulfuric scid.
5. Explain the requirements of reductants standardization.
6. Explain the classification of redox indicators.
7. Explain the general functional classification.
8. Explain the principle involved estimation of aldehyde group.

*** *** ***

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
SYLLABUS FOR SEMESTER – III (MSC- CHEMISTRY)
CLASSICAL METHOD OF ANALYSIS-I
PRACTICALS

1. Water analysis

(i) Determination of total hardness (Ca^{2+} and Mg^{2+}) of water samples

(ii) Determination of chloride (Cl^-) present in water samples

(iii) Determination of dissolved oxygen (DO) of drinking water and sewage water

2. Complexometric titrations

(i) Determination of the concentration of calcium in milk powder by complexometric titration (EDTA)

(ii) Determination of Calcium and Magnesium in limestone or dolomite samples using EDTA.

3. Fertilizer analysis

(i) Determination of ammonia from ammonia containing fertilizer

(ii) Determination of phosphate from fertilizer

4. Analysis of iron ore

(i) Complete analysis of iron ore

(ii) Determination of percentages of Fe (II) and Fe (III) present in iron ore sample

5. Analysis of Coal

(i) Determination of moisture content of coal sample

(ii) Determination of volatile matter of coal sample

(iii)Determination of fixed carbon of coal sample

(iv) Determination of ash content of coal sample.

Reference Books/Text Books

S.NO	AUTHOR	TITLE	PUBLISHER
1	J. Mendham R. C. Denny J.D.Barnes M.J.K.Thomas	Vogel Text book of Quantitative Chemical Analysis	Pearson Education

Schem Scheme of valuation

1. Record **10 Marks**

2. Viva- Voce **15 Marks**

3. Practical (Quantitative analysis) **50 Marks**

i. Principle with Chemical Reaction 10 Marks

ii. Brief Procedure 10 Marks

iii. Formula & Tabular forms	5 Marks
iv. Calculation	5 Marks
v. Report	
< 2% Error	20 Marks
>2% Error	15 Marks
>5% Error	10 Marks
Total	**75 Marks**

Cocurricular Activities

Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):

For Teacher: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of Quantitative analysis-Determination of amount of solute present in given solution.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Determination of amount of solute present in given solution. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

Max marks for Fieldwork/project work Report: 05.

Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

Unit tests (IE).

a) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.

2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.

3. Visits of facilities, firms, research organizations etc.

4. Invited lectures and presentations on related topics by field/industrial experts.

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program &Semester IIM.Sc. Chemistry Semester-III Paper-III**			
Course Code	TITLE OF THE COURSE **APPLIED ANALYSIS-I**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Analysis of iron ore and water analysis**.**	**60**	**10**	**30**	**4+3**

Course Objectives:

Student will be able to know the various metals and its analysis

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Scope of metallurgical analysis, Analysis of iron ores, Manganese ore, Chromite ore and phosphate rock ore
CO2	Analysis of steel, Refractory materials and fluxes
CO3	Analysis of soap, oils, paints and cements
CO4	Determination of DO, COD, BOD and Ions in water

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

Syllabus:

UNIT –I : ANALYSIS OF ORES

(a) General techniques of analysis applied to complex materials-Scope of metallurgical analysis -

General methods of dissolution of complex materials - Various chemical methods for the effective separation of the constituents in the complex materials.

(b) Analysis of ores: Iron ore- Analysis of the Constituents – Moisture , loss of ignition, Total Iron, ferrous Iron ,Ferric Iron, alumina, silica, Titania, Lime, Magnesia,

Sulphur, phosphrous, manganese, alkalies, combined water, Carbon in blast furnace, fluedust and sinter.

(c) Manganese Ore-Analysis of the Constituents –Total Manganese, MnO_2,SiO_2, BaO,Fe_2O_3, Al_2O_3,CaO,PandS

(d) Chromite Ore - Analysis of the Constituents – Chromium, SiO_2, FeO, Al_2O_3 CaO, &MgO.

(e) Phosphate rock Ore - Analysis of the Constituents - CaO,P_2O_5, F, SiO_2,CO_2,S,Na_2O,Al_2O_3,Fe_2O_3,Mgo,K_2O,Cl,MnO.Organic carbon, Moisture, Loss of ignition.

(f) Aluminium Ore (Bauxite) - Analysis of the Constituents – Silica, Alumina,Fe_2O_3,Titania,MnO,P_2O_5,CaO,MgO,vanadium,zirconium, and alkalies.

UNIT – II : **ANALYSIS OF FINISHED PRODUCTS-I**

(a) Analysis of steel for C, Si, S,P, Mn, Ni, Cr; Mg and analysis of blast furnace slag.

(b) Analysis of refractory materials:fireclay,flour spar,andmagnesite

(c) Analysis of fluxes –limestone and dolomite.

UNIT – III: **ANALYSIS OF FINISHED PRODUCTS-II**

(a) Chemical Analysis of cement-silica, NH_4OH group, ferric oxide, alumina, lime,magnesia, Sulphide Sulphur , K_2O,Na_2O, free CaO in Cement and Clinker,SO_3 andloss on ignition.

(b) Analysis of oils-saponification number, iodine number, and acid number..

(c) Analysis of soaps - moisture, volatile matter, total alkali, total fatty matter, free caustic alkali or free fatty acids, sodium silicate ,chloride.

(d) Analysis of paints-vehicle and pigment,$BaSO_4$,total lead and leadchromate

UNIT – IV: ASSESSMENT OF WATER QUALITY

Sources of water, classification of water for different uses, types of water pollutants and their effects,

Analytical methods for the determination of the following ions in water: Anions: CO_3^{2-}, HCO_3^-, F^-, Cl^-, SO_4^{2-}, PO_4^{2-},NO_3^-,NO_2^-, CN^-, S^{2-}

Cations:Fe^{2+},Fe^{3+},Ca^{2+},Mg^{2+},Cr^{3+},As^{5+},Pb^{2+},Hg^{2+},Cu^{2+},Zn^{2+},Cd^{2+},Co^{2+}

Determination of Dissolved oxygen (D.O), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), standards for drinking water

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	--	--
II	--	--	--	
III	--	--	--	
IV	--	--	--	

K_1= Remembering, K_2= Understanding, K_3= Applying, K_4= Analysing, K_5= Evaluating, K_6=Create.

Text Books/ Reference Books

S. No	AUTHOR	TITLE	PUBLISHER
1	Harrison John, Weily1979	Handbook of Analytical Control of Iron and Steel Production	McGrawHill
2	Foster Dee Sneel and Frank M	Commercial Methods of Analysis	McGrawHill
3	Lalude	Water Pollution	McGrawHill
4	AnilKumarDe	Environmental Chemistry	WileyEasternLtd.
5	S.M. Khopkar	Environmental Analysis	S.M. Khopkar(IITBombay
6	Griffin	Technical Methods of Analysis	McGrawHill

WebLinks:

https://youtu.be/XV609o_o9kg

https://youtu.be/9S11FizrS7I

https://youtu.be/7rWy8zvWfW4?si=Pvkwpa6BfJrPy-Et

https://youtu.be/mAcXLbiXIhA?si=L4zg7vKv4K393KbW

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Scope of metallurgical analysis, Analysis of iron ores, Manganese ore, Chromite ore and phosphate rock ore

CO2	Analysis of steel, Refractory materials and fluxes
CO3	Analysis of soap, oils, paints and cements
CO4	Determination of DO, COD, BOD and Ions in water

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	1	1	1	2	1	3	3	1
CO2	3	3	3	3	3	1	1	1	2	1	3	3	1
CO3	3	3	3	2	2	1	1	1	2	1	3	3	1
CO4	3	2	2	3	1	2	3	1	3	1	3	3	1
Avg.	3	2.75	2.25	2.75	2	1.25	1.5	1	2.25	1	3	3	1

Low =1 ; Moderate = 2 ; High = 3 ; No Correlation = 0

Programme Outcomes

At the completion of the M.Sc. Chemistry program, the students of our department will be able to:

(**PO1) Knowledge:** Apply the knowledge of Analysis of Ores to the solution of simple to complex ores

(PO2) Critical Thinking: Carry out experiments in the area of Analysis of finished products for different ores and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of Metallurgy.

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments for water analysis

(PO5): Communication: Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(PO6): Life-long Learning: Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

(PO7) Ethical Practices and Social Responsibility: Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

PROGRAM SPECIFIC OUTCOMES (PSO's)

At the time of Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of Metallurgy.

PSO2 - Demonstrate the knowledge of Analysis of Ores and finished products in the domain of

research, education and perspective metallurgy.

PSO3 - Evaluate distinct problems in the field of Water analysis, scientific interpretation, and reaction mechanisms with an understanding on basic tools to be employed.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
PG COURSES 2023-24
SYLLABUS FOR SEMESTER – II (MSC- CHEMISTRY)
PAPER III (ORGANIC CHEMISTRY)
WEIGHTAGE TO CONTENT

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

I IYEAR MSC (EXAMINATION AT THE END OF II SEMESTER)

PAPER- III: APPLIED ANALYSIS-I

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. a)Explain the suitable methods for determination of manganese in manganese ore.

(OR)

b) Explain the analysis of CO_2 in phosphate rock ore

2. a) Describe the procedure for analysis of C, Mn and Cr in steel

(OR)

b) Describe the chemical analysis of limestone

3. a) Write the analysis of the Saponification number , Iodine number and acid number of oils?

.

(OR)

b) Determination of total lead, lead chromate and BaSO4 of Paints?

4. a) Determination of carbonate and bicarbonate & Arsenic and Lead ions of water?

(OR)

b) Write the analysis of DO,BOD and COD of water?

SECTION : B

Answer any **FIVE** questions 5 X 3 = 15

1. Determination of moisture of iron ore?
2. Determination of silica present in bauxite ore
3. Explain the mechanism of blast furnance
4. Write the analysis of carbon in steel .
5. Determine Al in cement
6. Write the analysis of TFM of soaps
7. Define water pollutants
8. What are the standards of drinking water .

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program &Semester II M.Sc. Chemistry Semester-III Paper-IV**			
Course Code	TITLE OF THE COURSE **INSTRUMENTAL METHODS OF ANALYSIS-I**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Types of spectroscopy and its principles ,instrumentation and applications	**60**	**10**	**30**	**4+3**

Course Objectives:

Student will be able to know the types of spectroscopy and its principles ,instrumentation and applications

Course Outcomes:

On Completion of the course, the students will be able to

CO1	UV-Visible Spectroscopy, Spectro fluorimetry
CO2	Infrared spectroscopy, Raman Spectroscopy
CO3	NMR Spectroscopy, ESR Spectroscopy
CO4	Mass Spectroscopy, X-ray Spectroscopy

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

Syllabus

UNIT-I: SPECTROSCOPIC METHODS-I

(a) UV-Visible Spectroscopy: laws of absorption, deviation from Beer's law, single and double beam spectrophotometers-instrumentation, sources of radiation, detectors, qualitative analysis by absorption measurements, general precautions in Colorimetric determinations, determination of certain metal ions by using ligands –Fe2+, Fe3+,Al3+, NH4 +,Cr3+,Cr6+, Co3+,Cu2+,Ni2+andanions– NO2-, PO43- using suitable reagents, simultaneous determinations of dichromate and permanganate in a mixture, spectro photomeric titrations, principle of diode array spectrophotometers.

(b) Spectro fluorimetry: Theory of fluorescence, phosphorescence, factors affecting the above, quenching, relation between intensity of fluorescence and concentration, instrumentation, application with reference to Al3+, chromium salts, fluorescence, thiamin(B1)and riboflavin (B2) in drug samples

UNIT -II:

SPECTROSCOPIC METHODS-II

(a) *Infrared spectroscopy:* units of frequency, wavelength and wave number molecular vibrations, factors influencing vibrational frequencies, instrumentation, sampling techniques, detectors, characteristic frequencies of organic molecules, qualitative and quantitative analysis with reference to (petroleum refinery and polymer industry), selected molecules like CO, CO2, non-destructive IR method for the analysis of CO and other organic compounds, principles of Fouriert ransform IR.

(b) *Raman Spectroscopy:* Raman effect and spectra, differences between Raman spectra and IR spectra, instrumentation, Raman spectra of CO, CO2,N2O, H2O.

UNIT-III:

SPECTROSCOPIC METHODS-II

NMR Spectroscopy: resonance condition, origin of NMR spectra, instrumentation, chemical shift, factors affecting chemical shift, shielding, spin-spin splitting, mechanism for spin-spin coupling, interpretation of NMR spectra of typical organiccompounds,factorsinfluencingNMRspectra,fastchemicalreactions,magnitude of I, nuclei with quadrupole moments, FT NMR, study of isotopes otherthanproton-13C,15N,19F,31P,11B, double resonance, spin tickling, shift reagents, applications.

(a) ESR Spectroscopy: principle, g value, hyper fine splitting, qualitative analysis, Krammers degeneracy, fine splitting, instrumentation, introduction to double resonance technique, difference between ESR and NMR spectra, quantitative analysis, application to study of free radicals and other analytical applications.

UNIT-IV: SPECTROSCOPIC METHODS-III

(a) Mass Spectroscopy: Principle, basic instrumentation, energetics of ion formation, types of peaks observed, resolution, qualitative analysis, molecular weight determination, quantitative analysis, advantages

(b) X-ray Spectroscopy (XRF): chemical analysis by X-ray spectrometers, energy dispersive and wavelength dispersive techniques, evaluation methods, instrumentation, applications.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	--	
II	--	--	--	
III	--	--	--	
IV	--	--	--	--

K_1= Remembering, K_2= Understanding, K_3= Applying, K_4= Analysing, K_5= Evaluating, K_6=Create.

Text Books/ Reference Books

S. No	AUTHOR	TITLE	PUBLISHER
1	H.HWillard,MerittJr. andJ.ADean	Instrumental methods of analysis	Goel Publishing House,Meerut

2	Skoog and West	Principles of instrumental analysis	Goel Publishing House,Meerut
3	B.K Sarma	Instrumental methods of analysis	Goel Publishing House,Meerut
4	Chatwal andAnand	Instrumental methods of Analysis	London
5	A.R Date and A.L Glay	Applications of ICP-MS	London(EDS),Blackie, London.
6	A. Moutaser and D.W Gologhtly (Eds)	ICP in Analytical Atomic Spectrometry	VeHPublisher,NewYork
7	G.IMoore	Introduction to ICP emission Spectrometry in Analytical	London

Weblinks

1 https://youtu.be/1mrUHrZ-0zk?si=Hsu2iw0uIc0REZy_

2. https://youtu.be/zslQtSF5-TU?si=DGRw0DKXJga2ivc1

3. https://youtu.be/w3LS22E10Zc?si=ruxEk6Dlf2STmMzo

4. https://youtu.be/SBir5wUS3Bo?si=MY0d6epJDwsHk0Hw

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	UV-Visible Spectroscopy, Spectro fluorimetry
CO2	Infrared spectroscopy, Raman Spectroscopy
CO3	NMR Spectroscopy, ESR Spectroscopy
CO4	Mass Spectroscopy, X-ray Spectroscopy

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	1	1	1	2	1	3	3	1
CO2	3	2	2	3	2	1	1	1	2	1	3	3	1
CO3	3	3	1	3	3	1	2	1	2	1	3	3	1
CO4	3	2	2	3	3	1	2	1	3	1	3	3	1
Avg.	3	2.5	1.5	3	2.5	1	1.5	1	2.25	1	3	3	1

Low =1 ; Moderate = 2 ; High = 3 ; No Correlation = 0

Programme Outcomes

At the completion of the M.Sc. Chemistry program, the students of our department will be able to:

(**PO1) Knowledge:** Apply the knowledge of Spectroscopy techniques to the solution of simple to complex structural elucidation of Organic molecules.

(PO2) Critical Thinking: Carry out experiments in the area of NMR Spectroscopy for Structural analysis inorganic and Organic Compounds and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of NMR and Mass Spectroscopy

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments for Structural analysis.

(PO5): Communication: Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(PO6): Life-long Learning: Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

(PO7) Ethical Practices and Social Responsibility: Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

PROGRAM SPECIFIC OUTCOMES (PSO's)

At the time of Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of Spectroscopy.

PSO2 - Demonstrate the knowledge of NMR and Mass Spectroscopy in the domain of research, education and perspective entrepreneurship.

PSO3 - Evaluate distinct problems in the field of Spectroscopy data analysis, scientific interpretation, and reaction mechanisms with an understanding on basic tools to be employed.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
PG COURSES 2023-24
SYLLABUS FOR SEMESTER – II (MSC- CHEMISTRY)
PAPER IV (PHYSICAL CHEMISTRY)
WEIGHTAGE TO CONTENT

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit

1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC (EXAMINATION AT THE END OF II SEMESTER)

PAPER- IV: INSTRUMENTAL METHODS OF ANALYSIS-I

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. (a) Write the principle, Instrumentation and applications of UV-Visible spectroscopy?

(OR)

(b) Explain the principle and applications with reference(any three) of spectroflorimetry?

2. (a) Explain the principle and applications of IR spectroscopy.

(OR)

(b) Describe the principle and instrumentation of Raman spectroscopy.

3. (a) Write the mechanism for spin-spin coupling and factors effecting on chemical shift of NMR spectroscopy?

(OR)

(b) Describe the theory and working mechanism of ESR spectroscopy?

4. (a) Write the basic principle, instrumentation and peaks observed in mass spectroscopy

(OR)

(b) Explain principle, instrumentation and applications of XRF spectroscopy.

SECTION: B

Answer any **FIVE** questions 5 X 3 = 15

5. Define laws of absorption
6. Define fluorescence?
7. What is IR analysis of CO2
8. Write note on molecular vibration
9. What is FT-NMR?
10. How can you differentiate NMR and ESR?
11. Define Molecular ion in MS
12. Explain Matrix effects of XRF

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PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

IIYEAR MSC (EXAMINATION AT THE END OF III SEMESTER)

INSTRUMENTAL METHODS OF ANALYSIS

PRACTICALS

1. pH metry

(i) Determination of alkalinity of a coloured effluent using pH metric titration.

(ii) Determination of purity of commercial HCl using pH metric titration.

(iii)Determination of purity of commercial H2SO4 using pH metric titration.

2. Potentiometry

(i) Determination of Cr(VI) with Fe(II) using potentiometric end point

(ii) Determination of Fe (II) using ceric sulphate by potentiometric end point

(iii)Determination of a mixture of Ce(IV) and V(V) with Fe(II) by potentiometric end point

(iv)Determination of KSCN with AgNO3 by potentiometric end point.

3. Spectrophotometry

(i) Determination of Fe (III) using potassium thiocyanate

(ii) Determination of Iron(II) using orthophenanthroline

(iii)Determination of phosphate in fertilizer and cola drinks by Molybdenum blue method
(iv)Determination of Manganese (II) -periodate method

4. Flame photometry

(i) Determination of sodium present in bread samples
(ii) Determination of sodium and potassium in a given sample of fertilizer

5. Thin layer chromatography:

Determination of Rf values and identification of organic compounds in a given mixture by TLC
(i) Separation of mixture of benzil and 2-nitrophenol
(ii) Mixture of benzophenone and naphthalene
(iii) Mixture of 2-nitrophenol and 4-nitrophenol

Reference Books/Text Books

S.NO	AUTHOR	TITLE	PUBLISHER
1	A.I VOGEL	A Text Book of Quantitative InorganiC Analysis (3rd Edition)	London
2			

Schem Scheme of valuation

1. Record	**10 Marks**
2. Viva- Voce	**15 Marks**
3. Practical	**50 Marks**
i. Principle with Chemical Reaction	10 Marks
ii. Brief Procedure	5 Marks
iii. Formula & Tabular forms	5 Marks
iv. Calculation	5 Marks
v. Graph	5 Marks
vi. Report	
< 2% Error	20 Marks
>2% Error	15 Marks
>5% Error	10 Marks

Total **75 Marks**

Cocurricular Activities

Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):

For Teacher: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of Various instrumentation techniques like Potentiometry, pH Metry, Spectrophotometer, and other laboratory techniques.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Various instrumentation techniques like Potentiometry, pH Metry, Spectrophotometer, and other laboratory techniques. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

Max marks for Fieldwork/project work Report: 05.

Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

Unit tests (IE).

a) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.

2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.

3. Visits of facilities, firms, research organizations etc.

4. Invited lectures and presentations on related topics by field/industrial experts.

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program &Semester II M.Sc. Chemistry Semester-IV Paper-I**			
Course Code	TITLE OF THE COURSE **SEPARATION METHODS-II**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Chromatography techniques, sampling techniques, importance of analytical chemistry in industry	**60**	**10**	**----**	**4**

Course Objective

Students will gain knowledge on chromatographic techniques and sampling .

Course Outcomes:

	On Completion of the course, the students will be able to
CO1	Students will acquire holistic knowledge in paper and TLC techniques
CO2	Students will be able to know the ion exchange chromatography
CO3	Student will acquire knowledge in sampling of solids liquids and gases
CO4	Students will know about importance of analytical chemistry in industry and solvent extraction

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			**Employability**			**Entrepreneurship**	

Syllabus

UNIT-1

CHROMATOGRAPHY–5

(a) Paper chromatography: principle, papers as a chromatographic medium, modified papers, solvent systems mechanism of paper chromatography, experimental technique, different development methods- ascending ,descending, horizontal, circular spreading, multiple development, two dimensional development, reverse phase paper chromatographic technique-visualization and evaluation of chromatograms, applications.

(b) Thin layer chromatography: principle, chromatographic media-coating materials, applications, activation of adsorbent, sample development, solvent systems, development of

chromatoplate, types of development, visualization methods, documentation, applications in the separation, HPTLC-principle, technique,applications.

UNIT-II
CHROMATOGRAPHY-6

(a) Ion Exchange: principles of ion-exchange systems, synthetic ion-exchange resins, properties of anion and cation exchange resins, ion-exchange mechanism, ion- exchange equilibria, selectivity, ion-exchange capacity applications of ion- exchangers in different fields.

(b) Ion exchange chromatography: Principle, Equipment, Application Specifically Separations of Lanthanides. Actinides, amino acids.

(c) Ion chromatography: principles of separation, instrumentation, detectors, separation of cations and anions, applications in the analysis of water and air pollutants.

UNIT-III; SAMPLING OF SOLIDS ,LIQUIDS AND GASES

Sampling: Basis of sampling, purpose of sampling, homogeneous and heterogeneous samples, statistical criteria for good sampling, sample size, sampling unit, grosssample, laboratory sample.

Sampling of Solids: Cone and Quartering method, Long pile and alternative shovel method, precautions in preservation of solid samples, sampling of metals and other solids rods, wires, sheets, plates, especially Gold, Silver, Iron and other metals.

Sampling of different types of liquids: different sampling techniques, sampling of drinking water, industrial effluents, precautions in sampling and preservation of collected liquid samples.

Sampling of gases: sampling and Preconcentration by adsorption or absorption method, instantaneous monitoring, sampling in samplers and subsequent monitoring,different types of gas samplers, precautions in preservation of samples, systematic sampling and random sampling.

UNIT- IV; IMPORTANCE OF ANALYTICAL CHEMISTRY & SOLVENT EXTRACTION

(a)Importance of Analytical Chemistry to Industrial Research: Importance ofQualitative and Quantitative analysis in research and development, industries and other branches of science. Development and validation of an analytical method, units, concentrations, calculations, standards, chemical reactions, expressions of concentrations, importanceof separation methods with examples.

(b)Solvent Extraction: principles and processes of solvent extraction, Distribution Law and Partition coefficient, nature of partition forces, different types of solvent extraction systems – Batch extraction, Continuous extraction, Counter current extraction, solvent extraction systems,

applications in metallurgy, general applications in analysis and pre-concentration, special extraction systems like crown ethers, super fluid and surfactant extractions-examples.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	---	
II	--	--	--	
III	--	--	--	
IV	--	--	--	

K_1= Remembering, K_2= Understanding, K_3= Applying, K_4= Analysing, K_5= Evaluating, K_6=Create

Text Books/Reference Books

S. No	AUTHOR	TITLE	PUBLISHER
1	E. Helfman	Chromatography	Van Nostrand, Reinhold, New York
2	E. Lederer and M. Lederer	Chromatography	Elsevier, Amsterdam.
3	John A Dean	Chemical separation methods	Von Nostrand Reinhold, New York
4	4. R.P.W Scott	Techniques and practice of Chromatography	Marel Dekker Inc New York
5	E.Stahl	Thin layer chromatography	Academic Press, New York
8	James, G.Tartor	Ion chromatography	Academic Press, New York

Web Links

1. https://youtu.be/TdJ57SQ6GAQ
2. https://youtu.be/VOSkyj1dtbc
3 .https://youtu.be/e3lRt9XdV0s
4. https://youtu.be/ulb0IF-ECR

CO-PO Mapping

	On Completion of the course, the students will be able to

CO1	Students will acquire holistic knowledge in paper and TLC techniques
CO2	Students will be able to know the ion exchange chromatography
CO3	Student will acquire knowledge in sampling of solids liquids and gases
CO4	Students will know about importance of analytical chemistry in industry and solvent extraction

	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO1 0	PSO1	PSO2	PSO3
CO1	3	1	2	1	2	1	1	1	2	2	3	3	1
CO2	3	1	1	2	1	1	1	1	2	2	3	3	1
CO3	3	2	2	2	2	1	1	1	1	2	3	2	1
CO4	3	2	2	1	2	1	1	1	1	2	3	2	1
Avg.	3	2	1.75	1.5	1.75	1	1	1	1.5	2	3	2.5	1

Low =1 ; Moderate = 2 ; High = 3 ; No Correlation = 0

At the completion of the M.Sc. Chemistry program, the students of our department will be able to

(**PO1) Knowledge:** Apply the knowledge of Chromatography techniques to the solution of separation of simple to complex Organic molecules.

(PO2) Critical Thinking: Carry out experiments in the area of Chromatography and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of Solvent extraction.

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments for Application of analytical chemistry.

(PO5): Communication: Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(PO6): Life-long Learning: Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

(PO7) Ethical Practices and Social Responsibility: Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

PROGRAM SPECIFIC OUTCOMES (PSO's)

At the time of Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of Chromatography.

PSO2 - Demonstrate the knowledge of Solvent extraction in the domain of research, education and perspective entrepreneurship.

PSO3 - Evaluate distinct problems in the field of Application of analytical chemistry, scientific interpretation, and reaction mechanisms with an understanding on basic tools to be employed.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA

PG Courses 2023-24

SYLLABUS FOR SEMESTER – IV(MSC- CHEMISTRY)

Paper I (Separation methods-VI)

Weightage to Content

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC (EXAMINATION AT THE END OF IV SEMESTER)

PAPER- I: SEPARATION METHODS-VI

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer ALL questions. **4X15=60**

1. (a) write a brief note on paper chromatography and explain the different develop methods.

OR

(b) write a brief note on HPTLC Principle and applications.

2. (a) Give a detailed account on synthetic ion exchange resins and correct the properties ofcation and anion exchange resins.

OR

(b) write a brief note on Principle and instrumentation and detectors of Ion chromatography

3. (a) Write a brief note on sampling and statistical correction for good sampling.

OR

(b) Long and alternative short methods precautions in preservation of solid samples

4. (a) Different types of solvent extraction methods and explain it.

OR

(b) Write a note on the following

a. Distribution law , b. partition coefficient , c. Nature of partition

SECTION -B

Answer any FIVE Questions. 5x3=15M

1. write note on Ascending and descending development
2. write a short note on activation of absorbent
3. Applications of Ion exchangers in different fields.
4. Write a short note on ion exchange mechanism
5. homogeneous and heterogeneous samples.
6. write a short note on preserving gas samples.
7. Write the applications of solvent extraction in metallurgy
8. Write a short note on validation of an analytical method

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program &Semester II M.Sc. Chemistry Semester-IV Paper-II**			
Course Code	TITLE OF THE COURSE **QUALITY CONTROL AND TRADITIONAL METHODS OF ANALYISY-II**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Precipitation methods and analysis of drugs	**60**	**10**	**30**	**4+3**

Course Objectives:

Study the analysis of precipitation methods and drugs

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Student will be able to identify the precipitation and mechanism
CO2	Student have knowledge on PFHS and electro gravimetric
CO3	Student will be able to understand reductant system
CO4	Understanding the analysis of some selected drugs

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus

UNIT-I ; PRECIPITATION METHODS-1

Crystal habit and super saturation, nucleation and crystal growth, homogeneous and heterogeneous nucleation, solubility and particle size, colloids, completeness of precipitation , effect of excess precipitant, pH, complex formation, temperature, purity of precipitates, aging,

Co-precipitation and post precipitation : theory of adsorption of salts having an ion in common with the main precipitate, co-precipitation in colloidal precipitates, adsorption of solvents, mixed crystal formation by occlusion and entrapment, re- precipitation with examples, Post-precipitation – theory of post-precipitation, examples of post-precipitation, conditions for obtaining pure and quantitative precipitates.

Precipitation Titrations: Principle, Indicators for precipitation titrations, determination of halides.

UNIT-II
PRECIPITATION METHODS-2

Precipitation from Homogeneous Solution (PFHS): theory of PFHS, methods of PFHS – increase in pH, decrease in pH, cation release, anion release, reagent synthesis, change in oxidation state, photochemical reactions, precipitation from mixed solvents. Applications of PFHS methods.

Gravimetric determinations: nature of species, preparation of solutions, limitations, interferences, inorganic b. precipitants-chloride and sulphate, organic precipitants dimethyl glyoxime (DMG), oxine, benzidine, salicylaldoxime, benzoin oxime, sodium tetraphenyl boron, tetraphenyl arsonium chloride.

Electro-gravimetric analysis: principle, important terms in electrogravimetry, decomposition voltage or decomposition potential, over voltage and their importance, instrumentation, electrolysis at constant current, determination of Cu2+ by constant current electrolysis, electrolysis at controlled potentials, determination of Cu, Pb, Sn in brass and bronze by controlled potential electrolysis.

UNIT-III ;
REDUCTANT SYSTEM- PRINCIPLES AND APPLICATIONS IN ANALYSIS

Analytical chemistry of some selected reductant systems – formal, standard and normal potentials in various media, stability of the solutions, species responsible for the reduction properties, standardization, requirement for the selection of the reductants, selection of suitable indicators for various reductant systems,

Inorganic Systems – Cr (II), V (II), Ti (III), Sn (II), Fe (II) in H_3PO_4 and hydrazine,

Organic Systems – hydroquinone and Ascorbic acid.

UNIT- IV: ANALYSISOF SOME SELECTED DRUGS

Basic considerations of drugs – Classification Determination of the following Drugs:

Acetyl salicylic acid (Antipyretic – Analgesic)

Testosterone, progesterone and cortisone (Steroids and corticoids)

Sulphadiazine (sulphadrugs)

Phenobarbitone (Barbituric acid derivatives)

Chloramphenicol, Benzyl penicillin and Tetracycline (Antibiotics)

Thiamine (B1), Riboflavin (B2) and ascorbic acid (c) [Vitamins]

Isoniazid (Antimicrobacterial agents)

Methlydopa (Antihypertensive agents)

Metronidazole (Antiamoebic agents)

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	--	
II	--	--	--	
III	--	--	--	
IV	--	--	--	

K_1= Remembering, K_2= Understanding, K_3= Applying, K_4= Analysing, K_5= Evaluating, K_6=Create.

Reference Books/Text Books

S.NO	AUTHOR	TITLE	PUBLISHER
1	Griffin	Technical methods of analysis	McGrawHill BookCo.
2	D.GPeterseti	ChemicalSeparationandmeasurements	JohnM.HavesSandersCo.
3	H.ALaitina	Chemicalanalysis	McGrawHillBookCo.
4	I.M Kolthoff and R. Belcher	Volumetric Analysis, Vol III	Inter science public, Newyork

5	J.Bassettetal	Vogel'sTextBookofInorganicQuantitativeAnalysis	ELBS
6	D.A Skoog, D.M West and F.J Holler	Analytical Chemistry	SandersCollege Publishing, NewYork
7	Prof. Y. Anjaneyulu	Quality Assurance and Good Laboratory Practices	In NowPublication,NewYork
8	J.Dolezal,P.Povondra	DecompositionTechniquesinInorganic Analysis	JohnWileyandSons, NewYork

Web links

https://youtu.be/j9jvimqm8eY

https://youtu.be/Nk_wupeeb6E

https://youtu.be/8NspLCYVb6c

https://youtu.be/yjesFiq_Oc4?si=Yb9pgrpyINODUM3f

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Student will be able to identify the precipitation and mechanism
CO2	Student have knowledge on PFHS and electro gravimetric
CO3	Student will be able to understand reductant system
CO4	Understanding the analysis of some selected drugs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	1	1	2	1	3	3	3
CO2	3	2	1	2	1	1	1	1	2	3	3	3	3
CO3	3	2	1	2	1	1	1	1	1	3	3	3	3
CO4	3	3	1	1	1	1	1	1	1	3	3	3	3
Avg.	3	2.75	1	1.5	1	1	1	1	1.5	2.5	3	3	3

Low =1 ; Moderate = 2 ; High = 3 ; No Correlation = 0

Programme Outcomes

At the completion of the M.Sc. Chemistry program, the students of our department will be able to:

(**PO1) Knowledge:** Apply the knowledge of Precipitation techniques to the solution of simple to complex isolation of molecules.

(PO2) Critical Thinking: Carry out experiments in the area of precipitation and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of Reductant systems.

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments for Analysis of Drugs.

(PO5): Communication: Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(PO6): Life-long Learning: Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

(PO7) Ethical Practices and Social Responsibility: Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

PROGRAM SPECIFIC OUTCOMES (PSO's)

At the time of Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of Precipitation techniques

PSO2 - Demonstrate the knowledge of Analysis of drugs in the domain of research, education and perspective entrepreneurship.

PSO3 - Evaluate distinct problems in the field of Reductant systems, scientific interpretation, and reaction mechanisms with an understanding on basic tools to be employed.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA

PG COURSES 2023-24

SYLLABUS FOR SEMESTER – IV(MSC- CHEMISTRY)

PAPER II (QUALITY CONTROL AND TRADITIONAL METHODS OF ANALYSIS-II)

WEIGHTAGE TO CONTENT

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC (EXAMINATION AT THE END OF IV SEMESTER)

PAPER- II: QUALITY CONTROL AND TRADITIONAL METHODS OF ANALYSIS-II

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. a) Explain about homogeneous and heterogeneous nucleation in precipitation methods.

OR

(b) Explain the principle of precipitation, give a brief note on Indicators that are used inprecipitation titration.

2. (a) Discuss the theory of precipitations from homogeneous solution.

OR

(b) Write a brief note precipitation from mixed solvents and applications of precipitationsfrom homogeneous solution

3. (a) Discuss the significance of suitable indicators for reductant system with examples

OR

(b) Give a detailed account on Inorganic reductant systems-Cr (2), V (5) and Sn (2)

4. (a) Discuss about the determination of Sulphadiazine.

OR

(b) Write the determination of Tetracycline

SECTION: B

Answer any **FIVE** questions **5X3=15**

1. Write a brief note on colloids
2. Write the effect of PH and temperature on precipitations
3. Write a short note on Benzoin oxime.
4. Write a short note on Di methyl Glyoxime (DMG)
5. Write a note on selective reductant systems.
6. Write a short note on formal potential.

7. Write a note on Riboflavin

8. Write note on chloramphenicol

*** *** ***

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
SYLLABUS FOR SEMESTER – IV (MSC- CHEMISTRY)
CLASSICAL METHOD OF ANALYSIS-II
PRACTICALS

1. **Water analysis**
   (i) Determination of alkalinity (CO_3^{2-} , HCO_3^-) of water samples.
   (ii) Determination of chemical oxygen demand (COD) of drinking water and sewage water
   (iii) Determination of biological oxygen demand (BOD)of drinking water and sewage water

2. Redox titrations

(i) Determination of oxalate in kidney stones by permanganometric titration.

(ii) Determination of Fe(II) present in an Iron tablet using $KMnO_4$

3. Fertilizer analysis

(i) Determination of nitrate from fertilizer

(ii) Determination of sulfur (as sulfate) from sulfur containing fertilizer.

4. Analysis of oils and soaps

(i) Determination of saponification value, acid value and iodine value of oil sample

(ii) Determination of moisture content and total alkali of soaps

5. Separation and determination of ions by ion-exchanger resins

(i) Determination of Na^+ by cation exchanger resin

(ii) Determination of Na^+ and K^+ in a mixture by cation exchanger resin

(iii)Determination of Cland Brin a mixture by anion exchanger resin

(iv) Determination of ash content of coal sample.

Reference Books/Text Books

S.NO	AUTHOR	TITLE	PUBLISHER
1	J. Mendham R. C. Denny J.D.Barnes M.J.K.Thomas	Vogel Text book of Quantitative Chemical Analysis	Pearson Education

Schem Scheme of valuation

1. Record **10 Marks**

2. Viva- Voce	**15 Marks**
3. Practical (Quantitative analysis)	**50 Marks**
i. Principle with Chemical Reaction	10 Marks
ii. Brief Procedure	10 Marks
iii. Formula & Tabular forms	5 Marks
iv. Calculation	5 Marks
v. Report	
< 2% Error	20 Marks
>2% Error	15 Marks
>5% Error	10 Marks
Total	**75 Marks**

Cocurricular Activities

Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):

For Teacher: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of Quantitative analysis-Determination of amount of solute present in given solution.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Determination of amount of solute present in given solution. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

Max marks for Fieldwork/project work Report: 05.

Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

Unit tests (IE).

a) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.

2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.

3. Visits of facilities, firms, research organizations etc.

4. Invited lectures and presentations on related topics by field/industrial experts.

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program &Semester II M.Sc. Chemistry Semester-IV Paper-III**			
Course Code	TITLE OF THE COURSE **APPLIED ANALYSIS-II**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Analysis of raw material ,soils, fuels,air and fertilizers.	**60**	**10**		**4**

Course Objectives:

Student will be able to know the Analysis of raw material ,soils, fuels,air and fertilizers

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Students will be able to analyze the raw materials
CO2	Students will be able to know about analysis of soils, fuels and fertilizers
CO3	Students will able to know about assessment of air quality
CO4	Students will be able to understand kinetic methods of analysis

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

Syllabus:

UNIT –I : ANALYSIS OF RAW MATERIALS

(a) Analysis of non-ferrous alloys:

(i) Brass – Analysis of the constituents – Cu, Zn, Sn, Pb and Fe.

(ii) Bronze - Analysis of the constituents – Cu, Sn, Zn, Pb and Fe.

(iii) Solder - Analysis of the constituents – Sn, Pb and Sb.

(b) Analysis of Ferro alloys :

(i) Ferro silicon -Analysis of the constituents – Si, C, P,S

(ii) Ferro vanadium - Analysis of the constituents – V, C, P, S. Si, Al.

(iii) Ferro manganese - Analysis of the constituents – Mn, S, C, P, Si

(iv) Silico manganese -Analysis of the constituents – Mn, S, C, P, Si

UNIT – II : **ANALYSIS OF SOILS, FUELS AND FERTILIZERS**

(a) Analysis of soils: sampling, determination of moisture, total N, P, Si, lime, humusnitrogen, alkali salts, soil absorption ratio.

(b) Analysis of fertilizers: ammonical fertilizers, Phosphate fertilizers, Nitratefertilizers.

(c) Analysis of fuels: solid fuels-coal, proximate analysis, ultimate analysis, heatingvalue, grading of coal based on Ultimate Heat Value(UHV).

UNIT – III: **ASSESSMENT OF AIR QUALITY**

Composition of pure air, classification of air pollutants, toxic elements present indust and their sources – collection of air samples.
Sources, effects, control of pollution and chemical analysis for thefollowing
(a) Primary pollutants:
(i) Carbon compounds - Carbon monoxide(CO) and Carbon dioxide(CO_2).

(ii)Sulphur compounds- sulphur dioxide (SO_2), Sulphur trioxide (SO_3) and Hydrogen Sulphide (H_2S).

(iii) Nitrogen compounds - nitric oxide (NO),and nitrogen dioxide (NO_2),

(IV) Hydrocarbons - Aliphatic hydrocarbons and polycyclic aromatic hydrocarbons(PAH).

Particulate matter - Repairable and Suspended particulate matter, Inorganic andOrganic particulat

(b) Secondary pollutants - ozone (O_3), peroxy acetyl nitrate (PAN), peroxy benzylnitrate (PBN)
(c) Standards for ambient air quality

UNIT – IV: KINETIC METHODS OF ANALYSIS & NON AQUEOUS TITRIMETRY

(a) Kinetic methods of analysis: introduction, slow reactions, catalyzed reactions, methods of determination of catalyst concentration, extrapolation method for thedetermination of catalyst, variable time method, fixed time method,

examples for the determination of toxic metals and anions using some typical kinetic reactions.

b) (Non aqueous titrimetry : Classification of solvents and titrations for non aqueous titrmetry-Types of reactions - Indicators .

(i) Determination of acids
(ii) Determination of bases
(iii) Karl-Fisher reagent for the determination of moisture content in drugs andother

samples.

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Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	--	
II	--	--	--	
III	--	--	--	
IV	--	--	--	

K_1= Remembering, K_2= Understanding, K_3= Applying, K_4= Analysing, K_5= Evaluating, K_6=Create.

Text Books/ Reference Books

S. No	AUTHOR	TITLE	PUBLISHER
1	Harrison John, Weily1979	Handbook of Analytical Control of Iron and Steel Production	McGrawHill
2	Foster Dee Sneel and Frank M	Commercial Methods of Analysis	McGrawHill
3	Lalude	Water Pollution	McGrawHill
4	AnilKumarDe	Environmental Chemistry	WileyEasternLtd.
5	S.M. Khopkar	Environmental Analysis	S.M. Khopkar(IITBombay
6	Griffin	Technical Methods of Analysis	McGrawHill

WebLinks:

https://youtu.be/XV609o_o9kg

https://youtu.be/9S11FizrS7I

https://youtu.be/7rWy8zvWfW4?si=Pvkwpa6BfJrPy-Et

https://youtu.be/mAcXLbiXIhA?si=L4zg7vKv4K393KbW

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Students will be able to analyze the raw materials
CO2	Students will be able to know about analysis of soils, fuels and fertilizers
CO3	Students will able to know about assessment of air quality
CO4	Students will be able to understand kinetic methods of analysis

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	1	1	1	2	1	3	3	1
CO2	3	3	3	3	3	1	1	1	2	1	3	3	1
CO3	3	3	3	2	2	1	1	1	2	1	3	3	1
CO4	3	2	2	3	1	2	3	1	3	1	3	3	1
Avg.	3	2.75	2.25	2.75	2	1.25	1.5	1	2.25	1	3	3	1

Low =1 ; Moderate = 2 ; High = 3 ; No Correlation = 0

Programme Outcomes

At the completion of the M.Sc. Chemistry program, the students of our department will be able to:

(**PO1) Knowledge:** Apply the knowledge of Analysis of raw materials to the solution of simple to complex ores

(PO2) Critical Thinking: Carry out experiments in the area of Fuels, Fertilizers and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of Assessment of air quality

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments for Titrimetry.

(PO5): Communication: Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(PO6): Life-long Learning: Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

(PO7) Ethical Practices and Social Responsibility: Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

PROGRAM SPECIFIC OUTCOMES (PSO's)

At the time of Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of Metallurgy

PSO2 - Demonstrate the knowledge of Assessment of air in the domain of research, education and perspective entrepreneurship.

PSO3 - Evaluate distinct problems in the field of Titrimetry for data analysis, scientific interpretation, and reaction mechanisms with an understanding on basic tools to be employed.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
PG COURSES 2023-24
SYLLABUS FOR SEMESTER – II (MSC- CHEMISTRY)
PAPER III (ORGANIC CHEMISTRY)
WEIGHTAGE TO CONTENT

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC (EXAMINATION AT THE END OF IV SEMESTER)

PAPER- III: APPLIED ANALYSIS-II

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. (a) Explain detailed analysis of few of the chief constituents of Brass -Cu, Zn,

OR

(b) Explain the detail the analysis Ferro chromium alloy Cr, C and Si.

2. (a) Explain various types of fertilizers and discuss the analysis of phosphate and ammonicalfertilizer.

OR

(c) Analysis of soil-moisture content Si and P

3. (a) Explain the following

a. Monitoring of Sulphur compounds So2 and H2S
b. Secondary pollutants O3 and PAN

OR

(b) Write a brief note on the following pollutants a. Poly cyclic aromatic hydro carbons , b. Particulate matter inorganic and organic pollutants

4. (a) Explain the determination of toxic metals using kinetic methods of analysis.

OR

(b) Write a brief note on KARL-FISHER reagent for the determination of moisture content indrugs and other samples.

2. SECTION : B

Answer any **FIVE** questions 5 X 3 = 15

1. 1. Discuss short note on ferrous alloy
2. Write a short note on Silico manganese -P, Si
3. Write a short note on proximate analysis in solid fuels.
4. Write the analysis of N, P, Si in soil
5. Discuss the role of particulate matter in air pollution
6. Write a short note on poly cyclic aromatic Hydrocarbons.
7. How to determine catalyst by extrapolation method.
8. Write a Short note on determination of toxic metal

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program &Semester II M.Sc. Chemistry Semester-IV Paper-IV**
Course Code	TITLE OF THE COURSE **INSTRUMENTAL METHODS OF ANALYSIS-I**	

Teaching	Hours Allocated: 60(Theory)	L	T	P	C
Pre-requisites:	Analysis of Atomic spectroscopy and electro analytical methods	60	10	30	4+3

Course Objectives:

Student will be able to know Analysis of Atomic spectroscopy and electro analytical methods

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Students will be able to know about atomic spectroscopy
CO2	To understand the analysis TG,DTA and DSC
CO3	Students will gain knowledge on electro analytical methods
CO4	To understand the analysis of radio chemical methods

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus

UNIT-I: SPECTRO ANALYTICAL METHOD OF ANALYSIS

(a) Flame photometry: theory, instrumentation, combustion flames, detectors, and analysis of Na, K, Ca, Mg

(b) Atomic Absorption Spectrometer: theory, instrumentation, flame and non-flametechniques, resonance line sources, hollow cathode lamp, instrumentation, chemical and spectral interferences, applications with special reference to analysis of trace metals in oils, alloys and toxic metals in drinking water and effluents

(b) Inductively coupled plasma spectrometer(ICP-AES, ICP-MS): principles, instrumentation, plasma, AES detectors, quadrupole mass spectrometers, differencebetween the two detectors, analysis methods for liquids and solids, applications in the analysis of trace and toxic metals in water, geological and industrial samples.

(c) Arc and Spark spectrographic Direct analysis of solid for metals.

UNIT -II: THERMAL METHODS OF ANALYSIS

(a) Thermo gravimetry-theory, instrumentation, applications with special reference to $CuSO_4.5H_2O$, $CaC_2O_4.2H_2O$, $CaCO_3$, $(COOH)_2.2H_2O$

(b) Differential thermal analysis-principle, instrumentation, difference between TG andDTA -

applications with special reference to the clays and minerals, coals (fuels)

(c) Differential scanning calorimetry-principle, instrumentation, applications to inorganic materials like chlorates and per chlorates, ammonium nitrate, organic compounds and Drugs.

UNIT-III: ELECTRO ANALYTICA METHODS OF ANALYSIS-I

(a) Voltametry and polarographic analysis : principle of polarography, residual current, migration current, diffusion current, half-wave potential, Ilkovic equation, instrumentation, Dropping mercury electrode (DME), advantages and disadvantagesof DME, qualitative and quantitative analysis of inorganic ions-Cu, Bi, Pb, Cd, Zn,
AC polarography, pulse polarography

(b) Anode stripping voltametry: principle, instrumentation, Hanging mercury drop electrode, application in the analysis of Pb and Cd in environmental samples,principle of cathode stripping voltametry.

(c) Coulometric analysis: principles of coulometric analysis with constant current, coulometric analysis with controlled potential, applications of coulometric methodsfor the analysis of cations-As (III), Fe (II) and I^- and S^{2-} by using I2 liberations and Ce^{4+} liberation in solutions

UNIT-IV: ELECTRO ANALYTICAL AND RADIO CHEMICAL METHODS OF AMALYSIS-II

(a) Ion Selective Electrodes: reference electrodes - hydrogen electrode, calomel electrode, silver chloride electrode; indicator electrodes – hydrogen and glass electrodes, theory of membrane potentials and liquid junction potentials, types of ion selective electrodes, basic properties, potentials and construction, calibration of ion selective electrodes, ion selective electrodes with fixed membrane sites, silver, lead, cadmium, sulfide, fluoride, cyanide and glass electrodes, applications in the analysis of air and water pollutants, principles of liquid membrane, gas sensing and enzyme based electrode

Radio chemical methods of analysis: detection and measurement of radioactivity, introduction to radioactive tracers, applications of tracer technique, isotope dilution analysis - applications, activation analysis – application, advantages anddisadvantages, radio carbon dating technique

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	--	
II	--	--	--	
III	--	--	--	
IV	--	--	--	

K_1= Remembering, K_2= Understanding, K_3= Applying, K_4= Analysing, K_5= Evaluating, K_6=Create.

Text Books/ Reference Books

S. No	AUTHOR	TITLE	PUBLISHER
1	H.HWillard,MerittJr. andJ.ADean	Instrumental methods of analysis	Goel Publishing House,Meerut
2	SkoogandWest	Principlesofinstrumentalanalysis	Goel Publishing House,Meerut
3	B.K Sarma	nstrumental methods of analysis	Goel Publishing House,Meerut
4	ChatwalandAnand	Instrumental methods of Analysis	London
5	A.R Date and A.L Glay	Applications of ICP-MS	London (Eds), Blackie
6	A. Moutaser and D.W Gologhtly (Eds)	ICP in Analytical Atomic Spectrometry	VeHPublisher,NewYork
7	G.IMoore	Introduction to ICP emission Spectrometry in Analytical	London

Weblinks

1. **https://youtu.be/-xYHKME72**
2. **https://youtu.be/0QEaYsQKsjc**
3. https://youtu.be/pQdoH6WEfe
4. 4. https://youtu.be/SBir5wUS3Bo?si=MY0d6epJDwsHk0Hw

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	UV-Visible Spectroscopy, Spectro fluorimetry
CO2	Infrared spectroscopy, Raman Spectroscopy
CO3	NMR Spectroscopy, ESR Spectroscopy
CO4	Mass Spectroscopy, X-ray Spectroscopy

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3

CO1	**3**	**3**	**1**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**1**
CO2	**3**	**2**	**2**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**1**
CO3	**3**	**3**	**1**	**3**	**3**	**1**	**2**	**1**	**2**	**1**	**3**	**3**	**1**
CO4	**3**	**2**	**2**	**3**	**3**	**1**	**2**	**1**	**3**	**1**	**3**	**3**	**1**
Avg.	**3**	**2.5**	**1.5**	**3**	**2.5**	**1**	**1.5**	**1**	**2.25**	**1**	**3**	**3**	**1**

Low =1 ; Moderate = 2 ; High = 3 ; No Correlation = 0

Programme Outcomes

At the completion of the M.Sc. Chemistry program, the students of our department will be able to:

(**PO1) Knowledge:** Apply the knowledge of Photometry to the solution of simple to complex structural identification of Organic molecules.

(PO2) Critical Thinking: Carry out experiments in the area of Thermal analysis for Structural analysis inorganic and Organic Compounds and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of electroanalytical chemistry.

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments for Flame photometry and AAS

(PO5): Communication: Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(PO6): Life-long Learning: Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

(PO7) Ethical Practices and Social Responsibility: Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

PROGRAM SPECIFIC OUTCOMES (PSO's)

At the time of Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of flame photometry and AAS.

PSO2 - Demonstrate the knowledge of Electro analytical chemistry in the domain of research, education and perspective entrepreneurship.

PSO3 - Evaluate distinct problems in the field of Thermal method of analysis, scientific interpretation, and reaction mechanisms with an understanding on basic tools to be employed.

SYLLABUS FOR SEMESTER – II (MSC- CHEMISTRY)
PAPER IV (PHYSICAL CHEMISTRY)
WEIGHTAGE TO CONTENT

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC (EXAMINATION AT THE END OF IV SEMESTER)

PAPER- IV: INSTRUMENTAL METHODS OF ANALYSIS-II

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. (a) Explain the basic principle of flame photometry with illustration.
   (OR)
   (b) Write a brief note on atomic absorption spectrometer and also explain flame and non-flame technique.
2. (a) Discuss the principle of thermogravimetric analysis
   (OR)
   (b) Give a detailed account on differential scanning Calorimetry(DSC) analyse the drugs
3. (a) Give a brief account on Anode stripping of voltametry and analysis of Pb and Cd inenvironmental samples

(OR)

(b) write brief note on coulometric analysis and anlyse the As(3), Fe(2) and Ce(4)

4. (a) Write a detailed note on application of radioactive traces

(OR)

(b) Write a brief note on the following

a. Reference electrode- calomel electrode
b. Ion Selective electrodes with fixed membrane sites.

SECTION: B

Answer any **FIVE** questions 5 X 3 = 15

1. write a note on detectors of flame photometry
2. Determine analysis of trace metals in oil by AAS
3. Write a short note on TGA.
4. Determine the Ammonium nitrate by DSC
5. what is meant by Half wave potential in polargraphic analysis.
6. Write a short note on Hanging mercury drop electrode.
7. What is meant by indicator electrode.
8. What are the advantage of radio carbon dating technique

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PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

IIYEAR MSC (EXAMINATION AT THE END OF IV SEMESTER)

INSTRUMENTAL METHODS OF ANALYSIS-II

PRACTICALS

1. pH metry

(i) Determination of purity of commercial H_3PO_4 by pH metric titration
(ii) Determination of CH_3COOH by pH metric titration.
(iii)Determination of stability constant of copper glycinate

2. Potentiometry

(i) Determination of Fe(II) using Mn(VII) of by potentiometric titration
(ii) Determination of Fe (II) using V(V) of by potentiometric titration
(iii)Determination of a mixture of Mn(VII) and V(V) with Fe(II) using potentiometric end point
(iv)Determination of a mixture of bromide and chloride with $AgNO_3$ using potentiometric end point

3. Spectrophotometry

(i) Determination of nitrite in drinking water samples by diazotization method
(ii) Determination of nitrate -phenoldisulphonic acid method
(iii)Simultaneous Determination of Cr(VI) and Mn(VII) in a mixture without

separation

(iv) Determination of Cu(II) using EDTA – Photometric titration method.

4. Flame photometry

(i) Determination of Lithium by flame photometry

(ii) Determination of calcium from milk samples using flame photometry

5. Thin layer chromatography

(i) Separatation and identification of the given mixture of colourless compounds (Diphenylamine, Benzophenone and Naphthalene)

(ii) Separatation and identification of the given mixture of coloured compounds (azobenzene, hydroxyazobenzene, p-aminoazobenzene).

Reference Books/Text Books

S.NO	AUTHOR	TITLE	PUBLISHER
1	A.I VOGEL	A Text Book of Quantitative InorganiC Analysis (3rd Edition)	London

Schem Scheme of valuation

1. Record	**10 Marks**
2. Viva- Voce	**15 Marks**
3. Practical	**50 Marks**
i. Principle with Chemical Reaction	10 Marks
ii. Brief Procedure	5 Marks
iii. Formula & Tabular forms	5 Marks
iv. Calculation	5 Marks
v. Graph	5 Marks
vi. Report	
< 2% Error	20 Marks
>2% Error	15 Marks
>5% Error	10 Marks
Total	**75 Marks**

Cocurricular Activities

Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):

For Teacher: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of Various instrumentation techniques like Potentiometry, pH Metry, Spectrophotometer, and other laboratory techniques.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Various instrumentation techniques like Potentiometry, pH Metry, Spectrophotometer, and other laboratory techniques. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

Max marks for Fieldwork/project work Report: 05.

Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

Unit tests (IE).

a) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.

2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.

3. Visits of facilities, firms, research organizations etc.

4. Invited lectures and presentations on related topics by field/industrial experts.