

**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

Meeting Minutes/Resolutions



Convened on 03 November 2022

DEPARTMENT OF CHEMISTRY

P. R. GOVT. COLLEGE (Autonomous)

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

www.prgc.ac.in; e-mail: chemistry_dept@prgc.ac.in

**PROCEEDINGS OF THE PRINCIPAL,
P.R. GOVERNMENT COLLEGE(A),KAKINADA-A.P**

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

R.C.No.12A/A.C./BOS/2022-23, Dated: 24.09.2022

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

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

ORDERS:

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

S.No	Name of the Nominee	Designation
1	Dr. D. Chenna Rao	Chairman& Lecturer Incharge.
2	Dr. K. Deepthi	University Nominee Associate Professor Department of Chemistry Adikavi Nannaya University, Rajamahendravaram
3	Dr. V. Siddaiah	Subject Expert Associate Professor Department of Chemistry Andhra University, Visakhapatnam
4	Dr. B. Ramesh Babu	Representative from Industry Founder & M.D., BogaR laboratories, Peddapuram. Ph: 9701712028.
5	V. Sanjeeva Kumar	Member
6	T.V.V.Satya Narayana	Member
7	P. Vijay Kumar	Member
8	V. Rambabu	Member
9	G. Pavani	Member
10	Dr. N. Bujji Babu	Member
11	Dr. Ch. Praveen	Member
12	V. Venkateswara Rao	Member
13	S. Vijaya Lakshmi	Member
14	Y.Devi	Member
15	D. Bhavya Sri	Member
16	S. Abhisha	Member
17	G. Sandhya	Student Alumni Member
18	S. Venkateswar rao	Student Member
19	K. Subrahmanya swamy	Student Member

The above members are requested to attend the BoS meeting on 03-11-2022 and share their valuable reviews, and suggestions on the following functionaries.


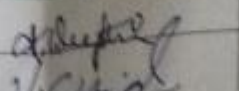
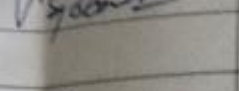
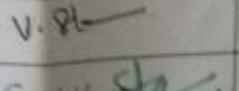
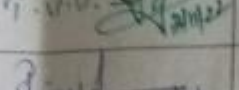
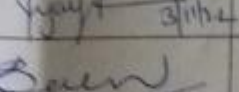
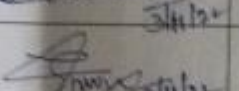
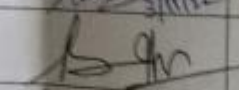
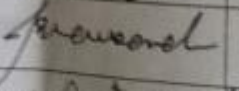
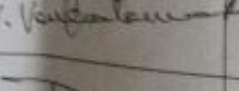

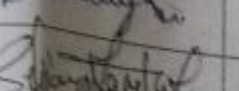


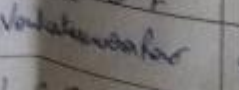
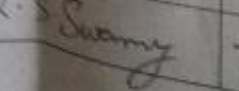

- Prepare syllabi for the subject keeping in view the objectives of the college, interest of the stake holders and National requirement for consideration and approval of the IQAC and Academic Council.
- Suggested methodologies for innovative teaching and evaluation techniques.
- Suggest the panel of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


PRINCIPAL

P. R. Government College(A),
Kakinada

Signatures of the members who attended the Board of studies in M.Sc. - Organic & Analytical Chemistry held on 03.11.2022 at 11.00 am.

Mode of Conduct of meeting: Offline/ Online

NAME	SIGNATURE	CONTACT NO.
Dr. D. Chenna Rao		9560740108
Dr. K. Deepthi		9985469607
Dr. V. Siddaiah		9440754164
Dr. B. Ramesh Babu		
V. Sanjeeva Kumar		9849324266
T.V.V. Satya Narayana		9490876913
P. Vijay Kumar		9652023092
V. Rambabu		9948485537
G. Pavani		9912526493
Dr. N. Bujji Babu		9441394792
Dr. Ch. Praveen		9491185518
V. Venkateswara Rao		9885165588
Y. Devi		9553267198
D. Bhavya Sri		6302865286
S. Vijaya Lakshmi		9133941966
S. Abhisha		
Ms. G. Sandhya		
S. Venkateswara Rao		9848217864
K. Subrahmanya Swamy		7993374608

VISION AND MISSION OF THE COLLEGE

Vision

To provide the right academic environment paving way for intellectual excellence, humane feelings and social commitment. The college believes in providing quality education for the socially disadvantaged, economically weaker sections of the society and thereby help them move up the ladder of success and social order.

Mission

- ➔ To impart holistic education with special emphasis on character, culture, updated knowledge and skill-oriented learning.
- ➔ To make the students enjoy the fruits of globalization without prejudice to their local and cultural environment.
- ➔ To impart necessary life skills so as to make them face any challenge in the bigger world – Social, ethical, psychological or professional.

P.R. GOVT.COLLEGE (A), KAKINADA

DEPARTMENT OF CHEMISTRY

Minutes of board of studies (BOS) meeting 2022-23 on 03-11-2022

Meeting of Board of Studies in Petro Chemicals is convened on 03-11-2022 through offline/Online at P.R. Govt. College (A), Kakinada.

Venue:

Conference Hall, Dt: 03-11-2022

The Principal Dr. B.V. Tirupanyam,

Chairman: Dr. D. Chenna Rao

Chairman and lecturer in charge,

Department of Chemistry

University Nominee: Dr. K. Deepthi

Associate Professor

Department of Chemistry

Adikavi Nannaya University, Rajamahendravaram

Industrialist: Dr. B. Ramesh Babu,

Founder & M.D., BogaR laboratories, Peddapuram,

Subject Expert: Dr.V.Siddaiah,

Associate Professor

Department of Chemistry

Andhra University, Visakhapatnam

All the faculty members of Chemistry Department and student alumni attended the meeting.

Agenda:

- To discuss the Semester System and Choice Based Credit System (CBCS) being implemented for the past 06 years, i.e., w.e.f. 2015-16.
- To discuss and approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of I, III Years for 2022-23.
- Syllabus, Model Question Papers and Model Blue Prints for I, III Semesters.
- Teaching learning methodology by 75:25 (External: Internal).
- Panel of paper setters and examiners.
- Proposals for Community Service Projects/Extension activities for the benefit of the society.
- Department action plan for 2022-23.

To discuss and resolve the minor modifications/refinement if Any Other Proposal with the Permission of the Chairman.

Resolutions:

The following agenda items are discussed and resolutions are made.

- It is resolved to continue choice based credit system in the chemistry as per the directions of the CCE, Vijayawada and University to the Previous year and Final year student's w.e.f. 2018-19.
- It is resolved to approve the Continuation/Modifications of the syllabus for the Odd Semesters of I, III Years for 2021-22.
- It is resolved to encourage students to active participation in various activities and give extra credits for students after successful completion of a particular activity such as SWAYAM, MOOCS etc., (Annexure -II)
- It is Resolved to follow 75%-25% external and internal w.e.f. 2017-2018 admitted batches and it continued.
- It is resolved that every student should maintain 75% attendance for both theory and practical's in order to attend the Mid and Semester examination.
- It is resolved to conduct departmental activities such as OZONE DAY, CHEM FEST, CHEMISTRY DAY and SCIENCE DAY. (Annexure-I)
- It is resolved to implement the recommended pedagogy for the first semester 2022-23

9. Resolved to conduct practical examinations semester wise.

- It is resolved to organize guest lectures by eminent professors.

Resolved to implement pass minimum for internal assessment for CBSE pattern students as the pattern is learner oriented.

- It is resolved to maintain status quo for same question paper pattern in I, II years. The following paper setters are recommended.

1. Dr.V. Siddaiah, Department of Chemistry, Andhra University.
2. Dr.V/Christapher, Department of Chemistry, Andhra University.
3. Dr.K. Deepthi, Department of Chemistry, ANUR Rajamahendravaram
4. Dr. B. Jagan Mohan Reddy, Department of Chemistry, ANUR Rajamahendravaram
5. Dr. Ravindrababu, Department of Chemistry, Arts College (A) Rajamahendravaram.
6. Dr M. Manoranjani, H O D Dept of PG Chemistry, PB Siddhartha arts and science College, Vijayawada.

Course structure of MSc Organic Chemistry

S. No	Semester	Title of the Paper	Theory/ Practical / Viva	Internal marks	External Marks	Total Marks	Credits
1	I	General Chemistry-I	T	25	75	100	4
2		Inorganic Chemistry-I	T	25	75	100	4
3		Organic Chemistry-I	T	25	75	100	4
4		Physical Chemistry-I	T	25	75	100	4
5		Inorganic Chemistry Practical -I	P	25	75	100	4
6		Organic Chemistry Practical -I	P	25	75	100	4
7		Physical Chemistry Practical -I	P	25	75	100	4
8	II	General Chemistry	T	25	75	100	4
9		Inorganic Chemistry	T	25	75	100	4
10		Organic Chemistry	T	25	75	100	4
11		Physical Chemistry	T	25	75	100	4
12		Inorganic Chemistry Practical -II	P	25	75	100	4
13		Organic Chemistry Practical -II	P	25	75	100	4
14		Physical Chemistry Practical -II	P	25	75	100	4
15	III	Organic Reaction Mechanisms - I & Pericyclic Reactions	T	25	75	100	4
16		Organic Spectroscopy-I	T	25	75	100	4
17		Modern Organic synthesis- I	T	25	75	100	4
18		Chemistry of Natural products -I	T	25	75	100	4
19		Multistep Synthesis of Organic Compounds:	P	25	75	100	4

20		Estimations and Chromatography	P	25	75	100	4
21	IV	Organic Reaction Mechanisms - II & Photo chemistry	T	25	75	100	4
22		Organic Spectroscopy-II	T	25	75	100	4
23		Modern Organic synthesis- II	T	25	75	100	4
24		Bio-organic chemistry	T	25	75	100	4
25		Chromatographic Separation and Isolation & identification of Natural Products	P	25	75	100	4
26		Spectral Identification of Organic Compounds ((UV, IR, ¹ H- NMR, ¹³ C- NMR and Mass).	P	25	75	100	4
27		Comprehensive Viva- voce	V	---	50	50	4
Total Credits							100

Course structure of M. Sc Analytical Chemistry

S. No	Semester	Title of the Paper	Theory/ Practical/ Viva	Internal marks	External Marks	Total Marks	Credits
1	I	General Chemistry-I	T	25	75	100	4
2		Inorganic Chemistry-I	T	25	75	100	4
3		Organic Chemistry-I	T	25	75	100	4
4		Physical Chemistry-I	T	25	75	100	4
5		Inorganic Chemistry Practical -I	P	25	75	100	4
6		Organic Chemistry Practical -I	P	25	75	100	4
7		Physical Chemistry Practical -I	P	25	75	100	4
8	II	General Chemistry	T	25	75	100	4
9		Inorganic Chemistry	T	25	75	100	4
10		Organic Chemistry	T	25	75	100	4
11		Physical Chemistry	T	25	75	100	4
12		Inorganic Chemistry Practical -II	P	25	75	100	4
13		Organic Chemistry Practical -II	P	25	75	100	4
14		Physical Chemistry Practical -II	P	25	75	100	4
15	III	Separation Methods-I	T	25	75	100	4
16		Quality Control and Traditional methods of Analysis-I	T	25	75	100	4
17		Applied Analysis-I	T	25	75	100	4
18		Instrumental Methods of Analysis-I	T	25	75	100	4
19		Classical methods of Analysis-I	P	25	75	100	4
20		Instrumental methods of Analysis-I	P	25	75	100	4
21	IV	Separation Methods-II	T	25	75	100	4
22		Quality Control and Traditional methods of Analysis-II	T	25	75	100	4
23		Applied Analysis-II	T	25	75	100	4

24		Instrumental Methods of Analysis- II	T	25	75	100	4
25		Classical methods of Analysis-II	P	25	75	100	4
26		Instrumental methods of Analysis- II	P	25	75	100	4
27		Comprehensive Viva-voce	V	---	50	50	4
Total credits							100

	P R Govt College (A)Kakinada	Program & Semester II M Sc Analytical chemistry (III Semester)			
Course Code	Paper - I: Separation Methods – I				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites	Adsorption, absorption, partition coefficient, polarity of the solvents.	60	10	30	4

Course Objectives:

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	
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Syllabus:

Unit – I: Chromatography – 1

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

Principles of chromatography, different migration, adsorption phenomena, partition, adsorption coefficient, retardation factor, retention time and volume, column

capacity, temperature effects, partition isotherm.

Dynamics of chromatography-efficiency of chromatographic column, zone spreading, High Equivalent Theoretical Plate (HETP), Van Deemter 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, nitrogenphosphorus 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, hydrocarbons 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 – 4

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, refractometric 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 Drug analysis, Environmental samples and others.

Text books:

- 1.R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
2. M.N. Sastri , Separation methods, Himalaya Publishing Company, Mumbai

Reference books:

1. E. Helfman, Chromatography, Van Nostrand, Reinhold, New York
2. E. Lederer and M. Lederer, Chromatography, Elsevier, Amsterdam.
3. Chemical separation methods, John A Dean, Von Nostrand Reinhold, New York
4. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
- 5.H.M Mc Nair and J. M. Miller, Basic Gas Chromatography, John Wiley, New York
6. W. Jeumings, Analytical Gas chromatography, Academic Press, New York
7. H. Eugelhardt (ed), Practice of HPLC, Springer Verrag, Berrin

Weightage to content

Semester -III

Paper-I

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Chromatography – 1	2	2	36	Understanding, Application
2	Chromatography – 2	2	2	36	Remembering, Understanding
3	Chromatography – 3	2	2	36	Application and understanding
4	Chromatography – 4	2	2	36	Remembering, Understanding
	TOTAL	8	8	144	

P.R.Govt College (A) Kakinada

II Year MSC Analytical Chemistry Model Question Paper III Semester

Separation Methods

Time: 3hr.

Max Marks:75

SECTION-A (4x15=60)

Answer all questions each question carries 15 Marks 4x15=60 Marks

1. A). Explain the different types of Chromatography techniques with examples
OR
B). Explain the following 1). Van Deemter equation 2). Resolution 3). Elution development
2. A). Discusses about the principles of Electrophoresis
OR
B). Explain the principle and applications of Column chromatography
3. A). Discusses the Gas chromatography principle and applications
OR
B). Explain the importance and applications of GC-MS in drug analysis
4. A). Explain about the HPLC principle and applications
B). Explain the instrument and applications of LC-MS

SECTION-B (5x3=15)

Answer any FIVE questions each question carries 3 Marks 5x3=15 Marks

5. Define frontal analysis
6. Define and Explain Rf value of chromatography
7. Define absorption isotherms
8. Define Gel filtration chromatography
9. Discusses the nitrogenphosphorus 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

Co-Curricular Activities:

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

1. **For Teacher:** Training of students by teacher in laboratory and field for not less than 15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
2. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

b) 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

Web Links:

1. https://youtu.be/XMtmSz_9umk
2. <https://youtu.be/ZN7euA1fS4Y>

	P R Govt College (A) Kakinada	Program & Semester			
Course Code CHE-7A	Paper- II: Quality control and Traditional methods of Analysis-I	II M Sc Analytical chemistry (III Semester)			
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+4

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 an analysis, Evaluation and reliability of analytical data, Statistical analysis, Quality assurance and management systems and ICH guide lines
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	
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Syllabus:

Unit – I: Quality control in Analytical Chemistry

(a) *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.

(b) *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.

(c) *Statistical analysis*: Mean deviation, Standard deviation, coefficient of variance, normal distribution, F test, T test, rejection of results, presentation of data.

(d) *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

(e) Brief out line of ICH guide lines on drug substances and products.

Unit – II: Decomposition techniques in 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 ultrasonic decomposition techniques.

(b) Organic Compounds

Principles of solubility of organic compounds, non polar, polar solvents.

Recrystallisation methods and application of solubility and Recrystallisation.

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 Systems chloramine-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, Olifinic

Text books:

1. Technical methods of analysis – Griffin, Mc Graw Hill Book Co.
2. Chemical Separation and measurements – D.G Peterseti, John M.Haves Sanders Co.
3. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co.
4. Newer redox titrants – Berka, Zyka and Vulterin, Pergamon Press
5. Volumetric Analysis, Vol III – I.M Kolthoff and R. Belcher, Interscience Public, New York
6. Vogel's Text Book of Inorganic Quantitative Analysis – J. Bassett et al, ELBS
7. Organic functional groups – S. Siggia

Reference books:

1. D.A Skoog, D.M West and F.J Holler, Analytical Chemistry, An Introduction, Sanders College Publishing, New York
2. K.V.S.G Murali Krishna, An Introduction ISO 9000, ISO 1400 Series, Environmental Management
3. Quality Assurance and Good Laboratory Practices, Prof. Y. Anjaneyulu, In Now Publication, New York
4. Quality Assurance in Analytical Chemistry – G.Kateman and F.W Pijpers, John Wiley and Sons, New York
5. Quantitative Chemical Analysis – I.M Kolthoff, E.B Sandel, E.J Meehan, S. Bruckenstein, Macmillan Company, London
6. Decomposition Techniques in Inorganic Analysis – J.Dolezal, P.Povondra, Z.Sulcek

Weightage to content

Semester -III

Paper-2

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Quality control in Analytical Chemistry	2	2	36	Understanding, Application
2	Decomposition techniques in analysis	2	2	36	Remembering, Understanding
3	Oxidant systems – Principles and applications in analysis	2	2	36	Application & Creation
4	Organic Functional group analysis	2	2	36	Remembering, Understanding
	TOTAL	8	8	144	

P.R.Govt College (A) Kakinada
II Year MSC Analytical Chemistry Model Question Paper III Semester
Quality control and Traditional methods

Time: 3hr.

Max Marks:75

SECTION-A (4x15=60)

Answer all of the following questions each question carries 15 Marks 4x15=60 Marks

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).Discusses about the principles of Decomposition and Dissolution for inorganic substances

OR

B).Explain the principles of solubility of organic compounds in non-polar and polar solvents

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

OR

B).Explain the standardization mechanism and applications of Chloramine-T

4. A).Discusses 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 (5x3=15)

Answer any FIVE questions each question carries 3 marks 5x3=15 Marks

5. Define selectivity and sensitivity
6. Explain the Q-Test for rejection of data
7. Write about acidic and reduction fusion
8. Explain the principle of decomposition of sample by Sulfuric acid
9. Explain the requirements of reductants standardization
10. Explain the classification of redox indicators
11. Explain the general functional classification
12. Explain the principle involved estimation of aldehyde group

Co-Curricular Activities:

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

6. **For Teacher:** Training of students by teacher in laboratory and field for not less than 15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
7. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
8. Max marks for Fieldwork/project work Report: 05.
9. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
10. Unit tests (IE).

d) Suggested Co-Curricular Activities

5. Training of students' by related industrial experts.
6. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.
7. Visits of facilities, firms, research organizations etc.
8. Invited lectures and presentations on related topics by field/industrial experts

Web links

1. <https://youtu.be/KxhVj4NsaKs>
2. <https://youtu.be/YfRqtzkX6Kk>

	P R Govt College (A)Kakinada	Program & Semester II M Sc Analytical chemistry (III Semester)			
Course Code	Paper – III: 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+4

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	
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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, phosphorous, manganese, alkalies, combined water, Carbon in blast furnace,

flue dust and sinter.

(c) Manganese Ore - Analysis of the Constituents – Total Manganese, MnO_2 , SiO_2 ,

BaO , Fe_2O_3 , Al_2O_3 , CaO , P and S

(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: fire clay, flint spar, and magnesite

(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 and

loss 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 lead chromate

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-, HCO₃

-, F-, Cl-, SO₄

2-, PO₄

3-, NO₃

-, NO₂

-, CN-, S₂-

Cations: Fe²⁺, Fe³⁺, Ca²⁺, Mg²⁺, Cr³⁺, As⁵⁺, Pb²⁺, Hg²⁺, Cu²⁺, Zn²⁺, Cd²⁺, Co²⁺

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

Text books:

1. Handbook of Analytical Control of Iron and Steel Production, Harrison John, Wiley 1979
2. Standard methods of Chemical Analysis, Welcher
3. Technical Methods of Analysis, Griffin, Mc Graw Hill
4. Commercial Methods of Analysis, Foster Dee Snel and Frank M. Griffin, Mc Graw Hill Book Co.
5. Water Pollution, Lalude, Mc Graw Hill
6. Environmental Chemistry, Anil Kumar De, Wiley Eastern Ltd.
7. Environmental Analysis, S.M. Khopkar (IIT Bombay)

Reference books:

1. Handbook of Analytical Control of Iron and Steel Production, Harrison John, Wiley 1979
2. Standard methods of Chemical Analysis, Welcher
3. Technical Methods of Analysis, Griffin, Mc Graw Hill

Weightage to content

Semester -III

Paper-3

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Analysis of Ores	2	2	36	Understanding, Application
2	Analysis of Finished Products – I	2	2	36	Remembering, Understanding
3	Analysis of Finished Products – II	2	2	36	Application & Creation
4	Assessment of water Quality	2	2	36	Remembering, Understanding
	TOTAL	8	8	144	

P.R.Govt College (A) Kakinada
II Year MSC Analytical Chemistry Model Question Paper III Semester
Applied Analysis

Time: 3hr.

Max Marks:75

SECTION-A (4x15=60)

Answer ALL questions each question carries 15 Marks 4x15=60

1. A). Explain the suitable methods for determination of manganese in manganese Ore
OR
B). Explain the analysis of CO₂ 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). Explain the analysis of Nitrate and Phosphate fertilizers
OR
B). Discusses the analysis of Total N and Si in soils
4. A). Discusses the drinking water standards
OR
B). Explain about different types of water pollution and their effects

SECTION-B (5x3=15)

Answer any FIVE questions each question carries 3 marks 5x3=15 Marks

5. Explain the estimation method of total Iron in Iron Ore
6. Explain the applications of complex materials
7. Explain the mechanism of blast furnace
8. Explain the analysis of Ni in steel
9. Explain about the Ammonical fertilizer
10. Explain about the chemical composition of Soil
11. Explain the classification of water for different uses
12. Define COD

Co-Curricular Activities:

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

11. **For Teacher:** Training of students by teacher in laboratory and field for not less than 15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
12. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
13. Max marks for Fieldwork/project work Report: 05.
14. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
15. Unit tests (IE).

f) Suggested Co-Curricular Activities

9. Training of students' by related industrial experts.
 10. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.
 11. Visits of facilities, firms, research organizations etc.
 12. Invited lectures and presentations on related topics by field/industrial experts

Web Links:

1. https://youtu.be/XV609o_o9kg
2. <https://youtu.be/9S11FizrS7I>

	P R Govt College (A) Kakinada	Program & Semester			
Course Code	Paper – IV: INSTRUMENTAL METHODS OF ANALYSIS - I	II M Sc Analytical chemistry (III Semester)			
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites	Types of spectroscopy and its principles ,instrumentation and applications	60	10	30	4+4

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, Spectrofluorimetry
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	
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Syllabus:

Unit – I : Spectroscopic Methods – 1

(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⁺ and anions – NO₂

-, PO₄³⁻

using suitable reagents, simultaneous determinations of dichromate and permanganate in a mixture, spectrophotometric titrations, principle of diode array spectrophotometers.

(b) *Spectrofluorimetry*: 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 – 2

(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 Fourier transform 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 -3

(a) *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 organic compounds, factors influencing NMR spectra, fast chemical reactions, magnitude of I, nuclei with quadrupole moments, FT NMR, study of isotopes other than proton-¹³C,

^{15}N , ^{19}F , ^{31}P , ^{11}B , double resonance, spin tickling, shift reagents, applications.

2

(b) 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 -4

(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, matrix effects, applications.

Text books:

1. Instrumental methods of analysis – H.H Willard, Meritt Jr. and J.A Dean
2. Principles of instrumental analysis – Skoog and West
3. Vogels Textbook of Quantitative Inorganic analysis – J. Basset, R.C Denney, G.H Jefferey and J.Madhan
4. Instrumental methods of analysis – B.K Sarma, Goel Publishing House, Meerut
5. Instrumental methods of Analysis – Chatwal and Anand
6. Instrumental methods of Analysis – Ewing
7. Handbook of ICP
8. The ICP – Bogdain B.

Reference books:

1. Applications of ICP-MS, A.R Date and A.L Glay, London (Eds), Blackie, London
2. A. Moutaser and D.W Golightly (Eds), ICP in Analytical Atomic Spectrometry, VeH Publishers, New York
3. G.I Moore, Introduction to ICP emission Spectrometry in Analytical

Weightage to content

Semester -III

Paper-4

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Spectroscopic Methods – 1	2	2	36	Understanding, Application
2	Spectroscopic Methods – 2	2	2	36	Remembering, Understanding
3	Spectroscopic Methods – 3	2	2	36	Application & Creation
4	Spectroscopic Methods – 4	2	2	36	Remembering, Understanding
	TOTAL	8	8	144	

P.R.Govt College (A) Kakinada
II Year MSC Analytical Chemistry Model Question Paper III Semester
Instrumental Methods of Analysis

Time: 3hr.

Max Marks:75

SECTION-A (4x15=60)

Answer ALL questions each question carries 15 Marks 4x15=60

1. A).Define Beer-Lambert law and explain Single, Double beam spectrophotometer
OR
B).Explain about the general precautions to be follow for colorimetric determination of metal ions
2. A).Explain the principle and applications of IR spectroscopy
OR
B).Describe the Principle and Instrumentation of Raman spectroscopy
3. A).Explain the principle and applications of NMR Spectroscopy
OR
B).Describe the theory and working mechanism of ESR spectroscopy
4. A).Describe the instrument of mass spectroscopy and explain the basic principle
OR
B).Explain about the mass spectroscopy in qualitative and Quantitative analysis

SECTION-B (5x3=15)

Answer any FIVE questions each question carries 3 marks 5x3=15 Marks

5. Explain the principle of UV-Visible spectroscopy
6. Explain the fluorescence
7. Explain the IR analysis of CO₂
8. Write note on molecular vibrations
9. Define chemical shift
10. Explain any three differences between NMR and ESR
11. Define Mossbauer spectroscopy
12. Explain the applications of Mass spectroscopy

Co-Curricular Activities:

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

16. **For Teacher:** Training of students by teacher in laboratory and field for not less than 15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
17. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
18. Max marks for Fieldwork/project work Report: 05.
19. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
20. Unit tests (IE).

h) Suggested Co-Curricular Activities

13. Training of students' by related industrial experts.
14. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.
15. Visits of facilities, firms, research organizations etc.
16. Invited lectures and presentations on related topics by field/industrial experts

P. R. GOVERNMENT COLLEGE(A), KAKINADA

Department of Chemistry

M.Sc. (Final) Chemistry Syllabus for III-Semester

Specialization: *Analytical Chemistry*

ANALYTICAL CHEMISTRY PRACTICAL – I

(With effect from 2021-2022 admitted batch)

Classical Methods of Analysis-1

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. Complex metric titrations
 - (i) Determination of the concentration of calcium in milk powder by complex metric 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

Instrumental Methods of Analysis-1

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 H_2SO_4 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 AgNO_3 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 R_f 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

References:

- 1. A Text Book of Quantitative Inorganic Analysis (3rd Edition) – A. I. Vogel

Scheme of valuation instrumentation

Record: 10M

Viva: 15M

Chemicals and apparatus: 4M

Principle: 3M

Chemical equation:3M

Theory and procedure: 10M

Tables: 10M

Calculation: 10M

Graphs: 5M

Report: 10M

Classical

Record: 10M

Viva: 15M

Chemicals and apparatus: 4M

Principle: 3M

Chemical equation:3M

Theory and procedure: 10M

Tables: 10M

Calculation: 15M

Report: 10M

Web links



1. https://youtu.be/_qtWCvLR9No
2. https://youtu.be/_qtWCvLR9No
3. <https://youtu.be/GWiIKadh5Pk>

