



Programme Specifications

M.Sc. Programme

Programme:
Analytical Chemistry

Department:
Chemistry

Faculty of Mathematical & Physical Sciences
M.S. Ramaiah University of Applied Sciences

University House, New BEL Road, MSR Nagar, Bangalore – 560 054

www.msruas.ac.in

Programme Specifications: M.Sc. Chemistry with Specialization in Analytical Chemistry

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|------------------------|---|
| Faculty | Faculty of Mathematical and Physical Sciences (FMPS) |
| Department | Chemistry |
| Programme | M.Sc. Chemistry with Specialization in Analytical Chemistry |
| Dean of Faculty | Dr. Deepak A.S. |
| HOD | Dr. T. Niranjana Prabhu |

1. Title of the Award

M.Sc. (Analytical Chemistry)

2. Modes of StudyFull-Time **3. Awarding Institution /Body**

M S Ramaiah University of Applied Sciences – Bangalore, India

4. Joint Award

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5. Teaching Institution

Faculty of Mathematical and Physical Sciences (FMPS)

M S Ramaiah University of Applied Sciences – Bangalore, India

6. Date of Programme Specifications

August 2019

7. Date of Programme Approval by the Academic Council of MSRUAS

August 2019

8. Next Review Date

August 2021

9. Programme Approving Regulatory Body and Date of Approval

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10. Programme Accrediting Body and Date of Accreditation

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11. Grade Awarded by the Accreditation Body

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12. Programme Accreditation Validity

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13. Programme Benchmark

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14. Rationale for the Programme

Analytical chemistry is the study of separation, identification, and quantification of chemical components of natural and artificial materials. Qualitative analysis gives an indication of the identity of the chemical species in the sample and quantitative analysis determines the amount of one or more of these components. Modern analytical chemistry is dominated by instrumental analysis e.g. spectroscopy and chromatography. Analytical chemistry has applications in forensics, bio analysis, clinical analysis, environmental analysis, and materials analysis. Analytical chemistry plays an increasingly important role in the pharmaceutical industry where it is used in discovery of new drug candidates and in clinical applications where understanding the interactions between the drug and the patient are critical. There are a lot of career opportunities analytical chemists in pharmaceutical industries, government laboratories and Industries involved in manufacturing/processing of food/beverage products.

The Faculty of Mathematical and Physical Sciences of MSRUAS offers the M.Sc. (Analytical Chemistry) programme with an outcome based curriculum emphasizing the Critical, Analytical and Problem Solving skills to equip the students to pursue their scientific and research career with better preparedness and a mature professional outlook. The presence of other allied Faculties of the University provides for a multi-disciplinary approach which is emerging as a key differentiator in the success of modern scientific and engineering endeavors.

In the coming years, the government intends to boost up funds for basic sciences. There is an acute shortage of qualified teaching staff. The job prospects for candidates with M.Sc. (Analytical Chemistry) looks good in academia and industry.

15. Programme Aim

The aim of the programme is to train postgraduates with advanced knowledge and understanding of analytical chemistry with higher order critical, analytical, problem solving and research skills; ability to think rigorously and independently to meet higher level expectations of academia and research with sufficient transferrable skills.

16. Programme Objectives

The programme objectives of M. Sc. Chemistry with Specialization in Analytical Chemistry are to:

- Impart higher level knowledge and understanding of analytical chemistry
- Prepare students to evaluate the soundness of chemical concepts proposed
- Train students to perform chemical experiments using the standard laboratory equipment/modern instrumentation and gather reliable data
- Enable students carry out data processing, computation, data analysis and numerical simulations.
- Teach students proper procedures and regulations for safe handling and use of chemicals.
- Hone students' skills to pursue chemistry as a teaching and research career
- Train students in team work and in lifelong learning for continuous professional development

17. Intended Learning Outcomes of the Programme

The intended learning outcomes are listed under four headings:

1. Knowledge and Understanding, 2. Cognitive Skills 3. Practical Skills and 4. Capability/ Transferable Skills.

17.1 Knowledge and Understanding

After undergoing this programme, a student will be able to:

- KU1: Outline fundamental and applied aspects of chemical analysis
- KU2: Choose an appropriate method of analysis for selected analytes in a variety of matrices.
- KU3: Describe the principles of atomic and molecular spectroscopy, NMR and mass spectrometry.
- KU4: Recognize the uncertainties/errors associated with measurements and data collection

17.2 Cognitive Skills

After undergoing this programme, a student will be able to:

- CS1: Analyze and solve problems related to chemical analysis of compounds
- CS2: Distinguish key techniques in separation sciences such as liquid and gas chromatography
- CS3: Apply fundamentals of analytical chemistry to pharmaceutical, environmental and materials analyses.
- CS4: Explain the principles of NMR, mass spectrometry, Raman and IR spectroscopy.

17.3 Practical Skills

After undergoing this programme, a student will be able to:

- PS1: Conduct experiments with various spectroscopic instruments to analyze a material
- PS2: Perform chemical separation with liquid and gas chromatography

PS3: Validate analytical methods

PS4: Carry out necessary computational and simulation work

17.4 Capability /Transferable Skills

After undergoing the programme, a student will be able to

TS1: Communicate and present ideas clearly and concisely

TS2: Perform under constraints to meet the desired objectives

TS3: Build, work and lead teams effectively

TS4: Adopt a reflective approach to personal development and embrace the philosophy of continual professional development

18. Programme Structure

The following are the Course a student is required to successfully complete for the award of the degree. The programme is delivered as per the Time-Table for every batch.

Semester 1

| Sl. No. | Course Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Max. Marks | Total Credits |
|--------------|-------------|----------------------------------|----------------|-------------------|-------------------|------------|---------------|
| 1 | 19CHY511A | Physical Chemistry 1 | 4 | | | 100 | 4 |
| 2 | 19CHY512A | Inorganic Chemistry 1 | 4 | | | 100 | 4 |
| 3 | 19CHY513A | Organic Chemistry 1 | 4 | | | 100 | 4 |
| 4 | 19CHY514A | Instrumental Methods of Analysis | 4 | | | 100 | 4 |
| 5 | 19CHY515A | Chemistry Laboratory 1 | | | 4 | 50 | 2 |
| 6 | 19CHY516A | Chemistry Laboratory 2 | | | 4 | 50 | 2 |
| 7 | 19CHY517A | Seminar 1 | | | 2 | 50 | 1 |
| Total | | | 16 | | 10 | 550 | 21 |

Semester 2

| Sl. No. | Course Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Max. Marks | Total Credits |
|--------------|-------------|-------------------------|----------------|-------------------|-------------------|------------|---------------|
| 1 | 19CHY521A | Physical Chemistry 2 | 4 | | | 100 | 4 |
| 2 | 19CHY522A | Inorganic Chemistry 2 | 4 | | | 100 | 4 |
| 3 | 19CHY523A | Organic Chemistry 2 | 4 | | | 100 | 4 |
| 4 | 19CHY524A | Computational Chemistry | 4 | | | 100 | 4 |
| 5 | 19CHY525A | Chemistry Laboratory 3 | | | 4 | 50 | 2 |
| 6 | 19CHY526A | Chemistry Laboratory 4 | | | 4 | 50 | 2 |
| 7 | 19CHY527A | Seminar 2 | | | 2 | 50 | 1 |
| Total | | | 16 | | 10 | 550 | 21 |

Semester 3

| Sl. No. | Course Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Max. Marks | Total Credits |
|--------------|-------------|--|----------------|-------------------|-------------------|------------|---------------|
| 1 | 19CHY531A | Data Analysis and Statistical Interference | 3 | | | 100 | 3 |
| 2 | 19CHY532A | Advanced Analytical Chemistry Techniques | 3 | | | 100 | 3 |
| 3 | 19CHY533A | Analysis of Biopharmaceuticals and Foods | 3 | | | 100 | 3 |
| 4 | 19CHY534A | Environmental Analytical Chemistry | 3 | | | 100 | 3 |
| 5 | 19CHY590A | Research Methodology | 2 | | | 50 | 2 |
| 6 | 19CHY535A | Analytical Chemistry Laboratory 1 | | | 4 | 50 | 2 |
| 7 | 19CHY536A | Analytical Chemistry Laboratory 2 | | | 4 | 50 | 2 |
| 8 | 19CHY537A | Seminar 3 | | | 2 | 50 | 1 |
| Total | | | 14 | | 10 | 600 | 19 |

Semester 4

| Sl. No. | Course Code | Course Title | Theory (h/W/S) | Tutorials (h/W/S) | Practical (h/W/S) | Max. Marks | Total Credits |
|--------------|-------------|-----------------------|----------------|-------------------|-------------------|------------|---------------|
| 1 | 19CHY598A | Internship* | | | 8 | 100 | 4 |
| | 19CHY599A | Seminar** | | | | | |
| 2 | 19CHY600A | Dissertation Work *** | | | 30 | 300 | 15 |
| Total | | | | | 38 | 400 | 19 |

* Internship can be done during the vacation period for a maximum period of 8 weeks, where the student needs to submit a report along with the presentation.

**A student can opt for seminar instead of internship, where a student in consultation with his/her project supervisor is expected to conduct review of literature related to their project work, write a review article and submit along with a presentation on the same topic.

*** A student in consultation with allotted supervisor is required to conduct research on a topic, submit a dissertation report along with an article in a prescribed journal format.

19. Assessment and Grading

Performance in every theory course will be assessed on the following two components:

Theory Courses with 4 and 3 credits**Component - 1: 50 Marks**

Part A: Two term tests will be conducted. Average of 2 tests will be considered (25% weightage).

Part B: A student needs to submit assignment/s (25% weightage).

Component - 2: 50 Marks

A Written Examination for 100 marks will be conducted. Obtained marks out of 100 are scaled down to 50 marks.

Theory Courses with 3 or 4 credits with laboratory component integrated

Component - 1: 50 Marks

Part A: Two term tests will be conducted. Average of 2 tests will be considered (25% weightage).

Part B: A student needs to submit assignment/s (15% weightage) and perform laboratory examination (10% weightage).

Component - 2: 50 Marks

A Written Examination for 100 marks will be conducted. Obtained marks out of 100 are scaled down to 50 marks.

Theory Courses with 1 or 2 credits

Component - 1: 25 Marks

A student needs to submit assignment/s (50% weightage).

Component - 2: 25 Marks

A Written Examination for 50 marks will be conducted. Obtained marks out of 50 are scaled down to 25 marks.

Seminars with 1 or 2 credits

Component - 1: 25 Marks

A student needs to submit a report on the seminar topic given (50% weightage).

Component - 2: 25 Marks

A student is required to give a presentation on the topic given (50% weightage).

Seminars with 3 or 4 credits

Component - 1: 50 Marks

A student needs to submit a report on the seminar topic given (50% weightage).

Component - 2: 50 Marks

A student is required to give a presentation on the topic given (50% weightage).

Laboratories with 1 or 2 credits

Component - 1: 25 Marks

A student needs to submit a record for the experiments conducted (50% weightage).

Component - 2: 25 Marks

Laboratory examination will be conducted at the end of semester (50% weightage).

Internship

Component - 1: 50 Marks

A student is required to submit a report on learning at an Industry with a certificate from the concerned Industry

Component - 2: 50 Marks

A student is required to give a presentation on the topic given (50% weightage).

Dissertation

Component - 1: 100 Marks

Part A: A student is required to give a pre-project presentation (40 Marks).

Part B: A student is required to give a mid-term project presentation (60 Marks).

Component - 2: 200 Marks

Part A: A student is required to give a final project presentation (50 Marks) and is required to submit a report on the work carried out (100 Marks)

Part B: A student is required to submit a journal article in the given format from the work carried out (50 marks)

Pass Criteria

A student is required to score a minimum of 40% marks in Semester end examination and 40% marks overall in each course for successful completion of a course and for earning the corresponding credit(s).

20. Teaching and Learning Methods

The module delivery comprises of combination of few or all of the following:

1. Face to Face Lectures using Audio-Visuals
2. Workshops, Group Discussions, Debates, Presentations
3. Demonstrations
4. Guest Lectures
5. Laboratory/Field work
6. Industry Visit
7. Seminars/Conferences
8. Group Exercises
9. Project Exhibitions

21. Student Support for Learning

Student are given the following support:

1. Module Notes
2. Reference Books in the Library
3. Magazines and Journals
4. Internet Facility
5. Computing Facility
6. Laboratory Facility
7. Workshop Facility
8. Staff Support
9. Lounges for Discussions
10. Any other support that enhances their learning

22. Quality Control Measures

The following are the Quality Control Measures:

23. Curriculum Map

| Module Code | Intended Learning Outcomes | | | | | | | | | | | |
|-------------|-----------------------------|-----|-----|-----|--|-----|-----|-----|------------------|-----|-----|-----|
| | Knowledge and Understanding | | | | Cognitive (Thinking) Skills (Critical, Analytical, Problem Solving, Innovation) | | | | Practical skills | | | |
| | KU1 | KU2 | KU3 | KU4 | CS1 | CS2 | CS3 | CS4 | PS1 | PS2 | PS3 | PS4 |
| 19CHY511A | X | X | X | | X | | | | | | | |
| 19CHY512A | X | X | | X | X | | | | | | | |
| 19CHY513A | X | X | | | X | X | X | X | | | | |
| 19CHY514A | X | X | X | | X | X | X | X | | | | |
| 19CHY521A | X | X | X | | X | | | | | | | |
| 19CHY522A | X | X | | X | X | | | | | | | |
| 19CHY523A | X | X | | | X | X | X | X | | | | |
| 19CHY524A | X | X | X | | X | X | X | X | | | | |
| 19CHY531A | X | X | X | | X | | | | | | | |
| 19CHY532A | X | X | | X | X | | | | | | | |
| 19CHY533A | X | X | | | X | X | X | X | | | | |
| 19CHY534A | X | X | X | | X | X | X | X | | | | |
| 19CHY590A | X | X | X | X | X | X | X | X | | | | |
| 19CHY515A | X | X | | X | X | X | X | | X | X | X | X |
| 19CHY516A | X | X | | X | X | X | X | | X | X | X | X |
| 19CHY525A | X | X | | X | X | X | X | | X | X | X | X |
| 19CHY526A | X | X | | X | X | X | X | | X | X | X | X |
| 19CHY535A | X | X | | X | X | X | X | | X | X | X | X |
| 19CHY536A | X | X | | X | X | X | X | | X | X | X | X |
| 19CHY517A | X | | X | | | | X | X | | | | |
| 19CHY527A | X | | X | | | | X | X | | | | |
| 19CHY537A | X | | X | | | | X | X | | | | |
| 19CHY598A | X | X | X | X | X | X | X | X | X | X | X | X |
| 19CHY599A | | X | | X | X | X | X | | | | | |
| 19CHY600A | X | X | X | X | X | X | X | X | X | X | X | X |

24. Capability/ Transferable Skills Map

| Module Code | Group work | Self learning | Research Skills | Written Communication Skills | Verbal Communication Skills | Presentation Skills | Behavioral Skills | Information Management | Personal management/ Leadership Skills |
|-------------|------------|---------------|-----------------|------------------------------|-----------------------------|---------------------|-------------------|------------------------|--|
| 19CHY511A | X | X | X | X | X | | | X | |
| 19CHY512A | X | X | X | X | X | | | X | |
| 19CHY513A | X | X | X | X | x | | | X | |
| 19CHY514A | X | X | X | X | X | | X | X | |
| 19CHY521A | X | X | X | X | X | | X | X | |
| 19CHY522A | X | X | X | X | X | | | X | |
| 19CHY523A | X | X | X | X | X | | | X | |
| 19CHY524A | X | X | X | X | X | | | X | |
| 19CHY531A | X | X | X | X | X | | | X | |
| 19CHY532A | X | X | X | X | X | | | X | |
| 19CHY533A | X | X | X | X | X | | X | X | |
| 19CHY534A | X | X | X | X | X | | X | X | X |
| 19CHY590A | X | X | X | X | X | | X | X | X |
| 19CHY515A | | X | X | X | X | | X | X | |
| 19CHY516A | | X | X | X | X | | X | X | |
| 19CHY525A | | X | X | X | X | | X | X | |
| 19CHY526A | | X | X | X | X | | X | X | |
| 19CHY535A | | X | X | X | X | | X | X | |
| 19CHY536A | | X | X | X | X | | X | X | |
| 19CHY517A | | X | X | | X | X | X | X | X |
| 19CHY527A | | X | | X | X | X | X | X | X |
| 19CHY537A | | X | | X | X | X | X | X | X |
| 19CHY598A | | X | X | X | X | X | X | X | X |
| 19CHY599A | | X | | X | X | X | X | X | X |
| 19CHY600A | X | X | X | X | X | X | X | X | X |

25. Co-curricular Activities

Students are encouraged to take part in co-curricular activities like seminars, conferences, symposium, paper writing, attending industry exhibitions, project competitions and related activities for them to enhance their knowledge and network.

26. Cultural and Literary Activities

To remind and ignite the creative endeavors, annual cultural festivals are held and the students are made to plan and organize the activities.

27. Sports and Athletics

Students are encouraged to develop a habit of taking part in outdoor and indoor games on daily basis.

