

Guru Jambheshwar University, Moradabad

School of Chemical Sciences (Chemistry)

Faculty of Pure Sciences

Program Proposal Document

Master of Science (Chemistry)

(Minor specialization in Metal Processing & Surface Technology)

1. **Introduction:** **Moradabad** is an economically significant city, renowned globally for its brassware and handicraft industries. Often referred to as the "**Brass City of India**" or "**Peetal Nagri**", Moradabad has carved a niche for itself in international markets for its exquisite metal art, making it a major export hub and contributor to India's economy. It is distinguished not only by its rich cultural heritage but also by its dynamic industrial base. The M.Sc. Chemistry program aligns with the vision of the University "To cultivate scientific leadership in sustainable metal chemistry through industry-integrated education, research innovation, and culturally rooted academic excellence." This two-year postgraduate program aims to integrate the fields of advanced chemistry, industrial applications, and environmental responsibility.
2. **Program Rationale:** As the home of India's largest brassware industry, Moradabad represents a unique confluence of **traditional craftsmanship and modern industrial growth**. Its status as a **Smart City** underlines the region's potential for innovation and sustainable development. The presence of institutions like the **Moradabad Handicraft Service Centre (MHSC)** and **CBFFC** creates a fertile ground for academic-industry collaboration, especially in disciplines like **chemistry, environmental studies, and materials science**. Designed with the local industrial landscape of Moradabad in mind, the **course leverages real-time exposure to the brassware, electroplating, polishing, and furnace-based sectors to train skilled professionals in sustainable chemistry**.
3. **Alignment with NEP 2020 Framework:** The National Education Policy 2020 emphasizes **interdisciplinary learning, industry-academia collaboration, and employment-oriented programs**. The proposed M.Sc. program is designed to:
 - Integrate **core chemical sciences with Environmental management**.
 - Offer **industry-based projects and internships**.
 - Encourage **problem-solving and sustainability innovation**.

NEP Guideline	Program Implementation
Multiple Entry and Exit	Exit after 1 year with PG Diploma (40credits); re-entry permitted through ABC.
Credit Framework	80 credits over 4semesters.
Academic Bank of Credits (ABC)	Full compliance with UGC (Establishment and Operation of ABC) Regulations, 2021.
Choice Based Credit System (CBCS)	Core, Elective, Open, and Skill Enhancement courses offered.

Experiential Learning	20–25% credits earned through internships, professional practice labs, and projects.
Interdisciplinary Exposure	Electives available from Environmental Science, Data science
Skill Development	Embedded labs on communication, use of AI, Softwares for Science.
Digital Learning	One course via SWAYAM/NPTEL to be covered in 3 rd or 4 th semester (2credits).
Holistic and Continuous Evaluation	Continuous internal assessment (60%) and end-semester evaluation (40%).

4. Program Objectives

- To build a strong academic foundation and impart advanced knowledge in Chemical Sciences in Organic, Inorganic, Physical, and Analytical Chemistry integrated with practical application.
- Equip students with advanced skills in analytical, inorganic, and surface chemistry applicable to metal industries.
- To foster academia-industry linkages and provide industrial exposure through internships and collaborative projects.
- Bridge traditional knowledge and modern industrial practices, especially in electroplating, alloy treatment, and corrosion science.
- Promote research in green and sustainable surface technologies using organic and natural product chemistry.
- Strengthen Moradabad's MSME sector through knowledge transfer and skilled human capital.
- To develop research aptitude, critical thinking, and scientific acumen among postgraduate students

5. Program Outcomes: After completing the Two year Post graduate program, the graduates will be able to-

- Demonstrate advanced knowledge of Surface chemistry and Electroplating, which could be utilized in local Brass Industry
- Apply Knowledge of Metallurgy and alloys to develop materials those are more durable and less hazardous.
- Demonstrate advance knowledge of Instrumentation techniques.
- Handle different kinds of high standard sensitive instruments like GC-MS, AAS, etc. used in Quality testing in different labs and industries.
- Analyze the spectral data obtained through UV-visible spectrophotometer, IR spectrophotometer, and NMR analysis

- **Through the Public outreach activities** during the program, involving artisans and sustainability groups, the students will be able to know the problems and provide real-time solution to the problems at local level.
- Guide local industries to work in a manner that is less harmful for our environment
- Engage in research and innovation

6. Eligibility criteria:

- Bachelor's Degree in Science or equivalent (10+2+3 system) with minimum **45% marks** or as per University norms.
- Admissions through **University Admission Process/ CUET-PG** (as applicable).

7. Program Duration and Credit Structure: 2 years (4 semester) Program

Award	Duration	Credits	Exit option
M.Sc. Chemistry	2 yrs (4 semesters)	80-85	Final award
PG Diploma in Instrumentation Techniques	1 yr (2 semesters)	40	Exit after 2 semesters

8. Program Structure (Semester-wise distribution):

Semester 1 (Total credits: 22)

S. No.	Title of Course	Credits
1	Advanced Inorganic Chemistry-I (Chemical Bonding, Introduction to Coordination Chemistry, Bio-inorganic Chemistry)	4
2	Advanced Organic Chemistry- I (Stereochemistry & Reaction mechanisms)	4
3	Advanced Physical Chemistry- I (Classical Thermodynamics, Electrochemistry & Chemical Kinetics)	4
4	Analytical Chemistry- I (Point Groups and Diffraction Techniques)	4
5	Practical Lab	4
6	Seminar/Presentations	2

Semester 2 (Total credits: 24)

S. No.	Title of Course	Credits
1	Advanced Inorganic Chemistry-II (Coordination Chemistry, Organometallic compounds, Metal clusters and Inorganic Spectra)	4
2	Advanced Organic Chemistry- II (Pericyclic reactions and Photochemistry, Bio-organic Chemistry)	4
3	Advanced Physical Chemistry- II (Quantum Chemistry)	4
4	Analytical Chemistry- II (Separation and Spectroscopic Techniques)	4
5	Practical Lab	4
6	Summer Internship (6-8 weeks)	4

Exit with PG Diploma in Instrumentation Techniques with 40 credits

Semester 3 (Total credits: 22)

S. No.	Title of Course	Credits
1	Research methodology & Statistical Analysis	4
2	Metallurgical Chemistry and Alloy design (specialization)	4
3	Solid state, Surface Chemistry and Electroplating (specialization)	4
4	Discipline elective: 1. Green Chemistry 2. Natural Product Chemistry 3. Industrial Waste management	4
5	Open Elective: 1. Law (Legal literacy for Professionals) 2. Environmental Chemistry 3. Renewable energy & sustainable practices	2
6	Practical Lab	4

Semester 4

S. No.	Title of Course	Credits
1	Major Internship/Dissertation (12-16weeks)	10
2	Seminar/Viva voce	2
3	MOOCs/NPTEL/SWAYAM	2

9. Internship and Professional Practice:

- Short Internship: After Semester II (6–8weeks, 4 credits).
- Major Internship/Dissertation: Semester IV 12-16 weeks (10 credits).
- Each internship will be governed by a Learning Agreement signed by the student, industry mentor, and faculty guide.
- Evaluation (Joint): Industry (40%) + Faculty (40%) + Viva (20%).

10. Assessment and Evaluation

Component	Weightage
Continuous Internal Assessment (Assignments, Quiz, Seminars, Presentations, Practicals, Reports of Industrial/Academic Trips)	40%
End Semester Examination / Viva	60%
Internship/Project Evaluation	As per joint assessment policy
Minimum Passing Grade	40% aggregate per course

11. Pedagogical approach:

- a) Experiential learning: Atleast one visit to local industry will be organized in every semester to learn about the processes involved.
- b) Industry integration: 16 credits in total have been assigned to Minor and major Internship in Industry to ensure hands on experience and development of skills required by industries.
- c) Research linked learning: To develop research acumen in students, visits to CSIR and other research labs may be conducted for exposure to research facilities.
- d) ICT-enabled classrooms will ensure blended learning.
- e) Skill based courses like AI & ML will help the graduates to upgrade to the changing techniques.

12. Faculty and Infrastructure Requirements:

1 Professor + 2 Associate Professors + 4 Assistant Professors

S. No.	Qualification (Preferred)	Area of Specialization	Proposed Role in Program
1	Ph.D. in Inorganic Chemistry	Industrial Inorganic Chemistry, Solid-State Chemistry	Core Faculty – Semester I & II
2	Ph.D. in Organic Chemistry	Spectroscopy, Natural Product Chemistry	Core faculty, Elective (Semester I-II-III) Project Guide -Research Phase
3	Ph.D. in Physical Chemistry	Surface Chemistry, Electroplating	Core Faculty & Specialization - Semester I & III
4	Ph.D. in Analytical Chemistry	Environmental Chemistry, Instrumentation related with spectroscopy	Core & Lab Faculty – Semester II & III Project Guide -Research Phase
5	M.Tech. in Metallurgy	Alloy Design, Furnace Management	Specialization and Industry Mentor – Semester III-IV
6	Ph.D. in Organometallic Chemistry	Bio-inhibitors, Eco-coatings	Semester-II and IV Project Guide -Research Phase
7	Ph.D. in any of the above		Project Guide – Research Phase and any pertinent subject

13. Quality Assurance and Monitoring:

The program's growth trajectory will be evaluated through:

- Annual academic and infrastructure audits
- Feedback from students, industry, and faculty
- Graduate tracking (placements, entrepreneurship, higher studies)
- Research output (papers, patents, consultancies)
- Periodic external peer reviews

These metrics will inform adaptive curriculum updates and resource planning.

14. SWOT analysis:

Strengths

- **Unique Program Niche:** No other regional university offers a specialization in metal processing and surface technology.
- **Strong Industry Linkages:** Support from MHSC, CBFFC, and Smart City Furnace Centre for practical exposure and internships.
- **Interdisciplinary Curriculum:** Merges physical, inorganic, organic, and green chemistry aligned with NEP 2020.
- **Skill-Based Learning:** Emphasis on industrial applications, spectroscopy, electroplating, and alloy technologies.

- **Research Potential:** Dedicated Centre for Green Interfaces promotes student-led innovations and projects.

Weaknesses

- **Initial Faculty Gaps:** Limited number of domain-specific faculty in metallurgy or industrial chemistry.
- **Laboratory Setup Time:** Delay in full-fledged lab and equipment commissioning can slow early momentum.
- **Brand Recognition:** As a new university/program, limited national recognition may impact first-year admissions.
- **Dependence on External Experts:** Reliance on visiting faculty/mentors could affect continuity and student mentoring.

Opportunities

- **MSME Engagement:** Moradabad's industrial ecosystem offers real-time consulting, research, and placement opportunities.
- **NEP 2020 & Atmanirbhar Bharat:** Strong government push for industry-academia collaboration and indigenous R&D.
- **Startup Ecosystem:** Potential for green chemistry and alloy-processing-based startups with incubation support.
- **Global Collaboration:** Possibility to build international research ties in corrosion science and eco-materials.

Threats

- **Technological Obsolescence:** Rapid industry changes in surface tech and materials science require constant curriculum updates.
- **Competition:** IITs/NITs may launch short-term diploma/online courses in industrial chemistry niches.
- **Funding Volatility:** Initial capex and lab investments may require consistent external grants or CSR backing.
- **Policy Delays:** Delayed recognition or accreditation approvals could affect student enrolments and UGC compliance.

15. Approval and Implementation

- **Effective Session:** 2025–26
- **Offered by:** *School of Chemical Sciences*, Guru Jambheshwar University, Moradabad
- **Mode:** Regular / Full-Time
- **Intake Capacity:** 30(modifiable as per BoS decision)
- **Medium of Instruction:** English
- **Credit Registration:** Through Academic Bank of Credits (ABC)

16. Annexures (for Submission)

Submitted for consideration and approval by Board of Studies and Academic Council.

Prepared by:

Dr. Vaishali Poonia

Coordinator: M.Sc. Chemistry

Date: November 9, 2025

Approved by:

Dean (Academic affairs): _____

Vice Chancellor: _____

Annexure I

Detailed Course Outcomes (COs) and CO-PO Mapping Matrix

Program: Master of Science (Chemistry)

University: Guru Jambheshwar University, Moradabad

Faculty:

Duration: 2 yrs (4 semesters) Credits: 80

Program Outcomes (POs)

PO Code	PO Statement
PO1	Demonstrate advanced knowledge of Surface chemistry and Electroplating, which could be utilized in local Brass Industry
PO2	Knowledge of Metallurgy and alloys to develop materials that are more durable and less hazardous.
PO3	Demonstrate Advanced knowledge of Instrumentation techniques.
PO4	Handle different kinds of high standard sensitive instruments like GC-MS, AAS, etc. used in Quality testing in different labs and industries.
PO5	Analyse the spectral data obtained through UV-visible spectrophotometer, IR spectrophotometer, and NMR analysis
PO6	Through the Public outreach activities during the program, involving artisans and sustainability groups, the students will be able to know the problems and provide real-time solution to the problems at local level.
PO7	Guide local industries to work in a manner that is less harmful for our environment
PO8	Engage in research and innovation

Annexure II

Internship & Professional Practice Policy

1. Introduction
2. Objectives of Internship
3. Structure of Internship and Professional Practice
4. Internship Framework
 - 4.1.Pre-Internship Phase
 - 4.2.During Internship
 - 4.3.Post-Internship
5. Learning Agreement (Template)
6. Internship Logbook (Template)
7. Internship Report (Suggested structure)
8. Evaluation Scheme
9. Roles and Responsibilities
 - 9.1. Student
 - 9.2.Faculty Mentor
 - 9.3.Industry Supervisor
 - 9.4.Department/University
10. Assessment Rubric (Outcomes-based Evaluation)
11. Integration with Academic credits
12. Key expected Outcomes (Internship Learning Indicators)

Methodology

- Step 1: Classroom Learning (Learn)
- Step 2: Practice in Labs & Projects (Apply)
- Step 3: Internship & Field Exposure (Experience)
- Step 4: Research & Innovation (Create)
- Step 5: Presentation and Reflection (Share)
- Step 6: Evaluation and Feedback (Improve)