

# Academic Programs Booklet

College of Science

2026



Prepared By: VP For Academic Programs and Graduate Studies Office

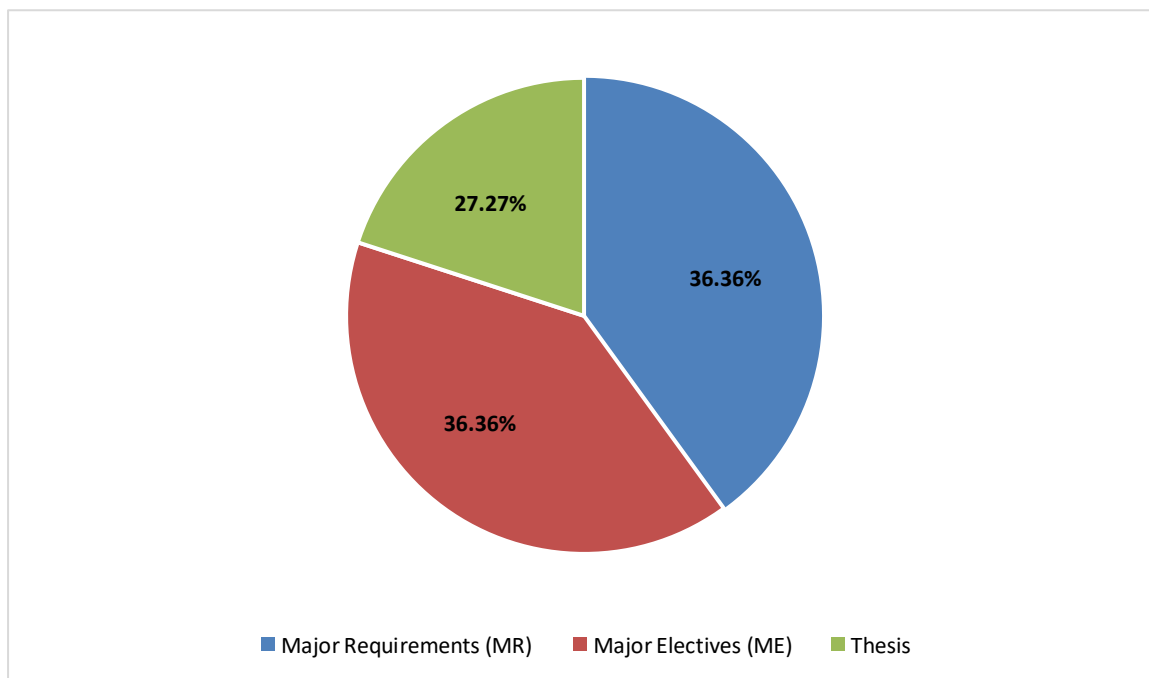
# College of Science

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# Master of Science in Environmental Chemistry (2026)

## Program Components



Major Requirements (MR)	12
Major Electives (ME) <sup>1</sup>	12
Thesis	9
Total Credit (CRD)	33

## Teaching Language: English

<sup>1</sup> Student must select **four** elective courses.

## Detailed Study Plan

### Year 1 - Semester 1

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEMY 610	Research Methodology and Seminars	3	0	3	MR	-----	Yes
CHEMY 613	Environmentally Analytical Technology	3	0	3	MR	-----	Yes
CHEMY 623	Advanced Environmental Chemistry	3	0	3	MR	-----	Yes

### Year 1 - Semester 2

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEMY 624	Waste Management and Treatment	3	0	3	MR	-----	Yes
CHEMY 6xx	Elective 1	3	0	3	ME	-----	Yes
CHEMY 6xx	Elective 2	3	0	3	ME	-----	Yes

### Year 2 – Semester 3

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEMY 6xx	Elective 3	3	0	3	ME	-----	Yes
CHEMY 6xx	Elective 4	3	0	3	ME	-----	Yes

### Year 2 – Semester 4

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEMY 622	Thesis	0	27	9	Thesis	-----	No

## Major Elective Courses List

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEMY 612	Environmentally Benigne Technology	3	0	3	ME	----	Yes
CHEMY 616	Atmospheric Chemistry	3	0	3	ME	----	Yes
CHEMY 617	Organic Contaminants in the Environment	3	0	3	ME	----	Yes
CHEMY 620	Nanomaterials for Environmental Remediation	3	0	3	ME	----	Yes
CHEMY 625	Green Materials Production and Applications	3	2	3	ME	----	Yes
CHEMY 626	Sustainable Water Treatment and Resource Recovery	3	0	3	ME	----	Yes
CHEMY 628	Nano-Enabled Sensors or Environmental Monitoring	3	0	3	ME	----	Yes
CHEMY 629	Sustainable Energy and Environmental Impact	3	0	3	ME	----	Yes
CHEMY 630	Computational Intelligence in Environmental Chemistry	3	0	3	ME	----	Yes

## Course Description

**Course Code:** CHEMY 610                      **Course Title:** Research Methodology and Seminars  
Research methods; art of scientific investigation; identification of problems; scientific background of the proposed plan, online information collection, digital library search; research design; data collection; data analysis; analyzing quantitative data; analyzing qualitative data; statistical analysis and interpretation of data; writing research report; Ontological and epistemological underpinning of research methods; quantitative and qualitative research methods; collection, analysis and interpretation of data; use of secondary data; problem-based research; research ethics.

**Course Code:** CHEMY 612                      **Course Title:** Environmentally Benign Technology  
Principles of industrial pollution prevention, environmentally friendly techniques, Photochemical degradation principles, Homogeneous and heterogeneous photocatalysis, Photo-oxidation and photo-degradation, biodegradation process and mechanism, phytoremediation, green corrosion inhibitors, Microwave-assisted synthesis for environmental applications, ultrasonic chemistry for cleaner production and pollutant treatment, designing greener processes.

**Course Code:** CHEMY 613                      **Course Title:** Environmental Analytical Techniques  
Sampling procedure for air, soil, and water; separation techniques; classical and modern analytical methods; instrumental method of chemical analysis; advanced spectroscopic and electrochemical techniques; chromatography and hyphenated chromatographic techniques; sensors technology and applications; electron probe microanalysis; imaging and elemental analysis of solid materials, instrument selection; recognizing and evaluating controlling hazards; quality control (documentation, calibration, and sample management); data handling using advanced statistical tools.

**Course Code:** CHEMY 616                      **Course Title:** Atmospheric Chemistry  
Environmental segments; atmospheric classification; tropospheric oxidation chemistry; water in atmosphere; chemistry of the major air pollutants; ambient atmosphere and air pollution; climate change; their behavior; health impacts; air burden and sources; USEPA standards for ambient air; indoor air pollution; sources; control; case study; atmospheric reactions of sulfur; and nitrogen compounds; carbon burden on atmosphere and major reactions; chemistry of the greenhouse gases; GHGs inventory; volatile organic compounds (VOCs); photochemical smog; particulate matter; analysis of atmospheric samples ( $\text{SO}_2$ ,  $\text{NO}_2$ ,  $\text{O}_3$ ).

**Course Code:** CHEMY 617                      **Course Title:** Organic Contaminants in the Environment  
Types of anthropogenic organic chemicals, sources and routes of entry to the environment; dispersion of organic pollutants in environment and problems; chemistry of fate and transformation of anthropogenic organic contaminants in the environment; Major groups of organic contaminants: polycyclic aromatic hydrocarbons (PAHs), organic dyes, pesticides and petroleum hydrocarbons, volatile organic compounds, pharmaceuticals and personal care products (PPCPs), polychlorinated biphenyls (PCBs) polyfluorinated compounds (PFCs), persistent organic pollutants (POPs); chemical structures, properties, and environmental behavior; ecotoxicology of organic contaminants; toxicity and mode of action; bioavailability and bioaccumulation; human health effects of organic contaminants; endocrine disrupting organic chemicals (EDCs): environmental and human health effects of EDCs; detection and characterization of organic contaminants; treatment methods for removal of organic contaminants.

**Course Code:** CHEMY 620                      **Course Title:** Nanomaterials for Environmental Remediation  
Overview of nanotechnology and environment; nanomaterials preparation methods; nanomaterials characterization; size and shape dependent properties; nanomaterials for the removal of pollutants (dyes, heavy metals, chlorinated organic, etc.); application of nanomaterials in environmental remediation.

**Course Code:** CHEMY 623                      **Course Title:** Advanced Environmental Chemistry  
Overview of traditional environmental segments; Carbon, nitrogen, sulfur, phosphorus, and water cycles; Interactions between endogenic and exogenic processes; Hydrosphere, Water Pollution, Air Pollution, Soil Pollution; Pollution Control and Management, Environmental impact assessment (EIA) and life cycle assessment (LCA); Climate change mitigation and adaptation, Nature-based solutions and green infrastructure, Environmental justice, socio-economic and emerging environmental issues.

**Course Code:** CHEMY 624      **Course Title:** Waste Management and Treatment

Scope, and significance of waste management; types of waste (industrial, hazardous waste, electronic waste, radioactive waste and biomedical wastes); generation and characteristics of waste; current practices of waste collection and transport; waste processing techniques; disposal of Waste; reuse and recycling of waste; health hazards associated with poor management of solid wastes; Domestic vs. industrial wastewater characteristics, Chemical treatment processes: Coagulation-flocculation, Chemical oxidation ( $O_3$ ,  $H_2O_2$ , UV-based processes), Ion exchange and electrochemical treatment, Sludge management; legislative and economic aspects of waste management; Waste Chemistry in Environmental Remediation, Soil and groundwater contamination by waste, Chemical remediation methods (in situ oxidation, bioremediation), pollution trade off and detoxification techniques, quality control and understanding of National Environmental Quality Standards (NEQs).

**Course Code:** CHEMY 625      **Course Title:** Green Materials Production and Applications

Green Materials, Sources and Classifications of Green Materials, Sustainable Synthesis and Production Methods, Sustainability Assessment of Natural Materials, Green Solvents in Materials Processing, Naturally Occurring Minerals, Green Polymers and Bioplastics, Natural Fiber Reinforced Composites, Industrial and Commercial Applications, Future Trends and Case Studies.

**Course Code:** CHEMY 626      **Course Title:** Sustainable Water Treatment and Resource Recovery

Scientific and technological foundation in sustainable water treatment processes and the recovery of valuable resources from water and wastewater streams. Conventional and advanced treatment technologies, integrated resource recovery approaches, and the principles of circular water economies. Water desalination, Desalination techniques, Energy-efficient, low-waste systems, case studies from municipal, industrial, and agricultural sectors. Topics include biological, chemical, and physical treatment methods, sludge valorization, nutrient recovery, and water reuse practices aligned with the UN Sustainable Development Goals (SDGs).

**Course Code:** CHEMY 628      **Course Title:** Nano-Enabled Sensors for Environmental Monitoring

A scientific and technical foundation in environmental monitoring using sensor technologies and nanomaterials. Principles, design, and application of physical, chemical, and biological sensors for detecting pollutants in air, water, and soil. The integration of nanomaterials enhanced sensor performance, sensitivity, and selectivity. Real-world environmental challenges, sustainability, and alignment with global monitoring standards.

**Course Code:** CHEMY 629      **Course Title:** Sustainable Energy and Environmental Impact

Energy resources; non-renewable energy resources and environmental issues; fossil fuels (coal, petroleum and natural gas) formation; classification; properties and environmental aspects of fossil fuels during exploration; production; transportation and combustion; nuclear energy reactors and environmental aspects of nuclear energy/radioactive waste disposal; future prospects nuclear fusion & fission; renewable energy resources (hydroelectricity, solar energy, geothermal energy, biomass and biogas) and assessment of their environmental aspects.

**Course Code:** CHEMY 630      **Course Title:** Computational Intelligence in Environmental Chemistry

Overview of computational approaches in environmental chemistry, numerical modelling and scientific computing, Molecular mechanics and force fields, Ab initio, DFT, and semi-empirical methods, Software's, Modelling of Photodegradation pathways of pollutants, Thermodynamic property prediction, Reaction mechanism and kinetics simulations, Transition state theory and rate constant calculation, Simulating atmospheric reactions and pollution dispersion, Carbon capture,  $CO_2$  reduction and sensing, Data analysis Tools: Python (pandas, scikit-learn), MATLAB, Validating computational results with lab data, designing experiments guided by computational predictions.

**Course Code:** CHEMY 622

**Course Title:** Thesis

The thesis should demonstrate that the student has the capacity to carry out original research, the ability to review appropriate background material, formulate and address significant questions, to obtain, collate, and analyze appropriate data to draw logical conclusions there-from, to integrate in a meaningful way the new knowledge into the greater body of existing knowledge and state its significance. The final thesis will be submitted to the Department's Postgraduate Committee and can be either original research work and/or a creative project. Moreover, the thesis will be defended before an internal and external examiner and/or in public who will be appointed as per university policy.



