



Iligan Institute of Technology
of the Mindanao State University
Quality Education for a better Mindanao

Ph.D. IN CHEMISTRY (REVISED CURRICULUM)

Introduction

The Iligan Institute of Technology of the Mindanao State University (MSU-IIT) is mandated to develop the scientific manpower and technical capability of the Mindanao region in order to achieve a speedy economic development of the country. As an academic institution, it must offer and support programs that will bring about the effective fulfillment of its goals. The Commission on Higher Education (CHED) identified it as a *Graduate Center for Chemistry* under its Mindanao Advanced Education Project (MAEP). As such, it is tasked to help produce the critical mass of scientists in the field of chemistry that will catalyze the development of Mindanao. In 1998, it was identified by CHED as a *Center of Excellence (COE) in Chemistry*. The Department of Chemistry of MSU-IIT, being one of the academic divisions of the institute, must strive towards the realization of this mandate. One way of achieving this is to offer graduate programs in Chemistry, specifically *Doctor of Philosophy in Chemistry* Program, in addition to its specific tasks of undertaking basic, applied, and mission-oriented researches.

Objective

The *Doctor of Philosophy in Chemistry* Program aims to provide advanced training in the Science of Chemistry which will enable the student to conduct an independent investigation of a research problem.

Admission Requirements

- (1) Applicants must possess an M.S. Chemistry degree or its equivalent.
- (2) Applicants must submit the following:
 - (a) a completed application form of the MSU-IIT Graduate School;
 - (b) a certified true copy of the Official Transcript of Records; and
 - (c) two letters of recommendations from former lecturers/professors.
- (3) All applications will be evaluated by the Chemistry Graduate Committee. An interview with the applicant may be required in some cases.

Degree Requirements

1. Courses: A minimum of six (6) total units of course work after the M.S. degree, three (3) units of thesis proposal preparation, four (4) units of seminar presentations, twelve (12) total units of thesis work, and one (1) unit of thesis seminar, are required.

The directed research work consists of a laboratory investigation of a research problem leading to the Ph.D. Thesis. The graduate seminars are one (1) unit courses involving the presentation of a research paper arising from library, directed research work, and thesis.

2. Defense: The student must have successfully defended his/her Ph.D. Thesis.
3. Publication: In addition to the comprehensive examination requirement, the student must have at least 1 refereed international publication (full length paper) from his/her Directed Research Work or Ph.D. Thesis. No student will be cleared for graduation without showing proof (e.g., galley proof of the paper, or original reprint of the published paper) of the required publication. Acceptability of proofs will be decided upon by the Chemistry Graduate Committee. If all requirements have been met except the publication, the student is

required to register in Chem 599 (Ph.D. Thesis) for residency purposes only every term until the publication requirement is complied.

**DOCTOR OF PHILOSOPHY IN CHEMISTRY (Ph.D. CHEM)
(LIST OF COURSES BY SEMESTER)**

First Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Pre-requisite(s)	Co-requisite(s)
			Lec	Lab	Total		
Cognate 1	-	3	3	0	3	None	None
Cognate 2	-	3	3	0	3	None	None
Chem 590	Ph.D. Thesis Proposal	3	3	0	3	None	None
	Total	9	9	0	9		

First Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)	Corequisite(s)
			Lec	Lab	Total		
Chem 591	Seminar I	1	1	0	1	None	None
Chem 598	Doctoral Directed Research	0	-	-	-	Chem 590	None
	Total	1	1	-	1		

Summer 1

An *Oral Comprehensive Examination* must be applied at the Graduate School by the students after passing Cumulative Exams. Passing the comprehensive exam is a pre-requisite for the conduct of the Ph.D. Thesis. The student may retake the PhD comprehensive examination only once; the retake examination must be done within one year of the first try.

The student has an option to continue enrolling in Chem 598 (Doctoral Directed Research) in this term Summer 1.

Second Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)	Corequisite(s)
			Lec	Lab	Total		
Chem 598	Doctoral Directed Research	0	-	-	-	Chem 590	None
Chem 592	Seminar II	1	1	0	1	Chem 591	None
	Total	1	1	-	1		

Second Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)	Corequisite(s)
			Lec	Lab	Total		
Chem 598	Doctoral Directed Research	0	-	-	-	Chem 590	None
Chem 593	Seminar III	1	1	0	1	Chem 592	None
	Total	1	1	-	1		

Summer 2

The student has an option to continue enrolling in Chem 598 (Doctoral Directed Research) in this term Summer 2.

Third Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)	Corequisite(s)
			Lec	Lab	Total		
Chem 598	Doctoral Directed Research	0	0	-	-	Chem 590	None
Chem 594	Seminar IV	1	1	0	1	Chem 593	None
	Total	1	1	-	1		

Third Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)	Corequisite(s)
			Lec	Lab	Total		
Chem 598	Doctoral Directed Research	0	0	-	-	Chem 590	None
Chem 595	Ph. D. Thesis Seminar	1	1	0	1	Chem 594	Chem 599
Chem 599	Ph. D. Thesis	12*	0	-	12	Compre. Exam and Chem 598	Chem 595
	Total	13	1	-	13		

*credit only, not actual course work.

CATALOGUE OF COURSES

CHEMISTRY COGNATE

ANALYTICAL CHEMISTRY

CHEM 421 ELECTROANALYTICAL CHEMISTRY

Theory and analytical applications of electrochemistry.

Credit : 3 units (3 hrs lec)

Prerequisite(s) : None

CHEM 422 CHROMATOGRAPHIC METHODS OF ANALYSIS

Principles and applications of chromatographic methods of analysis.

Credit : 3 units (3 hrs lec)

Prerequisite(s) : None

CHEM 423 RADIOCHEMICAL METHODS OF ANALYSIS

Theory and analytical application of radiochemistry.

Credit : 3 units (3 hrs lec)

Prerequisite(s) : None

CHEM 429 CURRENT TOPICS IN ANALYTICAL CHEMISTRY*

(*May be enrolled three times for a maximum of 3 units.)

Advances and current researches in analytical chemistry.

Credit : 1 unit (1 hr lec)

Prerequisite(s) : None

ORGANIC CHEMISTRY-BIOCHEMISTRY

CHEM 431 CHEMISTRY OF NATURAL PRODUCTS

Advances in the chemistry and biosynthesis, isolation techniques, and structure elucidation of natural products.

Credit : 3 units (3 hrs lec)

Prerequisite(s) : None

CHEM 432 POLYMER CHEMISTRY

Reactions, reaction mechanisms and synthesis of polymers.

Credit : 3 units (3 hrs lec)

Prerequisite(s) : None

CHEM 433 PHOTOCHEMISTRY

Theory of photochemistry and photoreactions.

Credit : 3 units (3 hrs lec)

Prerequisite(s) : None

CHEM 434 ORGANIC MEDICINAL CHEMISTRY

Study of organic compounds that are used as drugs or medicinal agents, their activity, applications, limitations, stability, forms and uses.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 435 ORGANOMETALLICS

Reaction mechanisms of organometallic compounds and their role in homogeneous catalysis and biochemical processes.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 439 CURRENT TOPICS IN ORGANIC CHEMISTRY*
(*May be enrolled three times for a maximum of 3 units.)

Advances and current researches in organic chemistry.

Credit : 1 unit (1 hr lec)
Prerequisite(s) : None

CHEM 440 STRUCTURE AND FUNCTION OF BIOMOLECULES

Structure and function of biochemical systems, their regulation, biosynthesis and coordinated metabolic pathways.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 442 LIPIDS, PROTEINS, AND CARBOHYDRATES

Advances in lipids, proteins, and carbohydrates chemistry. Extraction and separation methods in lipids, proteins and carbohydrate analyses.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 443 ENZYMES

Enzyme structure and function; allosterism. Equilibrium and kinetic aspects of enzyme reactions. Coenzymes, functions and structure. Biochemical reaction mechanisms and their regulation.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 444 NUCLEOSIDES AND NUCLEIC ACIDS

The replication of living organism's mutation. Repair mechanisms. Recent development in the biochemistry of nucleosides and nucleic acids.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 449 CURRENT TOPICS IN BIOCHEMISTRY*
(*May be enrolled three times for a maximum of 3 units.)

Advances and current researches in biochemistry.

Credit : 1 unit (1 hr lec)
Prerequisite(s) : None

INORGANIC CHEMISTRY

CHEM 451 COORDINATION CHEMISTRY

The chemistry of complexes formulated by a central atom or ion surrounded by a set of other atoms, ions, or small molecules. Symmetry groups and molecular symmetry are the main concern of this study.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 452 MACROCYCLIC CHEMISTRY

The study of characteristically interesting and unusual macrocyclic ligand systems. Areas of study include the structures and properties of macrocyclic compounds; synthesis; polyether crown and related systems; host-guest chemistry, kinetics; thermodynamics and electrochemical aspects of a range of macrocyclic system.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 453 SUPRAMOLECULAR CHEMISTRY

The chemistry of intermolecular bond that is concerned with the structure and function of entities formed by the association of two or more molecular or ionic species.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 454 BIOINORGANIC CHEMISTRY

Explores the variety of function of metal ions in specific steps that they play in biology. This study includes areas on ion pumps and transport proteins and the biochemical catalysts, metalloenzymes.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 455 SOLID STATE CHEMISTRY

The current enthusiasm for "material chemistry" has greatly increased the synthesis and study of new inorganic solids. The study covers areas on basic concept of prototypical solid structures, lattice enthalpies, ionic and covalent bonding, intercalation compounds, crystal structures, electronic band structures, x-ray and neutron diffraction structures.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 459 CURRENT TOPICS IN INORGANIC CHEMISTRY*
 (*May be enrolled three times for a maximum of 3 units.)

Advances and current researches in inorganic chemistry.

Credit : 1 unit (1 hr lec)
Prerequisite(s) : None

PHYSICAL CHEMISTRY

CHEM 471 QUANTUM CHEMISTRY**
 (**Or equivalent course in other departments as approved by the Chemistry Graduate Committee.)

Theorems of quantum mechanics, variational methods, perturbation theory, many-electron atoms, electronic structure of polyatomic molecules.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 473 METHODS OF COMPUTATIONAL CHEMISTRY

Semi-empirical method, molecular mechanics, ab-initio methods, density functional theory.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 475 MOLECULAR DYNAMICS***
 (**Or equivalent course in other departments as approved by the Chemistry Graduate Committee.)

MD simulations of small systems, equilibrium and dynamical properties, time-dependent phenomena.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 476 CHEMICAL APPLICATION OF GROUP THEORY

Symmetry, matrix representation of groups, electronic structure of polyatomic molecules, molecular vibrations, molecular orbitals.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 477 STATISTICAL THERMODYNAMICS

Ensembles, partition functions, application to thermodynamics.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 479 CURRENT TOPICS IN PHYSICAL CHEMISTRY*
 (*May be enrolled three times for a maximum of 3 units.)

Advances and current researches in physical chemistry.

Credit : 1 unit (1 hr lec)
Prerequisite(s) : None

ALLIED CHEMISTRY

CHEM 481 ADVANCED ENVIRONMENTAL CHEMISTRY

Advanced study of the sources, reactions, transport, effects, and fate of chemical species in water, soil, and air environments, and the effects of technology thereon.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 482 AQUATIC CHEMISTRY

Advanced treatment of the chemistry of natural waters.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 483 ATMOSPHERIC CHEMISTRY

Advanced treatment of the chemistry of the air environment. Gaseous inorganic and organic pollutants and their reactions. Photochemical smog chemistry.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 484 FATE OF POLLUTANTS IN THE ENVIRONMENT

Advanced treatment of the study of the fate of pollutants in air, water, and soil/sediment environments. Literature readings. Modeling.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 485 PRINCIPLES OF WATER QUALITY CONTROL

Standard methods of chemical analysis to determine the quality of water and wastewater.

Credit : 1 unit (1 hr lec)
Prerequisite(s) : None

CHEM 485.2 PRINCIPLES OF WATER QUALITY CONTROL LABORATORY

Laboratory experiments covering standard methods of chemical analysis to determine the quality of water and wastewater.

Credit : 2 units (6 hrs lab)
Corequisite(s) : Chem 385 (Principles of Water Quality Control)

CHEM 486 ADVANCED ENVIRONMENTAL CHEMICAL ANALYSIS

Sampling methods, extraction methods, method validation techniques, advanced instrumental analysis of environmental contaminants in air, water, soil and sediment environments.

Credit : 3 units (3 hrs lec)
Prerequisite(s) : None

CHEM 487.2 ADVANCED ENVIRONMENTAL CHEMICAL ANALYSIS LAB I

Advanced instrumental analysis of environmental contaminants in water and wastewater environments. Liquid-liquid extraction, liquid-solid extraction, closed-loop stripping, etc.

Credit : 2 units (6 hrs lab)
Prerequisite(s) : None

CHEM 488.2 ADVANCED ENVIRONMENTAL CHEMICAL ANALYSIS LAB II

Advanced instrumental analysis of environmental contaminants in air and soil/sediment environments. Supercritical fluid extraction, ultrasonic extraction, microwave extraction, etc.

Credit : 2 units (6 hrs lab)
Prerequisite(s) : None

CHEM 489 CURRENT TOPICS IN ENVIRONMENTAL CHEMISTRY
(*May be enrolled three times for a maximum of 3 units.)

Advances and current researches in environmental chemistry.

Credit : 1 unit (1 hr lec)
Prerequisite(s) : None

CHEM 590 Ph.D. THESIS PROPOSAL

An adviser-guided preparation and writing of the student's Ph.D. Thesis proposal. The output at the end of the semester should be a bound copy successfully defended before the student's Thesis Guidance Committee.

Credit : 3 units
Prerequisite(s) : None

CHEM 591 SEMINAR I

A journal paper seminar presentation of a research paper from recent issues of scientific journals.

Credit : 1 unit (1 hr lec)
Prerequisite(s) : None

CHEM 592 SEMINAR II

A journal paper seminar presentation of a research paper from recent issues of scientific journals in different areas being covered in Chem 591.

Credit : 1 unit (1 hr lec)
Prerequisite(s) : Chem 591

CHEM 593 SEMINAR III

A journal paper seminar presentation of a research paper from recent issues of scientific journals in different areas being covered in Chem 591 and Chem 592.

Credit : 1 unit (1 hr lec)
Prerequisite(s) : Chem 592

CHEM 594 SEMINAR IV

A journal paper seminar presentation of a research paper from recent issues of scientific journals in different areas being covered in Chem 591, Chem 592 and Chem 593.

Credit : 1 unit (1 hr lec)
Prerequisite(s) : Chem 593

CHEM 595 Ph.D. THESIS SEMINAR

Seminar presentation of the doctoral dissertation.

Credit : 1 unit (1 hr lec)
Prerequisite(s) : Chem 594

CHEM 598 DOCTORAL DIRECTED RESEARCH

An adviser-guided laboratory investigation of a research problem leading to the Ph.D. Thesis/Dissertation. Requires research proposal, experimentation, and final report as the outputs.

Credit : 0 unit (xth hrs lab)
Prerequisite(s) : Chem 590 (Ph.D. Thesis Proposal)

CHEM 599 Ph.D. THESIS

A scientific investigation of an original research problem. Requires at least one (1) publication of research in international journal (ISI journals) of whole or in part of the thesis.

Credit : 12 units (credit only, not actual course work)
Prerequisite(s) : Chem 590 (Ph.D. Thesis Proposal)
Chem 598 (Doctoral Directed Research)
Passing the Written Comprehensive Exam