

## **CHEMISTRY DEPARTMENT**

### **De La Salle University-Manila**

### **Doctor of Philosophy in Chemistry**

The Doctor of Philosophy in Chemistry Degree at De La Salle University is designed to provide advanced study and research in Chemistry. The program was initially offered in consortium with University of the Philippines in Diliman and Ateneo de Manila University. The Ph. D. degree in Chemistry is earned by those able to demonstrate breadth and depth of knowledge of the facts and theories of chemistry and the ability to conduct independent chemical research as evidenced by the acceptance of a doctoral dissertation.

#### **Admissions**

The applicant should comply with the graduate school admission requirements of DLSU. In addition, the applicant needs to pass qualifying examinations in five areas of Chemistry. Should the student fail in a qualifying examination, he/she should enroll in a refresher course in the specific area for credit. The student needs to obtain a minimum grade of 2.75 for the course to be credited.

#### **Program Requirements**

(as per revisions approved by Council of Deans, Term 3 AY 2003-2004)

|                          |                       |
|--------------------------|-----------------------|
| Course Work              | 18 units              |
| Seminar                  | 4 units               |
| Seminar (Candidacy Exam) | 1 candidacy exam      |
| Comprehensive Exam       | 4 comprehensive exams |
| Thesis Dissertation      | 12 units              |
| Total                    | 34 units              |

All PhD Chemistry students must have satisfactorily completed the chemistry core courses either during their master or doctoral studies. The five (5) chemistry core courses are graduate level: Organic Chemistry, Inorganic Chemistry Physical Chemistry, Biochemistry, and Analytical Chemistry. The minimum number of units for each course is 3 units.

#### **Seminar**

“The objectives of the graduate seminars are: to train the student to carry out independent research of the literature, to expose the student in various areas of Chemistry, and to train them in the oral delivery of a technical paper.” (CHED Technical Sub-Panel)

#### Seminar Guidelines and Policies:

Students must take four 1-unit courses of seminar, one course per term.

Seminar courses should be rotated among graduate faculty members, i.e. students should enroll in seminar courses with different faculty members (different fields) and not just his/her intended thesis adviser.

For a 1-unit seminar course, a student must give a presentation and attend a minimum of three seminars (inside or outside the university).

Graduate students enrolled in seminar courses must attend all seminars presented by fellow graduate students and those sponsored by the department.

Grading is numerical and 30% of the grade will come from the assessment of the faculty members who attended the presentation.

Each student will be required to have a seminar notebook where he/she lists and summarizes the contents of the seminars attended.

The student must submit a printed copy of his/her seminar/lecture to the department. The manuscript must follow the prescribed Chemistry journal format.

The seminar is a formal event which is open to the public. A student presenter must have a minimum number of attendees at the seminar (at least 4 faculty members, including the seminar instructor, and 6 students) to receive credit for his/her presentation.

Students giving the seminar must make all the necessary arrangements, e.g. invitations, advertisements, logistics, etc.

Students should give their seminar presentation anytime from the first to the twelfth week of the term. A seminar-ban week will be imposed on the last week of classes.

### **Comprehensive Examinations for PhD Students**

Of the four examinations, three are written exams on special topics (e.g. journal article, seminar topic) assigned by the graduate committee. The topics should be within the student's field of specialization.

The last is an oral examination on the student's main field (organic, analytical, inorganic or physical chemistry). A panel of three (3) faculty members will sit as examiners.

The College and university policies on retake of comprehensive examinations will be followed.

A generic section for team-teaching will be created to facilitate the payment of fees for the examiners.

### **Candidacy Examination**

A student must pass all of the four comprehensive examinations before taking the candidacy examination.

In the candidacy examination, a student must present a research proposal on a topic not related to his/her area of specialization.

The graduate school coordinator must assign a minimum of three panelists (which includes the student's intended thesis adviser) to examine the proposal and presentation.

The candidacy exam is a formal event open to the public.

Copies of the proposal should be submitted to the panelists at least one week before the intended date of presentation.

All arrangements (audiovisual, physical, etc.) should be made by the student.  
Grading will be PASS or FAIL.

A generic section for team-teaching will be created to facilitate the payment of fees for panelists.

### **Publication Requirement**

Students enrolled in the PhD Chemistry Program should be able to publish part of their dissertation in refereed and abstracted journal as a requirement for graduation.

### **Dissertation**

A student must pass all of the four comprehensive examinations before enrolling in thesis dissertation.

A student must pass the candidacy examination before defending his dissertation.

### **Dissertation Defense**

A student who wishes to defend his/her thesis must submit a copy of the thesis to the reader who is recommended by the adviser. The manuscript must be submitted at least four weeks before the intended defense date. The reader will eventually sit as the chairman of the thesis panel.

The reader will examine the manuscript and after two weeks will decide if enough material was covered in the study. He will then convene the defense panel composed of the chairman (himself) and four other members, one of which is an external reviewer.

After the defense, the panelists are encouraged to submit a summary sheet listing the corrections and major points for modification of the thesis write-up.

The panel shall consist of 3 members and must include an external examiner to be chosen by the adviser upon consultation with the concerned advisee. All members of the committee should have should have a PhD Chemistry degree.

### **Other Requirements for Dissertation**

The student is required to submit the following to be eligible for graduation:

A bound copy of the dissertation to the department

A bound and an electronic copy of the dissertation to the thesis adviser

A poster of the study

The student must have published at least one article (or have an accepted manuscript for publication)

### Grades

1. The minimum grade with credit is 2.5.
2. The College Graduate Council has agreed to implement the following grading schemes for non-regular subjects:

| Subject                  | Purpose                                      | Minimum Grade with Credit   |
|--------------------------|--|-----------------------------|
| Audit                    | Personal enrichment                          | AUDIT                       |
|                          | Requirement for retaking comprehensive exams | AUDIT                       |
| Enrichment/<br>Refresher | New admission                                | 1.0 (M.S./Ph.D.)            |
|                          | Re-admission                                 | { 2.0 (M.S.)<br>2.5 (Ph.D.) |

3. Students taking Directed Research are given a grade of AUDIT. Those taking Thesis/Dissertation are given a grade of 9.9 until the students complete all requirements.
4. As per department policy, no Incomplete grade is given for graduate courses.
5. The deadline for submission of GS grading sheets and course card distribution follows that of the undergraduates. Course cards may be distributed earlier but not later than the scheduled date. The COS-GSO will notify concerned faculty of his/her course card schedule.

### Directed Research

1. A graduate student who has enrolled and passed/completed all academic requirements may start work on his thesis provided he is enrolled in Directed Research. He may or may not have taken or passed the comprehensive examinations.
2. Students should enroll in Directed Research as an AUDIT class.
3. Directed Research will be offered every term and during summer. The course carries zero (0) units; however, the student will be asked to pay for three laboratory units. The student may enroll in this course for an unlimited number of times until he becomes eligible to enroll in thesis. The course will be on a tutorial basis with the research advisers as instructor.
4. A student enrolled in Directed Research/Thesis/Dissertation is required to obtain a Certificate of Research Enrolment from the Graduate School Office to be presented to the adviser to confirm his/her enrolment.
5. Directed Research can be funded by the Faculty Development Program only once.

### Research and Mentoring

1. Only those students with Certificate of Research Enrolment (Directed Research, Thesis, Dissertation) should be allowed to work in the laboratory or accommodated for research consultation. Mentors are requested to refer those without clearance to the COS-GSO.

2. As per CHED directive, members of a thesis/dissertation panel must include an external examiner to be chosen by the adviser upon consultation with the concerned advisee. This policy has been adopted in SY 1998-99 and is applicable to all students including those who already have defended their thesis proposals earlier than SY 1998-99.
3. Research advisers are reminded that application for proposal/final defense must be filed and completed two weeks before the scheduled date of defense.
4. Please note that students who are expected to defend their thesis/dissertation during the Summer Term but not before the 3<sup>rd</sup> Term deadline set by the Registrar's Office do not need to enroll in Thesis/Dissertation. However, they must enroll in Residency in order to gain campus access. If the defense is set after the 3<sup>rd</sup> Term deadline but before the Term 1 of the next SY, student must enroll in Thesis/Dissertation for the Summer Term.
5. As part of the degree requirements, students must submit a hard copy of the thesis or dissertation, an electronic copy (CD or floppy), a poster, and a manuscript in the style of Manila Journal of Science before the final grade is given.

### **Course Description**

#### Remedial English Course

#### **Advanced Technical Reading and Writing 1 (ENG501M)**

##### **3 units**

The first part of an intensive English academic reading and writing course, focuses on the review of basic reading and writing skills and their application in the preparation of short academic papers such as definitions and descriptions, and non-prose forms. It emphasizes the mastery of active reading strategies, the effective use of rhetorical and organizational features of academic writing, and proper documentation.

#### **Advanced Technical Reading and Writing 2 (ENG502M)**

##### **3 units**

The second part of the intensive English academic reading and writing course, focuses on the writing of data commentary and the various parts of a research report, with emphasis on the different rhetorical moves and the linguistic features that realize these moves. The course continues to emphasize the observance of integrity in writing and research.

#### Research Courses

#### **Directed Research without Laboratory (CHM901P)**

##### **0 unit**

The development of an original problem under the supervision of an adviser. The course is designed for students who are not yet eligible to enroll in the thesis course but who wish to start working in their research problem which does not entail laboratory work.

#### **Directed Research with Laboratory (CHM902P)**

##### **0 unit**

Development of an original research problem through laboratory experimentation under the supervision of an adviser. The course is designed for student who wish to start laboratory research work but are not yet eligible to enroll in the thesis course.

**Chemistry Dissertation (CHM976P-935P)**

**12 units**

Conduct of an original research under the supervision of a dissertation mentor.

**Seminar 1-6 (CHM931P-934P)**

**ELECTIVE COURSES**

**Advanced Analytical Techniques in Chemistry Lecture (CHM621P)**

A course dealing with the principles and instrumentation in spectroscopy, chromatography, mass spectrometry, hyphenated techniques, thermal analytic methods, and voltammetry.

3 units

**Advanced Analytical Techniques in Chemistry Laboratory (CHM622P)**

A laboratory course covering instrumental analytical applications of absorption and emission spectroscopy, chromatography, and voltametric methods in determining important physicochemical data.

1 unit

**Advanced Biochemistry (CHM683D)**

A study of the structure and function of biomolecules, biochemical pathways, and signal transduction.

3 units

**Advanced Physical Organic Chemistry (CHM745D)**

A course emphasizing the application of physical chemistry in the study of structure and reactivity of organic compounds as well as organic reaction mechanisms.

3 units

**Advanced Techniques in Biochemistry Laboratory (CHM782P)**

This course deals with the theory and application of modern biochemical techniques and instrumentation. Topics covered include the use chromatographic and electrophoretic techniques, and spectroscopy in the separation, characterization, analysis, and structural elucidation of biomolecules.

1 unit

**Biological Membranes/Molecular Basis of Selected Diseases (CHM785P)**

Part I focuses on the molecular principles to explain the structure, function, dynamics and bioenergetics of biological membranes. Part II deals with the molecular basis of selected diseases and drug therapy.

3 units

**Chemical Crystallography 1 (CHM777P)**

An introduction to x-ray diffraction processes of single crystals. The course includes crystallographic symmetry, x-ray principles, diffraction processes and collection and interpretation of x-ray data.

3 units

**Chemical Crystallography 2 (CHM779P)**

A course dealing with crystallographic computational techniques and devices and their application towards the solution of three-dimensional molecular structures.

3 units

**Chemical Kinetics (CHM763P)**

A course dealing with the study of rates of chemical reactions, their description, interpretations, and mechanisms. The course includes the principal theories of unimolecular and bimolecular processes, chain reactions, absolute reaction rate theory and its applications to chemical systems. Selected topics, such as heterogeneous kinetics, isotopic effects, flow systems, fast reaction techniques, may be covered.

3 units

**Chemical Thermodynamics (CHM761P)**

An extended study of principles of the thermodynamics laws and their application to chemical and related systems, real and ideal. The principles and applications of statistical thermodynamics are introduced.

3 units

**Chemistry of Carbohydrates (CHM809P)**

A study of the chemistry of carbohydrates from a predominantly structural and mechanistic approach. Carbohydrate metabolism will also be discussed.

3 units

**Chemistry of Enzymes (CHM891P)**

A course in biochemistry which discusses enzyme classification and nomenclature, 3-dimensional structure of enzymes, mechanics of catalysis and enzyme-substrates interaction.

3 units

**Chemistry of Heterocycles (CHM893P)**

A study of systematic heterocyclic chemistry with emphasis on 5- and 6- membered systems. Comparison with carbocyclic systems will be included.

3 units

**Chemistry of Lipids (CHM891P)**

A study of the chemistry of lipids, the relationships between structures and functions. Lipid metabolism will also be discussed.

3 units

**Chemistry of Natural Products (CHM747P)**

The study of structures and biogenesis of the different groups of secondary metabolites. It also includes spectroscopic methods applied to structure elucidation of secondary metabolites, the experimental techniques in detection, extraction and isolation of secondary metabolites, a discussion of the research directions in the chemistry of natural products research, and inorganic aspects of natural products.

3 units

**Chemistry of Nucleic Acids and Proteins (CHM783P)**

A study of the structures, functions and biosynthesis and metabolism of nucleic acids and proteins.  
3 units

**Chromatographic Methods Lecture (CHM723P)**

A study of the principles, instrumentation, application, and qualitative as well as quantitative interpretation of the physico-chemical data of liquid chromatographic methods (SLC, HPLC, IEC, GPC) and gas chromatographic methods (GSC, GLC). New methods such as supercritical fluid chromatography may also be included.  
2 units

**Chromatographic Methods Laboratory (CHM724P)**

A laboratory course on separation of mixtures by liquid and gas chromatographic methods.  
1 unit

**Coordination Chemistry (CHM703P)**

A course covering the structure and bonding of coordination compounds, their reactivities and mechanisms. Spectral, magnetic, and crystallographic data are used in the characterization of these compounds.  
3 units

**Electroanalytical Chemistry (CHM721D)**

A course covering fundamental concepts of analytical electrochemistry, methodology, and practical applications of electrochemical techniques, such as controlled-potential and controlled current methods, and spectroelectrochemistry, and introductory electronics.  
3 units

**Environmental Chemistry (CHM751D)**

A course dealing with the fundamentals of dynamic equilibria processes in the environment sources as well as the study on the nature and chemistry of pollutants, monitoring, and control of environmental pollution in air, land and water.  
3 units

**Enzymology (CHM783D)**

This course deals with enzyme structure and function, kinetics, mechanism, and regulation.  
3 units

**Food and Plant Biochemistry (CHM787P)**

Part I focuses on the molecular principles to explain the structure, function, dynamics and bioenergetics of biological membranes. Part II deals with the molecular basis of selected diseases and drug therapy.  
3 units

**Inorganic Synthesis Lecture (CHM701P)**

A course dealing with the analysis, strategy, and planning involved in the synthesis of inorganic compounds, particularly coordination compounds.

2 units

**Inorganic Synthesis Laboratory (CHM702P)**

A laboratory course accompanying the inorganic synthesis lecture. Laboratory experiments on the synthesis of inorganic compounds such as metal carbonyls, transition metal complexes, metalloarenes are included. Techniques of monitoring of reaction, proper handling of sensitive materials, determining correct reaction set-ups, as well as characterization of inorganic products are emphasized.

2 units

Co-requisite : CHM701M

**Marine Natural Products (CHM893P)**

A phyletic survey of the natural products isolated from the marine environment, with chemical ecology and chemotaxonomy implications and biosynthetic considerations.

3 units

**Medicinal Chemistry (CHM805P)**

The study of structure, synthesis, mechanism of action and biosynthesis of medicinal agents such as cardiovascular agents, central nervous system stimulants and depressants, anesthetics, antiallergenics, analgesics, and hormones.

3 units

**Nanoscience (CHM755M)**

Deals with chemistry of nanoparticles and its applications.

3 units

**Molecular Biochemistry (CHM781P)**

Recent trends in biochemistry and molecular biology

3 units

**Optical Methods of Analysis (CHM727P)**

A study on optical instrumentation and the principles and applications of spectrography and spectrophotometry.

3 units

**Organic Reactions and Mechanisms (CHM643P)**

An intensive review of selected organic chemical reactions and mechanisms emphasizing the experimental approach.

3 units

**Organic Reactions Laboratory (CHM644P)**

A laboratory course covering the application of concepts and theories discussed in organic synthesis lecture. Techniques such as monitoring of reactions, proper handling of toxic and air sensitive compounds, and determining correct reaction set-up are also included.

2 units

**Organic Synthesis Lecture (CHM741P)**

A course dealing with the analysis, strategy, and planning of multi-step organic synthesis, including the application of protecting groups and metal catalysts, the choice of proper reagents, and reaction conditions.

3 units

**Physical Biochemistry (CHM789P)**

This 3-unit course focuses on the basic principles of quantitative and physical biochemistry. Topics include acid-base balance, bioenergetics, enzyme catalysis, and techniques used to determine the structure of biomolecules

3 units

**Polymer Chemistry (CHM807P)**

This course tackles topics on the physicochemical properties of polymers which include the molecular weight, morphology, bulk, solubility, elasticity and thermal transitions. It looks into the mechanisms and kinetics of polymerization process as well as copolymerization.

3 units

**Physical Inorganic Chemistry (CHM705P)**

General principles of spectroscopic analysis and characterization of inorganic compounds. Group Theory is utilized.

3 units

**Quantum Chemistry 1 (CHM661P)**

A study of the postulates of quantum mechanics as applied to simple systems and hydrogen-like systems. The course includes group theory and discussions of selected approximation methods for many electron systems.

3 units

**Quantum Chemistry 2 (CHM765P)**

A course dealing with approximation methods for chemical systems and a study of time dependent processes.

3 units

**Special Topics in Analytical Chemistry (CHM721P)**

Study of the recent trends in analytical chemistry

3 units

**Special Topics in Analytical Chemistry (CHM813P)**

Study of the recent trends in analytical chemistry

3 units

**Special Topics in Biochemistry (CHM819P)**

Study of the recent trends in biochemistry

3 units

**Special Topics in Inorganic Chemistry (CHM811P)**

Study of the recent trends in inorganic chemistry

3 units

**Special Topics in Inorganic Chemistry (CHM815P)**

Study of the recent trends in inorganic chemistry

3 units

**Special Topics in Physical Chemistry (CHM817P)**

Study of the recent trends in physical chemistry

3 units

**Spectroscopic Methods in Organic Chemistry (CHM743P)**

**3 units**

A course dealing with the application of spectroscopic techniques (UV-Vis, IR, MS, NMR) in the structure of elucidation of organic compounds. Two dimensional NMR techniques are emphasized.

**Stereochemistry (CHM745P)**

**3 units**

A course on control elements in organic synthesis. Topics include regioselectivity, stereoselectivity, asymmetric induction/catalysis, and Woodward-Hoffman rules.

**Structural Concepts in Inorganic Chemistry (CHM603P)**

This course introduces the quantitative basis of group theory and the use of symmetry in chemistry. It includes the chemical applications of group theory in areas such as spectroscopy and bonding. It also deals with atomic theory, structure and symmetry, bonding theories, acid-base chemistry and chemical forces in inorganic compounds. Coordination compounds, organometallics, cage/cluster compounds, and bio-organic systems are likewise presented from the viewpoint of their structure and bonding.

3 units