



## **B.S. - M.S. IN CHEMISTRY STRAIGHT PROGRAM**

### **Introduction**

The B.S.-M.S. in Chemistry Straight Program is intended for exceptional undergraduate B.S. Chemistry students who are highly qualified to go into the M.S. Program. By going into the Straight Program, the number of years spent to get the M.S. degree (after the B.S. degree) is decreased, thereby producing M.S. graduates earlier, which is an advantage both to the student in particular and to the country in general. By graduating earlier, less government funds are spent, and earlier service to the country is rendered by the M.S. in Chemistry degree holder.

This is a “rider” program, which follows the latest approved B.S. in Chemistry Program and latest approved M.S. in Chemistry Program, and thus makes use of existing resources.

### **Objectives**

1. To produce M.S. in Chemistry graduates from highly exceptional undergraduate B.S. in Chemistry students in a relatively shorter time.
2. To increase the absolute and relative numbers of highly trained manpower in chemistry research especially for the Mindanao and Visayas regions.
3. To upgrade college and university chemistry teaching in content and in methodology.
4. To provide chemical industries with highly trained manpower in chemistry to man analytical and quality control laboratories.

### **Admission Requirements**

1. Must have taken all the course requirements of the latest approved B.S. in Chemistry Program up to the Fourth Year Level except the following:

Seminar II (Chem 192 B) .....	1 unit
Cognates .....	8 units
	(in Proposed Revised B.S. Chemistry Curriculum)
Thesis (Chem 199) .....	3 units
2. Must have an overall GPA of 2.00 or better (for all courses taken) at the end of the Third Year level.
3. Must take a qualifying examination in the four areas of Chemistry namely: Analytical, Inorganic, Organic, and Physical Chemistry. Qualifying examinations are rated as either “Q” (Qualified), “P” (Passed), or “D” (Deficient). Qualifying exams will be given as scheduled by the department.

To qualify for the straight program requires a rating of at least “Q” in two areas with at least “P” in the other 2 areas. A student who obtains only “P” ratings in the four areas (with no “Q”s) will have to go through the

regular B.S. program. Upon completion of the B.S., the student can apply for admission into the regular M.S. program.

Upon being qualified, the student, with his adviser, prepares his program of study for approval by the Chemistry Graduate Committee. He should now register for graduate thesis, instead of undergraduate thesis, and graduate courses, instead of the cognates. In case he opts not to finish the M.S. requirements, he applies for substitution of courses to credit his graduate courses for the B.S. Chemistry Degree.

### **Degree Requirements**

To qualify for the B.S. in Chemistry degree together with the MS in Chemistry degree through the B.S.-M.S. Straight Program, a student must comply with the following requirements:

1. Undergraduate Courses: Must have successfully completed all the course requirements of the latest approved B.S. in Chemistry Program up to the Fourth Year level, except Chem 192B (Seminar II, 1 unit), Cognates (8 units), and Chem 199 (Undergraduate Research, 3 units).
2. Graduate Courses: Must have successfully completed at least 36 units of the course work (including 6 units of M.S. Thesis) specified in his/her program of study.
3. GPA: Must have an overall Grade Point Average Grade of 2.0 or better after each semester, for all graduate courses taken. A student who fails to satisfy this requirement may be put on probation in the following semester upon recommendation of the Chemistry Graduate Committee. Failure to maintain the required GPA after the probation period of one semester shall automatically disqualify the student from the program.
4. Comprehensive Examination: Must have passed a comprehensive examination in her/his chosen area of specialization.
5. Defense: Must have successfully defended his/her M.S. Thesis.

**MASTER OF SCIENCE IN CHEMISTRY (MS 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		
Eng 1	College English I	3	3	0	3	None	None
Hist 1	Philippine History	3	3	0	3	None	None
Psych 1	Introduction to Psychology	3	3	0	3	None	None
Math 2	College Algebra	3	3	0	3	Department's Consent	None
Fil 1	Sining ng Komunikasyon	3	3	0	3	None	None
Chem 15	General Chemistry I	3	3	0	3	None	Math 2 or Math 17 & Chem 15.2
Chem 15.2	General Chemistry Lab I	2	0	6	6	None	Math 2 or Math 17 & Chem 15
PE 1	Physical Fitness and Health	2	0	2	2	None	None
NSTP 1	National Service Training Program I	(3)	0	3	3	None	None
<b>Total</b>		<b>22(25)</b>	<b>18</b>	<b>11</b>	<b>29</b>		

**First Year, Second Semester**

Course No.	Course Title	Units	Hrs/Wk			Pre-requisite(s)	Co-requisite(s)
			Lec	Lab	Total		
Eng 2	College English II	3	3	0	3	Eng 1	None
Eng 3	Oral Communication	3	3	0	3	None	None
Math 15	College Trigonometry	3	3	0	3	Math 2	None
Fil 2	Pagsulat at Pagbasa sa iba't-ibang Disiplina	3	3	0	3	Fil 1	None
Bio 1	Basic Biology	3	2	2	5	None	None
Chem 16	General Chemistry II	3	3	0	3	Chem 15 & 15.2 and Math 2 or Math 17	Chem 16.2 and Math 15 or Math 17
Chem 16.2	General Chemistry Lab II	2	0	6	6	None	Chem 16
PE 2	Martial Arts/Dance	2	0	2	2	PE 1	None
NSTP 2	National Service Training Program II	(3)	0	3	3	None	None
<b>Total</b>		<b>22(25)</b>	<b>17</b>	<b>15</b>	<b>32</b>		

### Second Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Pre-requisite(s)	Co-requisite(s)
			Lec	Lab	Total		
Hist 3	History of the Muslim Filipinos and the Indigenous Peoples of MINSUPALA	3	3	0	3	None	None
Pol Sci 2	Philippine Government and Constitution, Agrarian Reform and Taxation, Family Planning and Population Education	3	3	0	3	None	None
Math 51	Analytic Geometry and Calculus I	6	6	0	6	Math 15 or Math 17	None
Phys 21	General Physics I	3	3	0	3	Math 15 or Math 17	Math 51
Phys 21.1	Laboratory Physics I	1	0	3	3	None	None
Chem 35	Organic Chemistry I	3	3	0	3	Chem 16 & 16.2	Chem 35.2
Chem 35.2	Organic Chemistry Lab I	2	0	6	6	None	Chem 35
PE 3	Individual and Dual Sports	2	0	2	2	PE 1	None
<b>Total</b>		<b>23</b>	<b>18</b>	<b>11</b>	<b>29</b>		

### Second Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Pre-requisite(s)	Co-requisite(s)
			Lec	Lab	Total		
Math 61	Analytic Geometry and Calculus II	6	6	0	6	Math 51	None
Phys 31	General Physics II	3	3	0	3	Phys 21	Math 61
Phys 31.1	Laboratory Physics II	1	0	3	3	None	None
Chem 36	Organic Chemistry II	3	3	0	3	Chem 35 & 35.2	Chem 36.2
Chem 36.2	Organic Chem Lab II	2	0	6	6	None	Chem 36
Chem 28	Quantitative Analytical Chemistry	3	3	0	3	Chem 16 & 16.2	Chem 28.2
Chem 28.2	Quantitative Analytical Chemistry Lab	2	0	6	6	None	Chem 28
PE 4	Team Sports	2	0	2	2	PE 1	None
<b>Total</b>		<b>22</b>	<b>15</b>	<b>17</b>	<b>32</b>		

### Third Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Pre-requisite(s)	Co-requisite(s)
			Lec	Lab	Total		
Math 71	Analytic Geometry and Calculus III	6	6	0	6	Math 61	None
Phys 41	General Physics III	3	3	0	3	Phys 21	Math 71
Phys 41.1	Laboratory Physics III	1	0	3	3	None	None
Chem 45	Elementary Biochemistry	3	3	0	3	Chem 32 & 35.2 or Chem 36	Chem 45.2
Chem 45.2	Elementary Biochemistry Lab	2	0	6	6	None	Chem 45.2
Chem 73	Physical Chemistry I	3	3	0	3	Chem 28 & 28.2, Math 61, Phys 31	None
Chem 123	Spectrochemical Methods of Analysis	2	2	0	2	Chem 28, 28.2 and Chem 36 & 36.2	Chem 123.1
Chem 123.1	Spectrochemical Methods of Analysis Lab	1	0	3	3	None	Chem 123
<b>Total</b>		<b>22</b>	<b>17</b>	<b>12</b>	<b>29</b>		

### Third Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Pre-requisite(s)	Co-requisite(s)
			Lec	Lab	Total		
CSc 101	Introduction to computer Programming	3	2	3	5	Math 17 or its equivalent	None
Chem 151	Inorganic Chemistry	3	3	0	3	Chem 35 & 35.2 and Chem 73	None
Elective	Laboratory Physics III	3	3	0	3	As required by specific course	As required by specific course
Chem 74	Physical Chemistry II	3	3	0	3	Chem 73	None
Cognate		3	0	3	3	As required by specific course	As required by specific course
Chem 73.2	Physical Chemistry Lab I	2	0	6	6	Chem 73	None
Chem 128	Separation and Chromatographic Methods	2	2	0	2	Chem 28, 28.2 and Chem 35 & 35.2	Chem 128.1
Chem 128.1	Separation and Chromatographic Methods Lab	1	0	3	3	None	Chem 128
Chem 198	Methods of Chemistry Research	1	1	0	1	Chem 36&36.2, Chem 73&73.2, Chem 123&123.1, and Chem 128&128.1	None
<b>Total</b>		<b>21</b>	<b>17</b>	<b>12</b>	<b>29</b>		

#### Fourth Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Pre-requisite(s)	Co-requisite(s)
			Lec	Lab	Total		
Philo 2	Argumentation in Contemporary Society	3	3	0	3	None	None
Chem 181	Environmental Chemistry	2	2	0	2	Chem 31&31.1 or Chem 35&35.2	None
Chem 196A	Chemistry Seminar I	1	1	0	1	Chem 45&45.2, Chem 73&73.2 and Chem 123&123.1	None
Chem 74.2	Physical Chemistry Lab II	2	0	6	6	Chem 74	None
Hist 5	Life and Works of Rizal	3	3	0	3	None	None
Eng 4	Introduction to Literature	3	3	0	3	Eng 2	None
Elective		1	1	0	1	As required by specific course	As required by specific course
<b>Total</b>		<b>15</b>	<b>13</b>	<b>16</b>	<b>19</b>		

#### Fourth Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Pre-requisite(s)	Co-requisite(s)
			Lec	Lab	Total		
Chem 220/ 220N	Spectrochemical Methods of Analysis	3	3	0	3	None	None
Chem 230	Organic Reactions and Mechanisms	3	3	0	3	None	None
Chem 250	Inorganic Structures and Reaction Mechanisms	3	3	0	3	None	None
Chem 270 /272	Chemical Thermodynamics/ Chemical Kinetics	3	3	0	3	None	None
<b>Total</b>		<b>12</b>	<b>12</b>	<b>0</b>	<b>12</b>		

#### Fourth Year, Summer

Course No.	Course Title	Units	Hrs/Wk			Pre-requisite(s)	Co-requisite(s)
			Lec	Lab	Total		
Chem 221.2	Instrumental Methods of Analysis	2	0	6	6	Chem 220 or CGC's approval	None
Cognate 1	Elective on the field of specialization	3	3	0	3	9 units core courses and CGC's approval	None
	Written Comprehensive Examination					14 units core courses, GPA of 2.00 w/ no INC	
<b>Total</b>		<b>5</b>	<b>3</b>	<b>6</b>	<b>9</b>		

### Fifth Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Pre-requisite(s)	Co-requisite(s)
			Lec	Lab	Total		
Cognate 2	Elective on the field of specialization	3	3	0	3	9 units core courses or CGC's approval	None
Cognate 3	Elective on the field of specialization	3	3	0	3	9 units core courses or CGC's approval	None
Cognate 4	Elective on the field of specialization	3	3	0	3	9 units core courses and CGC's approval	None
Cognate 5	Elective on the field of specialization	3	3	0	3		
Chem 291	Seminar I	1	1	0	1	9 units core courses or CGC's approval	None
<b>Total</b>		<b>12</b>	<b>12</b>	<b>0</b>	<b>12</b>		

### Fifth Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Pre-requisite(s)	Co-requisite(s)
			Lec	Lab	Total		
Chem 299	MS Thesis	2	0	0	2	Passed the Comprehensive Exam	None
<b>Total</b>		<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>		

### Fifth Year, Summer

Course No.	Course Title	Units	Hrs/Wk			Pre-requisite(s)	Co-requisite(s)
			Lec	Lab	Total		
Chem 299	MS Thesis	2	0	0	2	Passed the Comprehensive Exam	None
<b>Total</b>		<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>		

### Sixth Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Pre-requisite(s)	Co-requisite(s)
			Lec	Lab	Total		
Chem 292	Thesis Seminar	1	0	0	1	None	Chem 299
Chem 299	MS Thesis	2	0	0	2	Passed the Comprehensive Exam	None
<b>Total</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>		

## CATALOGUE OF COURSES

### CHEM 220/220N SPECTROCHEMICAL METHODS OF ANALYSIS

Spectroscopic methods, theory, structure elucidation and analysis.

Credit : 3 units (3 hrs lec)  
Prerequisite(s) : Chemistry Graduate Committee's (CGC's) Approval

### CHEM 221.2 INSTRUMENTAL METHODS OF ANALYSIS

Laboratory work in instrumental methods of analysis.

Credit : 2 units ( 6 hrs lab)  
Prerequisite(s) : Chem 220 (Spectrochemical Methods of Analysis)  
or CGC's Approval

### CHEM 230 ORGANIC REACTIONS AND MECHANISMS

Study of structure including stereochemistry, reactivity, and reaction mechanisms of organic compounds.

Credit : 3 units (3 hrs lec)  
Prerequisite(s) : CGC's Approval

### CHEM 250 INORGANIC STRUCTURES AND REACTION MECHANISMS

Structural concepts and reaction mechanisms of inorganic compounds and transition metal ions.

Credit : 3 units (3 hrs lec)  
Prerequisite(s) : CGC's Approval

### CHEM 270 CHEMICAL THERMODYNAMICS

Theory and applications of classical thermodynamics.

Credit : 3 units (3 hrs lec)  
Prerequisite(s) : CGC's Approval

### CHEM 272 CHEMICAL KINETICS

Principles of kinetics, transport processes, reaction kinetics, theories of reaction rates.

Credit : 3 units (3 hrs lec)  
Prerequisite(s) : CGC's Approval

### CHEM 275 QUANTUM CHEMISTRY

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

Credit : 3 unit (3 hrs lec)  
Prerequisite(s) : CGC's Approval

CHEM 291 SEMINAR I

A seminar presentation of a research paper from current library scientific journals in any area of specialization.

Credit : 1 unit (1hr lec)  
Prerequisite(s) : 9 units of core courses

CHEM 292 THESIS SEMINAR

Presentation of the Thesis in a seminar.

Credit : 1 unit (1 hr lec)  
Corequisite(s) : Chem 299 (M. S. Thesis)

CHEM 299 M.S. THESIS

May be enrolled three times at 2 units each time. A grade of "passed" or "failed" will be given only after the student has enrolled 6 units of M. S. Thesis. A student receives a grade of "in Progress" for satisfactory performance each term the M. S. Thesis is enrolled until defunded.

Credit : 6 units (12 hrs lab)  
Prerequisite(s) : CGC's Approval

**CHEMISTRY COGNATES**

**ANALYTICAL CHEMISTRY**

CHEM 431/331 ELECTROANALYTICAL CHEMISTRY

Theory and analytical applications of electrochemistry.

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

CHEM 432/332 CHROMATOGRAPHIC METHODS OF ANALYSIS

Principles and applications of chromatographic methods of analysis.

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

CHEM 434/334 RADIOCHEMICAL METHODS OF ANALYSIS

Theory and analytical application of radiochemistry.

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

CHEM 429/329 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 hrs lec)  
Prerequisite(s) : None

## ORGANIC CHEMISTRY-BIOCHEMISTRY

### CHEM 431/331 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 432/332 POLYMER CHEMISTRY

Reactions, reaction mechanisms and synthesis of polymers.

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

### CHEM 433/333 PHOTOCHEMISTRY

Theory of photochemistry and photoreactions.

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

### CHEM 434/334 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 435/335 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 439/339 CURRENT TOPICS IN ORGANIC CHEMISTRY\*

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

Advances and current researches in organic chemistry.

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

### CHEM 440/340 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 442/342 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 443/343 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 444/344 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 449/349 CURRENT TOPICS IN BIOCHEMISTRY\*

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

Advances and current researches in biochemistry.

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

### **INORGANIC CHEMISTRY**

#### CHEM 451/351 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 452/352 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 453/353 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 454/354 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 455/355 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 459/359 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 hrs lec)  
Prerequisite(s) : None

### PHYSICAL CHEMISTRY

#### CHEM 471/371 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 473/373 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 475/375 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 476/376 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 477/377 STATISTICAL THERMODYNAMICS

Ensembles, partition functions, application to thermodynamics.

Credit : 3 units (3 hrs lec)

Prerequisite(s) : None

CHEM 479/379 CURRENT TOPICS IN PHYSICAL CHEMISTRY\*

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

Advances and current researches in physical chemistry.

Credit : 3 units (3 hrs lec)

Prerequisite(s) : None

**ALLIED CHEMISTRY**

CHEM 481/381 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 482/382 AQUATIC CHEMISTRY

Advanced treatment of the chemistry of natural waters.

Credit : 3 units (3 hrs lec)

Prerequisite(s) : None

CHEM 483/383 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 484/384 FATES 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 485/385 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

Corequisite(s) : Chem 485.2 (Principles of Water Quality Control Laboratory)

CHEM 485.2/385.2 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)  
Prerequisite(s) : None  
Corequisite(s) : Chem 485 (Principles of Water Quality Control)

CHEM 486/386 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 487.2/387.2 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 488.2/388.2 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 489/389 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