MAJOR IN CHEMISTRY - SECONDARY EDUCATION CONCENTRATION

Chemistry majors in the Secondary Education Concentration are eligible, upon graduation, to apply for certification to teach chemistry for grades 7-12 in the State of Maryland.

In the Chemistry Secondary Education Concentration, students must complete required units in content courses, Towson UTeach courses, and Core Curriculum courses.

Teacher Candidacy Standards for Teacher Education

The Teacher Education Executive Board, representing all initial teacher education programs at Towson University, utilizes the following **minimum** requirements as conditions for admission into teacher education programs, maintaining candidate status and formal entry into the capstone internship. Programs may include additional requirements for admission into the program and/or the capstone internship.

The College of Education admits students either as freshmen or as undergraduate transfer students from accredited, post-secondary institutions. During the freshman and sophomore years, students are generally engaged in pre-professional courses or courses that fulfill Core Curriculum requirements, as well as all identified prerequisites (e.g., specific and sequential courses in Core Curriculum) for admission to COE screened majors and programs.

All College of Education undergraduate programs are screened majors. As an integral part of the teaching/learning experience, students work with advisers in a strategic planning process across all years at TU. Accordingly, to support student success, all COE students are required to confer prior to registration each term with their assigned advisers.

I. PROCEDURES AND REQUIREMENTS FOR ADMISSION TO ALL TEACHER EDUCATION PROGRAMS

1. Complete a self-disclosure criminal background form to be submitted to the major department with the application.
2. Submit an application for formal admission to the program. Students seeking admission to teacher education programs must contact their department chairperson or program coordinator by 45 credit hours for program-specific procedures and requirements for admission to professional education programs.
3. A cumulative/overall GPA of 3.00 or higher is required for admission to an initial licensure teacher education program.

    i. Applicants with a GPA between 2.50 - 2.99 may be admitted conditionally if they provide evidence of passing scores on a Basic Skills Assessment* as identified by the Maryland State Department of Education (i.e. SAT, ACT, GRE, Praxis Core) and receive approval from the department chairperson/program coordinator.

    **Candidates may apply for a test waiver directly to the department. Such waivers should only be granted if it is predicted, based on the individual candidate's transcript data, that the candidate's final cumulative/overall GPA will be above a 3.00.*

II. REQUIREMENTS FOR MAINTAINING CANDIDATE STATUS

A. Maintain a semester GPA of 3.00 in required education courses for all programs.
    i. At the department's discretion, candidates who do not meet the above GPA requirement may continue for one additional semester under probationary status, but must meet the 3.00 GPA requirement at the end of the probationary period. If the GPA requirement is not met at the end of the probationary period, the candidate would be dismissed from the program.
B. Obtain a grade of C or better in academic major course work applicable only in programs requiring an academic major. (Middle School; Secondary; Art, Dance, Health, Music, World Languages, Physical Education).
C. Exhibit behavior that is consistent with the University's Code of Student Conduct, the Educator Preparation Program's Professional Behavior Policy, and established professional practice in educational and clinical settings. (see COE Behavior Policy)

III. PROCEDURES AND REQUIREMENTS FOR ENTRY INTO CAPSTONE INTERNSHIP FOR ALL PROFESSIONAL EDUCATION PROGRAMS.

A. Complete a criminal background check as required by the school system in which the internship is located.
B. Complete all required course work.

The Standards were revised and approved in February 1996, May 1998, February 2000, May 2007, May 2008, April 2009, December 2011, November 2012, February 2014, October 2014, February 2015, November 2015, May 2019, February 2020, and March 2021.

Requirements

Minimum requirements for admission into teacher education programs, maintaining candidate status and formal entry into the capstone internship are outlined on the Standards for Teacher Education page in the Undergraduate Catalog.

Code	Title	Units
Required Chemistry Courses		
CHEM 131 & 131L	GENERAL CHEMISTRY I LECTURE and GENERAL CHEMISTRY I LABORATORY	4
CHEM 132 & 132L	GENERAL CHEMISTRY II LECTURE and GENERAL CHEMISTRY II LABORATORY	4
CHEM 220 & 220L	ANALYTICAL CHEMISTRY [LECTURE] and ANALYTICAL CHEMISTRY [LAB]	5
CHEM 323	INORGANIC CHEMISTRY	4
or CHEM 351	BIOCHEMISTRY	
CHEM 334 & CHEM 336 & CHEM 337 & CHEM 339	ORGANIC CHEMISTRY I [LECTURE] and INTRODUCTORY ORGANIC CHEMISTRY LABORATORY and ORGANIC CHEMISTRY II [LECTURE] and INTERMEDIATE ORGANIC CHEMISTRY LABORATORY	10
CHEM 345	PRINCIPLES OF PHYSICAL CHEMISTRY	3
CHEM 372	PHYSICAL CHEMISTRY LABORATORY	2
CHEM 401	COMMUNICATION SKILLS IN CHEMISTRY	1

Electives		**4**
Select minimum 4 units from the following:		
CHEM 310	INSTRUMENTAL ANALYSIS	
CHEM 323	INORGANIC CHEMISTRY [1]	
CHEM 346	THEORETICAL FOUNDATIONS OF PHYSICAL CHEMISTRY [2]	
CHEM 351	BIOCHEMISTRY [1]	
CHEM 356	BIOCHEMISTRY LAB	
CHEM 357	ADVANCED BIOCHEMISTRY	
CHEM 391	SPECIAL PROBLEMS IN CHEMISTRY I	
CHEM 395	INTERNSHIP IN CHEMISTRY	
CHEM 461	ADVANCED LECTURE TOPICS	
CHEM 462	ADVANCED LABORATORY TECHNIQUES	
CHEM 472	APPLICATIONS OF ENVIRONMENTAL CHEMISTRY	
CHEM 480	CHEMICAL TOXICOLOGY	
CHEM 491	RESEARCH IN CHEMISTRY	
FRSC 363	CHEMISTRY OF DANGEROUS DRUGS	
FRSC 367	FORENSIC CHEMISTRY	
Additional Science and Mathematics Courses		
GEOL 121	PHYSICAL GEOLOGY	4
or ASTR 161	THE SKY AND THE SOLAR SYSTEM	
BIOL 191 & 191L	INTRODUCTORY BIOLOGY FOR HEALTH PROFESSIONS [LECTURE] and INTRODUCTORY BIOLOGY FOR HEALTH PROFESSIONS [LAB]	4
or BIOL 200 & 200L	BIOLOGY I: INTRODUCTION TO CELLULAR BIOLOGY AND GENETICS [LECTURE] and BIOLOGY I: INTRODUCTION TO CELLULAR BIOLOGY AND GENETICS [LAB]	
MATH 211	CALCULUS FOR APPLICATIONS	3
or MATH 273	CALCULUS I	
PHYS 211 & PHYS 212	GENERAL PHYSICS I; NON CALCULUS-BASED and GENERAL PHYSICS II; NON CALCULUS-BASED	8
or PHYS 241 & PHYS 242	GENERAL PHYSICS I CALCULUS-BASED and GENERAL PHYSICS II CALCULUS-BASED	
SCIE 380	TEACHING SCIENCE IN THE SECONDARY SCHOOLS	3
Total Units		**59**

[1] Course cannot be counted as both part of the required courses and part of the electives.

[2] Course has prerequisites not listed among the required courses.

Towson UTeach Course Requirements

Code	Title	Units
SEMS 110 & SEMS 120	INTRODUCTION TO STEM TEACHING I: INQUIRY APPROACHES TO TEACHING and INTRODUCTION TO STEM TEACHING II: INQUIRY-BASED LESSON DESIGN [1]	2
or SEMS 130	INTRODUCTION TO STEM TEACHING I & II COMBINED	
SEMS 230	KNOWING AND LEARNING	3
Foundation Courses		
SEMS 240		3
SEMS 250	PERSPECTIVES IN SCIENCE AND MATHEMATICS	3
SEMS 260	DIVERSITY AND DIFFERENCE IN THE STEM CLASSROOM	3
Requirements Open to Formally Admitted Students		
SCED 460	USING LITERACY IN THE SECONDARY SCHOOLS	3
SCED 461	TEACHING LITERACY IN THE SECONDARY CONTENT AREAS	3
SEMS 370	PROJECT-BASED INSTRUCTION	3
SEMS 430	SEMINAR IN APPRENTICE TEACHING	1
SEMS 498	INTERNSHIP IN MATHEMATICS AND SCIENCE SECONDARY EDUCATION	3
SCIE 393	INTERNSHIP IN SECONDARY EDUCATION-SCIENCE	12
Total Units		**39**

[1] Permission of Towson UTeach Department required to take SEMS 130.

For further information, contact Sonali Raje (Science Complex Room 5301 D, 410-704-4622; sraje@towson.edu.)

Students who decide not to complete all Towson UTeach Science requirements must complete all the requirements of the Chemistry major in order to graduate.

Four-Year Plan of Study

Sample Four-Year Plan

The selected course sequence below is an example of the simplest path to degree completion. Based on course schedules, student needs, and student choice, individual plans may vary. Students should consult with their adviser to make the most appropriate elective choices and to ensure that they have completed the required number of units (120) to graduate.

Freshman

Term 1	Units	Term 2	Units
CHEM 131 & 131L (Core 7)	4	Select one of the following:	4
GEOL 121 or ASTR 161 (Core 8)	4	BIOL 191 & 191L	
MATH 211 or 273 (Core 3)	3-4	BIOL 200 & 200L	
SEMS 110	1	CHEM 132 & 132L (Core 8)	4
Core 1 (or Core 2)	3	SEMS 120	1
		Core 2 (or Core 1)	3
		Core 4	3
	15-16		**15**

Sophomore

Term 1	Units	Term 2	Units
CHEM 220 & 220L	5	CHEM 336	2
CHEM 334	3	CHEM 337	3
PHYS 211 or 241	4	PHYS 212 or 242	4

SEMS 230	3	SEMS 240	3
		Core 6	3
	15		**15**

Junior

Term 1	**Units**	**Term 2**	**Units**
CHEM 323 or 351	3-4	CHEM Elective	4
CHEM 339	2	CHEM 345	3
SCED 460	3	SCED 461	3
SEMS 250 (Core 5)	3	SEMS 370	3
SEMS 260 (Core 13)	3	Core 11	3
Core 10	3		
	17-18		**16**

Senior

Term 1	**Units**	**Term 2**	**Units**
CHEM 372	2	SCIE 393	12
CHEM 401	1	SEMS 430	1
SCIE 380	3		
SEMS 498	3		
Core 9	3		
Core 12	3		
Core 14	3		
	18		**13**

Total Units 124-126

Learning Outcomes

NSTA Standard 1: Content Knowledge

Effective teachers of science understand and articulate the knowledge and practices of contemporary science. They interrelate and interpret important concepts, ideas, and applications in their fields of licensure. Below are the elements of the standard.
Pre-service teachers will:
1a) Understand the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association.
1b) Understand the central concepts of the supporting disciplines and the supporting role of science-specific technology.
1c) Show an understanding of state and national curriculum standards and their impact on the content knowledge necessary for teaching P-12 students.

NSTA Standard 2: Content Pedagogy

Effective teachers of science understand how students learn and develop scientific knowledge. Pre-service teachers use scientific inquiry to develop this knowledge for all students.Below are the elements of the standard.
Pre-service teachers will:
2a) Plan multiple lessons using a variety of inquiry approaches that demonstrate their knowledge and understanding of how all students learn science.
2b) Include active inquiry lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, relationships and natural patterns from empirical experiences. Applications of science-specific technology are included in the lessons when appropriate.
2c) Design instruction and assessment strategies that confront and address nave concepts/preconceptions.
Assessment: This Standard is usually met using Assessment 3 - Unit Plan.

NSTA Standard 3: Learning Environments

Effective teachers of science are able to plan for engaging all students in science learning by setting appropriate goals that are consistent with knowledge of how students learn science and are aligned with state and national standards. The plans reflect the nature and social context of science, inquiry, and appropriate safety considerations. Candidates design and select learning activities, instructional settings, and resources--including science-specific technology, to achieve those goals; and they plan fair and equitable assessment strategies to evaluate if the learning goals are met. Below are the elements of the standard.
Pre-service teachers will:
3a) Use a variety of strategies that demonstrate the candidates knowledge and understanding of how to select the appropriate teaching and learning activities including laboratory or field settings and applicable instruments and/or technology- to allow access so that all students learn. These strategies are inclusive and motivating for all students.
3b) Develop lesson plans that include active inquiry lessons where students collect and interpret data using applicable science-specific technology in order to develop concepts, understand scientific processes, relationships and natural patterns from empirical experiences. These plans provide for equitable achievement of science literacy for all students.
3c) Plan fair and equitable assessment strategies to analyze student learning and to evaluate if the learning goals are met. Assessment strategies are designed to continuously evaluate preconceptions and ideas that students hold and the understandings that students have formulated.
3d) Plan a learning environment and learning experiences for all students that demonstrate chemical safety, safety procedures, and the ethical treatment of living organisms within their licensure area.
Assessment:

NSTA Standard 4: Safety

Effective teachers of science can, in a P-12 classroom setting, demonstrate and maintain chemical safety, safety procedures, and the ethical treatment of living organisms needed in the P-12 science classroom appropriate to their area of licensure. Below are the elements of the standard.
Pre-service teachers will:
4a) Design activities in a P-12 classroom that demonstrate the safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials used within their subject area science instruction.
4b) Design and demonstrate activities in a P-12 classroom that demonstrate an ability to implement emergency procedures and the maintenance of safety equipment, policies and procedures that comply with established state and/or national guidelines. Candidates ensure safe science activities appropriate for the abilities of all students.
4c) Design and demonstrate activities in a P-12 classroom that demonstrate ethical decision-making with respect to the treatment of all living organisms in and out of the classroom. They emphasize safe, humane, and ethical treatment of animals and comply with the legal restrictions on the collection, keeping, and use of living organisms.

NSTA Standard 5: Impact on Student Learning

Effective teachers of science provide evidence to show that P-12 students understanding of major science concepts, principles, theories,

and laws have changed as a result of instruction by the candidate and that student knowledge is at a level of understanding beyond memorization. Candidates provide evidence for the diversity of students they teach. Below are the elements of the standard.
Pre-service teachers will:
5a) Collect, organize, analyze, and reflect on diagnostic, formative and summative evidence of a change in mental functioning demonstrating that scientific knowledge is gained and/or corrected.
5b) Provide data to show that P-12 students are able to distinguish science from non-science, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in
5c) Engage students in developmentally appropriate inquiries that require them to develop concepts and relationships from their observations, data, and inferences in a scientific manner.

NSTA Standard 6: Professional Knowledge and Skills

Effective teachers of science strive continuously to improve their knowledge and understanding of the ever changing knowledge base of both content, and science pedagogy, including approaches for addressing inequities and inclusion for all students in science. They identify with and conduct themselves as part of the science education community. Below are the elements of the standard.
Pre-service teachers will:
6a) Engage in professional development opportunities in their content field such as talks, symposiums, research opportunities, or projects within their community.
6b) Engage in professional development opportunities such as conferences, research opportunities, or projects within their community.