

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.

The Chemistry Secondary Education Concentration requires 126 units for completion. Students in this concentration must complete 96 required units in content and Towson UTeach courses and 30 units in Core Curriculum courses not satisfied by the major, earning a grade equivalent of 2.00 or higher in each course.

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

- Complete a self-disclosure criminal background form to be submitted to the major department with the application.
- 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.
- A cumulative/overall GPA of 3.00 or higher is required for admission to an initial licensure teacher education program.
 - 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

- Maintain a semester GPA of 3.00 in required education courses for all programs.
 - 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.
- 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).
- 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.

- Complete a criminal background check as required by the school system in which the internship is located.
- 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.

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 or CHEM 351 | INORGANIC CHEMISTRY or BIOCHEMISTRY I | 4 |
| CHEM 331 & CHEM 332 | ORGANIC CHEMISTRY I and ORGANIC CHEMISTRY II | 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 I ¹ | |
| CHEM 356 | BIOCHEMISTRY LAB | |
| CHEM 357 | BIOCHEMISTRY II | |
| 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 |
|--|---|-------|
| Introductory Towson UTeach Courses | | |
| Students must complete either | | |
| SEMS 110 & SEMS 120 | INTRODUCTION TO STEM TEACHING I: INQUIRY APPROACHES TO TEACHING and INTRODUCTION TO STEM TEACHING II: INQUIRY-BASED LESSON DESIGN | 2 |
| or SEMS 130 | INTRODUCTION TO STEM TEACHING I & II COMBINED | |
| *Permission of Towson UTeach Department required to take SEMS 130. | | |
| Towson UTeach Courses | | |

| | | |
|----------|---|---|
| SEMS 230 | KNOWING AND LEARNING | 3 |
| SEMS 240 | CLASSROOMS INTERACTIONS | 3 |
| SEMS 250 | PERSPECTIVES IN SCIENCE AND MATHEMATICS | 3 |
| SEMS 370 | PROJECT-BASED INSTRUCTION | 3 |
| SEMS 498 | INTERNSHIP IN MATHEMATICS AND SCIENCE SECONDARY EDUCATION | 3 |
| SCED 460 | USING LITERACY IN THE SECONDARY SCHOOLS | 4 |
| SCED 461 | TEACHING LITERACY IN THE SECONDARY CONTENT AREAS | 3 |

Towson UTeach Courses - Science

| | | |
|--------------------|---|-----------|
| SCIE 393 | INTERNSHIP IN SECONDARY EDUCATION-SCIENCE | 12 |
| SEMS 430 | SEMINAR IN APPRENTICE TEACHING | 1 |
| Total Units | | 37 |

For further information, contact Sonali Rajee (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.

Suggested Four-Year Plan

Based on course availability and student needs and preferences, the selected sequences will probably vary from those presented below. Students should consult with their adviser to make the most appropriate elective choices.

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 332 | 5 |
| CHEM 331 | | 5 PHYS 212 or 242 | 4 |
| PHYS 211 or 241 | | 4 SEMS 240 | 3 |
| SEMS 230 | | 3 Core 6 | 3 |
| | | | 17 |
| 15 | | | 15 |

Junior

| Term 1 | Units | Term 2 | Units |
|-------------------|-------|-----------------|-------|
| CHEM 323 or 351 | | 4 CHEM Elective | 4 |
| SEMS 250 (Core 5) | | 3 CHEM 345 | 3 |

| | | |
|---------------|---------------------|--------------|
| SCED 460 | 4 SCED 461 | 3 |
| Core 10 | 3 SEMS 370 | 3 |
| Core 11 | 3 Core 13 | 3 |
| 17 | | 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 126-127

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:

- 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.
- Understand the central concepts of the supporting disciplines and the supporting role of science-specific technology.
- 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:

- Plan multiple lessons using a variety of inquiry approaches that demonstrate their knowledge and understanding of how all students learn science.
- 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.
- Design instruction and assessment strategies that confront and address naive 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:

- 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.
 - 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.
 - 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.
 - 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:

- 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.
- 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.
- 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:

- 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.
- 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
- 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.