

Bachelor of Science in Chemistry (ACS Certified Program)

Required 120 credits (36 of which must be numbered 300 or above and 30 of which must be from UND) including:

I. Essential Studies Requirements (see University ES guidelines and course listings.)

II. The Following Curriculum:

Students may choose one of the ACS tracks listed below. The student must complete the requirements for:

- 1. Introductory Courses:** Orientation to Chemistry (CHEM 101) and either Fundamentals of Chemistry Concepts and Lab (CHEM 221 and CHEM 221L) OR the combination of General Chemistry I and II with Labs (CHEM 121, CHEM 121L, CHEM 122, and CHEM 122L)
- 2. Foundational Courses:** 5 one-semester courses at least three credits each. One class in each area of Chemistry: Analytical, Biochemistry, Inorganic, Organic, Physical
- 3. In-Depth Courses:** Four courses that add up to at least 12 credits. For a course to be considered in-depth, it must have a Foundational Course pre-requisite.
- 4. Research and Capstone:** Students must complete Senior Research (CHEM 494) and a capstone, typically Chemistry Capstone (CHEM 495). A capstone from another department may be considered.

ACS Tracks

Each of the ACS track options listed below requires the following Introductory Courses:

Introductory courses:

Code	Title	Credits
CHEM 101	Orientation to Chemistry ¹	1
CHEM 221 & 221L	Fundamentals of Chemistry - Concepts and Fundamentals of Chemistry Laboratory ^{2,3}	4
or CHEM 121 & 121L & CHEM 122 & CHEM 122L	General Chemistry I and General Chemistry I Laboratory and General Chemistry II and General Chemistry II Laboratory	

¹ CHEM 101 may be waived for transfer students or students who add or change their major to Chemistry beyond their first year.

² The combination of Chem 121, Chem 121L, Chem 122 and Chem 122L OR Chem 221 and Chem 221L are pre-requisites for Chem 254 and Chem 254L.

³ Chem 121 is 3 credits, Chem 121L is 1 credit. Chem 122 is 3 credits, Chem 122L is 1 credit.

Biochemistry Track

Code	Title	Credits
Foundational Courses		
CHEM 254 & 254L	Inorganic Chemistry I and Inorganic Chemistry I Laboratory	4
CHEM 333 & 333L	Analytical Chemistry and Analytical Chemistry Laboratory	4
CHEM 341 & 341L & CHEM 361	Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I	5

CHEM 466	Fundamentals of Physical and Biophysical Chemistry	3
CHEM 466L	Fundamentals of Physical and Biophysical Chemistry Laboratory	1
BIMD 301	Biochemistry	3
In-Depth Courses		
CHEM 342 & 342L & CHEM 362	Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II	5
CHEM 441	Instrumental Analysis I - Spectroscopy	2
CHEM 442 or CHEM 443	Instrumental Analysis II - Electrochemistry or Instrumental Analysis III - Chromatography/Mass Spectrometry	2
BIOL 341 & 341L	Cell Biology and Cell Biol Lab	4
BIMD 401	Advanced Biochemistry	3
Required Research and Capstone		
CHEM 494 or BIMD 494	Senior Research or Directed Studies	1-3
CHEM 495	Chemistry Capstone	3
Suggested Electives:		
CHEM 370	Drug Chemistry and Toxicology	3
CHEM 294	Introduction to Undergraduate Research	1-3
CHEM 455	Spectroscopy and Structure	3
CHEM 475	Materials Chemistry	3
BIOL 315	Genetics	3
BIOL 369 & 369L	Histology and Histology Lab	4
BIOL 364 & 364L	Parasitology and Parasitology Laboratory	4
N&D 441	Nutritional Biochemistry	4
Math, Physics, and Biology Requirements		
MATH 146 or MATH 165	Applied Calculus I or Calculus I	3
SOC 326 or MATH 166	Sociological Statistics or Calculus II	3
PHYS 211 or PHYS 251	College Physics I or University Physics I	4
PHYS 212 or PHYS 252	College Physics II or University Physics II	4
BIOL 150 & 150L	General Biology I and General Biology I Laboratory	4
BIOL 151 & 151L	General Biology II and General Biology II Laboratory	4

Biological Track

Code	Title	Credits
Foundational Courses:		
CHEM 254 & 254L	Inorganic Chemistry I and Inorganic Chemistry I Laboratory	4
CHEM 333 & 333L	Analytical Chemistry and Analytical Chemistry Laboratory	4
CHEM 466	Fundamentals of Physical and Biophysical Chemistry	3
CHEM 466L	Fundamentals of Physical and Biophysical Chemistry Laboratory	1
BIMD 301	Biochemistry	3
Organic Chemistry Options (Choose 1 option below)		
CHEM 340 & 340L	Survey of Organic Chemistry and Survey of Organic Chemistry Laboratory	5
OR		

CHEM 341 & 341L & CHEM 361 AND	Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I	5
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CHEM 342 & 342L & CHEM 362	Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II ²	5
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In-Depth Courses

BIOL 341 & 341L	Cell Biology and Cell Biol Lab	4
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CHEM 366	Polymers and the Environment	3
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CHEM 370	Drug Chemistry and Toxicology	3
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CHEM 401	Nanotechnology Nanomaterials	3
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CHEM 455	Spectroscopy and Structure	3
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Required Research and Capstone

CHEM 494 or BIMD 494	Senior Research Directed Studies	2-3
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CHEM 495	Chemistry Capstone	3
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Choose at least 4 credits from the following courses:

CHEM 294	Introduction to Undergraduate Research	1-3
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CHEM 441	Instrumental Analysis I - Spectroscopy	2
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CHEM 442	Instrumental Analysis II - Electrochemistry	2
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CHEM 443	Instrumental Analysis III - Chromatography/Mass Spectrometry	2
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Math, Physics, and Biology Requirements:

MATH 146 or MATH 165	Applied Calculus I Calculus I	3
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SOC 326 or MATH 166	Sociological Statistics Calculus II	3
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PHYS 211 or PHYS 251	College Physics I University Physics I	4
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PHYS 212 or PHYS 252	College Physics II University Physics II	4
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BIOL 150 & 150L	General Biology I and General Biology I Laboratory	4
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BIOL 151 & 151L	General Biology II and General Biology II Laboratory	4
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Suggested Electives:

BIOL 315	Genetics	3
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BIOL 369 & 369L	Histology and Histology Lab	4
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BIOL 364 & 364L	Parasitology and Parasitology Laboratory	4
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Chemical Engineering Track

This track will allow students to meet the requirements for a dual major with a B.S. in Chemical Engineering and a B.S. in Chemistry.

Code	Title	Credits
CHE Requirements		
CHE 102	Introduction to Chemical Engineering	2
CHE 103	Computing Tools for Chemical Engineers	3
CHE 201	Chemical Engineering Fundamentals	3
CHE 206	Unit Operations in Chemical Engineering	3
CHE 232	Chemical Engineering Laboratory I	2
CHE 301	Introduction to Transport Phenomena	4
CHE 303	Chemical Engineering Thermodynamics	4
CHE 305	Separations	3
CHE 315	Engineering Statistics and Design of Experiments	3
CHE 321	Chemical Engineering Reactor Design	3
CHE 331	Chemical Engineering Laboratory II	2
CHE 332	Chemical Engineering Laboratory III	2

CHE 403	Molecular Thermodynamics and Kinetics	3
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CHE 408	Process Dynamics and Control	3
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CHE 411	Plant Design I: Process Design and Economics	4
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CHE 412	Plant Design II: Process Project Engineering	5
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CHE 416	Chemical Product Design	3
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CHE 431	Chemical Engineering Laboratory IV	3
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CHEM Requirements

CHEM 221 & 221L	Fundamentals of Chemistry - Concepts and Fundamentals of Chemistry Laboratory	4
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CHEM 254 & 254L	Inorganic Chemistry I and Inorganic Chemistry I Laboratory	4
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BIMD 301	Biochemistry	3
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CHEM 333 & 333L	Analytical Chemistry and Analytical Chemistry Laboratory	4
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Organic Chemistry (5 - 8 credits)

CHEM 340 & 340L	Survey of Organic Chemistry and Survey of Organic Chemistry Laboratory	5 (340/L)
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or

8 (341/L)

&

342/L

or CHEM 341 & 341L & CHEM 342 & CHEM 342L

CHEM 470	Thermodynamics Kinetics	3
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Requirements from Other Departments

ENGL 110	College Composition I	3
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ENGL 130	Composition II: Writing for Public Audiences	3
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ENGR 206	Fundamentals of Electrical Engineering	3
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ENGR 340	Professional Integrity in Engineering	3
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LEAD 101	Learning Leadership	3
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MATH 165	Calculus I	4
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MATH 166	Calculus II	4
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MATH 265	Calculus III	4
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MATH 266	Elementary Differential Equations	3
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PHYS 251	University Physics I	4
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PHYS 252	University Physics II	4
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Suggested Material Science Electives (3 credits)

CHEM 475	Materials Chemistry	3
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CHEM 401	Nanotechnology Nanomaterials	3
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Suggested Advanced Chemical Sciences Electives (6 - 9 credits)

CHEM 471 & 471R	Quantum Mechanics Spectroscopy and Quantum Mechanics Spectroscopy Recitation	4
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CHEM 454 & 454L	Inorganic Chemistry II and Inorganic Chemistry II Laboratory	4
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CHE 525	Polymer Engineering	3
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Computational Track

Code	Title	Credits
Foundational Courses		
CHEM 254 & 254L	Inorganic Chemistry I and Inorganic Chemistry I Laboratory	4
CHEM 333 & 333L	Analytical Chemistry and Analytical Chemistry Laboratory	4
CHEM 470 & 470R	Thermodynamics Kinetics and Thermodynamics Kinetics Recitation	4
BIMD 301	Biochemistry	3

Organic Chemistry Options (Choose 1 option below)

CHEM 340 & 340L	Survey of Organic Chemistry and Survey of Organic Chemistry Laboratory	5	CHEM 443	Instrumental Analysis III - Chromatography/Mass Spectrometry	2
OR			or CHEM 402 & CHEM 294	Trends in Forensic and Environmental Analytical Chemistry and Introduction to Undergraduate Research	
CHEM 341 & 341L & CHEM 361	Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I	5	Required Research and Capstone		
AND			CHEM 494	Senior Research (lab research credits from other department can be considered)	3
CHEM 342 & 342L & CHEM 362	Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II	5	CHEM 495	Chemistry Capstone	3
In-Depth Courses			Math and Physics Requirements:		
CHEM 401	Nanotechnology Nanomaterials	3	MATH 146	Applied Calculus I	3
CHEM 441	Instrumental Analysis I - Spectroscopy	2	or MATH 165	Calculus I	
CHEM 442	Instrumental Analysis II - Electrochemistry	2	SOC 326	Sociological Statistics	3
CHEM 454 & 454L	Inorganic Chemistry II and Inorganic Chemistry II Laboratory	4	or MATH 166	Calculus II	
CHEM 455	Spectroscopy and Structure	3	PHYS 211	College Physics I	4
CHEM 470L	Physical Chemistry Laboratory	1	or PHYS 251	University Physics I	
CHEM 471 & 471R	Quantum Mechanics Spectroscopy and Quantum Mechanics Spectroscopy Recitation	4	PHYS 212	College Physics II	4
			or PHYS 252	University Physics II	
Required Research and Capstone			Choose at least 9 credits from the following courses as electives		
CHEM 494	Senior Research	2-3	COMM 360	Communicating Science	3
CHEM 495	Chemistry Capstone	3	ENRV 100	Environmental Studies Seminar	1
Math and Physics Requirements:			ENRV 122	Foundations of Environmental Science	3
MATH 165	Calculus I	4	ESSP 200	Sustainability Science	3
MATH 166	Calculus II	4	GEOG 274	Introduction to Geospatial Technologies	3
PHYS 251	University Physics I	4	GEOG 454	Conservation and Sustainable Use of Natural Resources	3
PHYS 252	University Physics II	4	GEOE 419	Groundwater Monitoring and Remediation	3
Suggested Electives:			GEOL 101	Introduction to Geology	3
CSCI 242	Algorithms and Data Structures	3	GEOL 103	Introduction to Environmental Issues	3
CSCI 270	Programming for Data Science	3			

Environmental Track

Code	Title	Credits
Foundational Courses		
CHEM 254 & 254L	Inorganic Chemistry I and Inorganic Chemistry I Laboratory	4
CHEM 333 & 333L	Analytical Chemistry and Analytical Chemistry Laboratory	4
CHEM 466	Fundamentals of Physical and Biophysical Chemistry	3
CHEM 466L	Fundamentals of Physical and Biophysical Chemistry Laboratory	1
BIMD 301	Biochemistry	3
Organic Chemistry Options (Choose 1 option below)		
CHEM 340 & 340L	Survey of Organic Chemistry and Survey of Organic Chemistry Laboratory	5
OR		
CHEM 341 & 341L & CHEM 361	Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I	5
AND		
CHEM 342 & 342L & CHEM 362	Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II	5
In Depth Courses: Choice of 12 credits from the following courses. Must include 44x series, up to 2 credits of 44x can be replaced by (1-2) research credits completed in CHEM 294.		
CHEM 366	Polymers and the Environment	3
CHEM 370	Drug Chemistry and Toxicology	3
CHEM 294	Introduction to Undergraduate Research	1-3
CHEM 441	Instrumental Analysis I - Spectroscopy	2
CHEM 442	Instrumental Analysis II - Electrochemistry	2

Physical Science Track

Code	Title	Credits
Foundational Courses		
CHEM 254 & 254L	Inorganic Chemistry I and Inorganic Chemistry I Laboratory	4
CHEM 333 & 333L	Analytical Chemistry and Analytical Chemistry Laboratory	4
CHEM 341 & 341L & CHEM 361	Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I	5
CHEM 470 & 470R	Thermodynamics Kinetics and Thermodynamics Kinetics Recitation	4
BIMD 301	Biochemistry	3
In-Depth Courses		
CHEM 342 & 342L & CHEM 362	Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II	5
CHEM 454 & 454L	Inorganic Chemistry II and Inorganic Chemistry II Laboratory	4
CHEM 470L	Physical Chemistry Laboratory	1
CHEM 471 & 471R	Quantum Mechanics Spectroscopy and Quantum Mechanics Spectroscopy Recitation	4
Required Research and Capstone		
CHEM 494	Senior Research	1-3
CHEM 495	Chemistry Capstone	3
Choose two courses (four total credits) of the following in the 44x series:		
CHEM 441	Instrumental Analysis I - Spectroscopy	2
CHEM 442	Instrumental Analysis II - Electrochemistry	2
CHEM 443	Instrumental Analysis III - Chromatography/Mass Spectrometry	2
Suggested Electives		
CHEM 401	Nanotechnology Nanomaterials	3

CHEM 475	Materials Chemistry	3
Math and Physics Requirements:		
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 251	University Physics I	4
PHYS 252	University Physics II	4
Suggested Electives:		
PHYS 253	University Physics III	4
GEOL 316	Earth Materials	3
GEOL 218 & 218L	Mineralogy and Mineralogy Lab	3

Materials Science Track

Code	Title	Credits
Foundational Courses		
CHEM 254 & 254L	Inorganic Chemistry I and Inorganic Chemistry I Laboratory	4
CHEM 333 & 333L	Analytical Chemistry and Analytical Chemistry Laboratory	4
CHEM 341 & 341L & CHEM 361	Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I	5
CHEM 466	Fundamentals of Physical and Biophysical Chemistry	3
CHEM 466L	Fundamentals of Physical and Biophysical Chemistry Laboratory	1
BIMD 301	Biochemistry	3
In-Depth Courses		
CHEM 342 & 342L & CHEM 362	Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II	5
CHEM 366	Polymers and the Environment	3
CHEM 370	Drug Chemistry and Toxicology	3
CHEM 401	Nanotechnology Nanomaterials	3
CHEM 454 & 454L	Inorganic Chemistry II and Inorganic Chemistry II Laboratory	4
CHEM 455	Spectroscopy and Structure	3
CHEM 475	Materials Chemistry	3
Required Research and Capstone		
CHEM 494	Senior Research	2-3
CHEM 495	Chemistry Capstone	3
Suggested Electives: Choose at least one from below		
CHEM 441	Instrumental Analysis I - Spectroscopy	2
CHEM 442	Instrumental Analysis II - Electrochemistry	2
CHEM 294	Introduction to Undergraduate Research	1-3
Math and Physics Requirements:		
MATH 146 or MATH 165	Applied Calculus I / Calculus I	3
SOC 326 or MATH 166	Sociological Statistics / Calculus II	3
PHYS 211 or PHYS 251	College Physics I / University Physics I	4
PHYS 212 or PHYS 252	College Physics II / University Physics II	4

Research-Focused Track

This track is intended to prepare students for all foundational areas in chemistry and is highly recommended for those who consider graduate school in chemistry.

Code	Title	Credits
Foundational Courses		
CHEM 254 & 254L	Inorganic Chemistry I and Inorganic Chemistry I Laboratory	4
CHEM 333 & 333L	Analytical Chemistry and Analytical Chemistry Laboratory	4
CHEM 341 & 341L & CHEM 361	Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I	5
CHEM 470 & 470R	Thermodynamics Kinetics and Thermodynamics Kinetics Recitation	4
BIMD 301	Biochemistry	3
In-Depth Courses		
CHEM 342 & 342L & CHEM 362	Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II	5
CHEM 441	Instrumental Analysis I - Spectroscopy	2
CHEM 442	Instrumental Analysis II - Electrochemistry	2
CHEM 443	Instrumental Analysis III - Chromatography/Mass Spectrometry	2
CHEM 454 & 454L	Inorganic Chemistry II and Inorganic Chemistry II Laboratory	4
CHEM 470L	Physical Chemistry Laboratory	1
CHEM 471 & 471R	Quantum Mechanics Spectroscopy and Quantum Mechanics Spectroscopy Recitation	4
Required Research and Capstone		
CHEM 494	Senior Research	1-3
CHEM 495	Chemistry Capstone	3
Suggested Electives:		
CHEM 475	Materials Chemistry	3
CHEM 455	Spectroscopy and Structure	3
CHEM 401	Nanotechnology Nanomaterials	3
BIMD 401	Advanced Biochemistry	3
Math and Physics Requirements		
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 251	University Physics I	4
PHYS 252	University Physics II	4

Teacher Licensure

Through a partnership with the College of Education and Human Development, the Department of Teaching, Leadership & Professional Practice, students may seek secondary licensure in Chemistry. The following program of study must be completed:

I. Chemistry Coursework

1. Chemistry Courses required for a Chemistry degree (B.S. Chemistry or B.S. Chemistry-ACS).
2. Essential studies coursework.

II. Admission to the Secondary Program i.e., completion of preadmission courses. See College of Education and Human Development for admission and licensing requirements (<https://catalog.und.edu/undergraduateacademicinformation/departmentalcoursesprograms/teachingandlearning/tl-bsed-se/>). Including courses:
T&L 250 Introduction to Education
T&L 251 Understanding Individuals with Different Abilities

III. The program in Secondary Education (see Department of Teaching, Leadership & Professional Practice (<https://und-public.courseleaf.com/undergraduateacademicinformation/departmentalcoursesprograms/teachingandlearning/tl-bsed-se/>))

Chemistry majors seeking secondary licensure must have an advisor in both the Chemistry Department and the Department of Teaching, Leadership & Professional Practice.