

# Department of Chemistry

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The Department of Chemistry has as its objectives preparation and training in both scientific principles and skills for chemists seeking industrial or governmental employment; students planning graduate study in the sciences or advanced professional courses of study in medicine or engineering; science teachers in public or private schools; and for students wishing to meet institutional requirements in chemistry.

Programs in the department lead to the Bachelor of Science degree with majors or concentrations in Professional Chemistry, Chemistry, or Science. The Professional Chemistry Program does not require a minor, and the other programs require a minor of at least 18 semester hours. Minors are also offered in Chemistry and Science. In addition, pre-professional programs for cytotechnology, dentistry, dental hygiene, health information management, medicine, medical technology, nuclear medicine technology, occupational therapy, pharmacy, physical therapy, and radiation therapy technology are offered under the Health Sciences concentration.

Environmental Science and Technology is an interdisciplinary major and minor offered by Agribusiness and Agriscience, Biology, Chemistry, and Engineering Technology and Industrial Studies. A complete description of the program can be found under the Department of Engineering Technology and Industrial Studies.

A grade of C or better is required on all transfer credits accepted as part of a major or minor in the Department of Chemistry. Students must have a grade point average of at least 2.00 on courses counting toward a major or minor in any of the department's programs. No more than 8 hours of 1000-level chemistry, 8 hours of 1000-level biology, or 8 hours of 2000-level physics courses may count toward a Chemistry or Science major or minor. No 1000-level physics course may count toward a Science major or minor.

Laboratory safety is of primary importance in the Department of Chemistry. Students are required to follow **all** laboratory safety rules, a statement of which will be

provided to all students at the first laboratory period. **Approved safety goggles must be worn at all times while in the laboratory.** Failure to comply with any of the laboratory rules may result in the student's removal from the laboratory for that laboratory period. Continued violation of safety rules can result in the withdrawal of the student from the course.

**Curricular listings include General Education requirements in Communication, History, Humanities and/or Fine Arts, Mathematics, Natural Sciences, and Social/Behavioral Sciences categories as outlined on pages 64–67.**

## Major in Chemistry, Professional Concentration

The Professional Chemistry concentration in the Chemistry major, approved by the American Chemical Society, consists of 48 semester hours in chemistry including CHEM 1110, 1120, 2230, 3010, 3020, 3530 or 4500, 4230, 4350, 4360, 4400, 4410, and 4430, plus at least 4 hours (including one hour of laboratory) from CHEM 4100, 4700/4780, 4730, 4000, 4510/4530, 4880, 4600, or 4610; mathematics through MATH 1920; MATH 3110 or PHYS 3150; PHYS 2010, 2011, 2020, 2021 (or 2110, 2111, 2120, 2121); BIOL 1110, 1120; at least 3 hours of computer science approved by advisor; and fulfillment of University General Education requirements. A minimum of 12 upper-division hours in the Chemistry major must be taken at MTSU. No minor is required for this major.

### Recommended Sequence

FRESHMAN		SOPHOMORE	
CHEM 1110 (Nat Sci)	4	CHEM 2230, 3010, 3020	13
CHEM 1120	4	PHYS 2010/2011, 2020/2021	8
MATH 1730 (Math)	4	MATH 1920	4
MATH 1910	4	ENGL 2020 or 2030 or	
BIOL 1110 (Nat Sci)	4	HUM 2610 (Hum/FA)	3
BIOL 1120	4	CSCI (approved by advisor)	3
ENGL 1010, 1020 (Comm)	6		<b>31</b>
	<b>30</b>		
JUNIOR		SENIOR	
CHEM 4400, 4350, 4360, (3530 or 4500)	14	CHEM 4230, 4410, 4430	9
COMM 2200 (Comm)	3	CHEM concentration	
HIST 2010, 2020, or 2030	6	upper-division electives	4
MATH 3110 or PHYS 3150	4	Humanities and/or Fine Arts	3
Humanities and/or Fine Arts	3	Social/Behavioral Sciences (2 prefixes)	6
	<b>30</b>	Electives	4
		Upper-division elective	3
			<b>29</b>

## Major in Chemistry

The Chemistry major consists of 36 semester hours in chemistry including CHEM 1110, 1120, 2230, 3010, 3020, 4330, 4340 (or 4350, 4360), and at least 7 hours from among the upper-division electives: CHEM (3530 or 4500), 3880, 4000, 4100, (4230 or 4630), 4400, 4510, 4530, 4600, 4610, 4700, 4780, 4880 and PSCI 4080. Also required are MATH 1910; PHYS 2010, 2011, 2020, 2021; BIOL 1110, 1120; and fulfillment of University General Education requirements. A minimum of 12 upper-division hours in the Chemistry major must be taken at MTSU.

**NOTE:** Students who wish to get jobs as chemists are strongly encouraged to take additional upper-division courses, especially CHEM 4630, follow the plan for the professional major, or take more advanced chemistry courses upon graduation. The Chemistry major requires one minor of at least 18 hours. Students who plan to graduate with no more than 120 hours should consult their advisors to be sure 42 upper-division hours are included in their curriculum.

### Recommended Sequence

FRESHMAN		SOPHOMORE	
CHEM 1110 (Nat Sci)	4	CHEM 2230, 3010, 3020	13
CHEM 1120	4	PHYS 2010/2011, 2020/2021	8
MATH 1730 (Math)	4	Minor	3
MATH 1910	4	ENGL 2020 or 2030 or	
BIOL 1110 (Nat Sci)	4	HUM 2610 (Hum/FA)	3
BIOL 1120	4	Upper-Division Elective	3
ENGL 1010, 1020 (Comm)	6		<b>30</b>
	<b>30</b>		

JUNIOR		SENIOR	
CHEM 4330, 4340	8	CHEM concentration	
COMM 2200 (Comm)	3	upper-division electives	7
HIST 2010, 2020, or 2030	6	Humanities and/or Fine Arts	3
Minor	10	Social/Behavioral Sciences	
Humanities and/or Fine Arts	3	(2 prefixes)	6
	<b>30</b>	Minor	5
		Upper-division electives	9
			<b>30</b>

## Minor in Chemistry

The minor in Chemistry consists of 19 semester hours of chemistry, including CHEM 1110 and 1120 with a maximum of 8 hours in freshman-level chemistry. At least four upper-division hours must be taken at MTSU.

## Teacher Licensure in Chemistry (7-12)

Students seeking a license to teach chemistry in secondary schools (grades 7-12) must complete (1) a major in Chemistry, (2) a minor in Secondary Education, and (3) a course (PSCI 1030) in addition to the General Education requirements.

### Secondary Education Minor Requirements

Students must contact their Secondary Education minor advisors for approval of appropriate courses.

**NOTE:** See Department of Educational Leadership on page 201 for Secondary Education minor requirements.

## Teacher Licensure in Interdisciplinary Studies (K-6)

Students may become licensed to teach in grades K-6 including science by following the Interdisciplinary Studies major. The science and math courses required are PSCI 1030 and 4030; BIOL 1030 and 3000; and MATH (1010 or 1710), 1410, 1420, and 4010. See other requirements for majors in the Elementary and Special Education Department section.

## Major in Science

The major in Science has two concentrations—General Science and Health Science. A minimum of 9 semester hours of upper-division courses in either concentration of the Science major must be taken at MTSU. The Science major requires only one minor which must include at least 3 semester hours at the upper-division level taken at MTSU.

### Concentration: General Science

The General Science concentration is a broad-based science degree requiring 19 semester hours acceptable for a minor in each of two fields selected from biology, chemistry, and physics plus 8 semester hours from the third field. Each student should work closely with his/her advisor in completing the program for the General Science concentration.

### Recommended Sequence

FRESHMAN		SOPHOMORE	
CHEM 1110 (Nat Sci)	4	Science major electives	8
CHEM 1120	4	PHYS 2010/2011, 2020/2021	8
MATH 1730 (Math)	4	Electives/Minor	11
BIOL 1110 (Nat Sci)	4	ENGL 2020 or 2030 or	
BIOL 1120	4	HUM 2610 (Hum/FA)	3
ENGL 1010, 1020 (Comm)	6		<b>30</b>
Elective/Minor	4		
	<b>30</b>		

JUNIOR		SENIOR	
Science major electives	8	Science major electives	6
COMM 2200 (Comm)	3	Humanities and/or Fine Arts	3
HIST 2010, 2020, or 2030	6	Electives/Minor	15
Electives/Minor	10	Social/Behavioral Sciences	
Humanities and/or Fine Arts	3	(2 prefixes)	6
	<b>30</b>		<b>30</b>

## Teacher Licensure in Science (7-12)

Students may become licensed to teach biology, chemistry, or physics in secondary schools (grades 7-12) by completing (1) a major in science with a General Science concentration in which biology, chemistry, or physics is, respectively, one of the 19-hour disciplines chosen; (2) courses in addition to the General Education requirements (see advisor); and (3) a minor in Secondary Education.

Students may also become licensed to teach biology, chemistry, or physics by majoring in the subject they intend to teach (see requirements listed under the specific major).

**Recommended Sequence****FRESHMAN**

CHEM 1110 (Nat Sci)	4
CHEM 1120	4
MATH 1730 (Math)	4
BIOL 1110 (Nat Sci)	4
BIOL 1120	4
ENGL 1010, 1020 (Comm)	6
Elective/Sec. Ed. Minor	4
<b>30</b>	

**JUNIOR**

Science major electives	8
COMM 2200 (Comm)	3
HIST 2010, 2020, or 2030	6
Electives/Sec. Ed. Minor	10
Humanities and/or Fine Arts	3
<b>30</b>	

**SOPHOMORE**

Science major electives	8
PHYS 2010/2011, 2020/2021	8
Electives/Sec. Ed. Minor	11
ENGL 2020 or 2030 or HUM 2610 (Hum/FA)	3
<b>30</b>	

**SENIOR**

Science major electives	6
Humanities and/or Fine Arts	3
Electives/Sec. Ed. Minor	15
Social/Behavioral Sciences (2 prefixes)	6
<b>30</b>	

**Concentration: Health Science**

The Health Science concentration is for students who expect to enter a professional school after completing an appropriate pre-professional curriculum. There are three groups of programs. One group leads to an MTSU degree through completion of three years of the program at MTSU, acceptance into a professional school, and successful completion of one year. These programs are referred to as three-and-one programs and result in a bachelor's degree in science from MTSU with a health science concentration. Some programs listed under health science are designed for transfer only and do not lead to a degree from MTSU while other programs require completion of a baccalaureate degree prior to entrance.

Admission to the MTSU pre-professional program does not assure admission to a professional program. In the beginning of the third year, the student should make application to the program of choice, following the procedures of the particular program. Selection for admission is competitive and is made by the admissions committee of the respective program according to its selection standards.

The limits on class size in most of the professional programs may prevent acceptance of some qualified applicants. In the event a first application is unsuccessful, the program may be easily changed to a Chemistry or Biology major leading to a B.S. degree, and then application may be made a second time.

Students should note the following:

**Chemistry**—Students with a weak background or no high school chemistry should enroll in CHEM 1010 before taking CHEM 1110.

**Irregularities**—Advanced placement, remedial courses, failure of required courses, or summer school may cause some students to deviate from the sequence in the recommended curriculum. Regular consultation with the advisor is most important.

**Advisors**—Advisors to these programs are assigned in the Clara W. Todd Pre-professional Health Science Advising Center located in the Chemistry Department. The advisor will provide a curriculum sheet as a guide for the program. Guidance is provided on the recommended courses and proce-

dures to be followed in leading to applications to a professional program. A pre-professional evaluation committee aids the students in providing recommendations requested by the professional programs.

**Degree from MTSU**—Students who plan to obtain degrees from MTSU must file the Intent to Graduate Form.

**Minor in Science**

The minor in Science consists of 24 semester hours acceptable for a minor: 16 hours in biology, chemistry, or physics, and 8 semester hours in one of the other two. At least 4 upper-division hours in a science must be taken at MTSU. Consult your advisor to determine which courses will satisfy minor requirements.

**Pre-medical Curriculum  
(Including optometry, osteopathy, podiatry,  
or chiropractic)**

The pre-medical curriculum prepares students to make application to all of the medical schools in Tennessee and most of the medical schools in the United States. A student planning to enter a medical school in another state is expected to supply the advisor with a catalog from the school under consideration.

Students are encouraged to complete a baccalaureate degree prior to entering medical school. The pre-medical curriculum lists all general education requirements, pre-medical requirements for application to medical schools, and recommended coursework. Since students can obtain a degree of their choice, it is very important to work closely with advisors regarding recommended coursework and fulfillment of degree requirements. The following sequence of classes may not yield a degree (see advisor). Students who plan to apply for admission to a school of optometry, osteopathy, podiatry, or chiropractic should follow this general pre-medical curriculum.

**Recommended Curriculum****FRESHMAN**

CHEM 1110 (Nat Sci)	4
CHEM 1120	4
BIOL 1110 (Nat Sci)	4
BIOL 1120	4
ENGL 1010, 1020 (Comm)	6
MATH 1910 (Math)	4
COMM 2200 (Comm)	3
Humanities and/or Fine Arts	3
<b>32</b>	

**SOPHOMORE**

CHEM 2230	5
CHEM 3010	4
BIOL 2120, 2230	8
PHYS 2010/2011, 2020/2021	8
ENGL 2020 or 2030 or HUM 2610 (Hum/FA)	3
Humanities and/or Fine Arts	3
<b>31</b>	

**JUNIOR**

CHEM 3020	4
CHEM 3530 or 4500	4
BIOL 3020, 4210	8
HIST 2010, 2020, or 2030	6
Social/Behavioral Sciences (2 prefixes)	6
Upper-division elective	1
<b>29</b>	

**SENIOR**

CHEM 4330	4
CHEM 4340	4
BIOL 4130	4
Chemistry, biology, and general electives	16
<b>28</b>	

**NOTE:** Electives must be selected carefully in order to assure meeting institutional requirements for graduation: (1) completion of General Education requirements; (2) completion of a minor; (3) completion of a minimum 42 semester hours of upper-division work (courses numbered 3000 and above).

### Pre-physical Therapy Curriculum

The following curriculum is proposed for students planning to make application to the physical therapy program in the College of Allied Health Sciences at the University of Tennessee-Memphis. Students are encouraged to complete a baccalaureate degree prior to entering a physical therapy (PT) school. Consult your advisor. Since different schools have different prerequisites, curriculum guide sheets for this and other PT schools in Tennessee should be obtained from the coordinator of pre-professional advising. At that time, a pre-physical therapy advisor is assigned. *Frequent contact with the advisor is essential to being properly prepared for application to the professional schools.* Volunteer work in physical therapy is required. A student intending to apply to other schools should obtain admission packets from them and consult with his or her advisor.

#### Recommended Curriculum

FRESHMAN		SOPHOMORE	
BIOL 1110, 1120	8	BIOL 2010, 2020	8
ENGL 1010, 1020	6	PHYS 2010/2011, 2020/2021	8
CHEM 1110, 1120	8	PSY 1410, 2300	6
MATH 1730	4	Courses from major*	
Courses from major*			

**NOTE:** Other prerequisite courses: PSY 3020 (3 hrs.) or MATH 1530 (3 hrs), CSCI 1150 (3 hrs.) or INFS 2200 (3 hrs.), HIST 2010, 2020 (6 hrs.), and COMM 2200 (3 hrs.)

Student must obtain an advisor for the physical therapy program who helps select a major in addition to meeting prerequisites for physical therapy requirements. The advisor will assist in selecting elective courses. UT-M requires 9 hours of social science which should be taken from MTSU General Education requirements or courses necessary to meet requirements of other PT programs. Some suggested courses are PSY 4190, 4210, 3230, 3590; ANTH 2010; SOC 1010; PHIL 1030, 2110; ECON 2410. Other elective courses should be selected from BIOL 3010, 3020, 4130 or other **approved** biology or chemistry courses. Other suggested elective courses are EXSC 4830 and PHED 4910.

### Three-and-One Programs

The following are programs that lead to an MTSU degree: pre-cytotechnology, pre-dental, pre-medical technology, pre-pharmacy, pre-nuclear medicine technology, and pre-radiation therapy technology.

Since acceptance into dental or pharmacy school after three years is highly competitive, most students complete the specified pre-dental or pre-pharmacy curriculum then complete a fourth year at MTSU which will lead to a bachelor's degree in biology, chemistry, or science.

General requirements for a degree under this concentration:

1. Complete the specified three-year pre-professional curriculum consisting of at least 90 hours.
2. Apply to, be accepted in, and successfully complete either one year (30 hours) in the professional school or one year of an approved clinical or laboratory school (for which 30 hours will be granted).
3. Each program will require a minimum of 35 hours of science (biology, chemistry, physics).
4. Twenty-one (21) upper-division hours from MTSU of which 12 must be in science as approved by the advisor.

**NOTE:** Any hours granted for laboratory experience do not apply to these 21 upper-division hours.

5. The last 30 semester hours of MTSU coursework must be in residence at MTSU.

### Pre-cytotechnology Curriculum (CT)

The curriculum outlined for the Medical Technology program may be followed at MTSU; after successful completion of a program in a nationally accredited cytotechnology school, a B.S. degree from MTSU can be received.

#### Recommended Curriculum

FRESHMAN		SOPHOMORE	
CHEM 1110 (Nat Sci)	4	CHEM 3010, 3020 or	
CHEM 1120	4	CHEM 2030, 3530	8
BIOL 1110 (Nat Sci)	4	BIOL 2120, 2230	8
BIOL 1120	4	HIST 2010, 2020, or 2030	6
ENGL 1010, 1020 (Comm)	6	ENGL 2020 or 2030 or	
MATH 1710 (Math)	3	HUM 2610 (Hum/FA)	3
PHYS 2010/2011 or 1300	4	Humanities and/or Fine Arts	
COMM 2200 (Comm)	3	(2 prefixes)	6
	<b>32</b>		<b>31</b>
JUNIOR		SENIOR	
CHEM elective*	3	Professional program	
BIOL 4110, 4300	8	credits (granted upon	
BIOL elective	3	completion of first year	
Social/Behavioral Sciences		of approved program)	30
(2 prefixes)	6		<b>30</b>
Electives*	7		
	<b>27</b>		

\*Total upper-division hours must equal at least 21; total of 90 hours prior to professional program.

### Pre-dental Curriculum

The following curriculum is proposed for students planning to enter the College of Dentistry at the University of Tennessee-Memphis and will meet the requirements for a B.S. degree from MTSU upon successful completion of one year in dental school. See page 61 for specific requirements.

**NOTE:** Many applicants find that a B.S. degree is required to be competitive for acceptance; therefore, most pre-dental students usually pursue a Chemistry major and Biology minor or vice versa.

#### Recommended Curriculum

FRESHMAN		SOPHOMORE	
CHEM 1110 (Nat Sci)	4	CHEM 2230	5
CHEM 1120	4	CHEM 3010	4
BIOL 1110 (Nat Sci)	4	PHYS 2020/2021	4
BIOL 1120	4	BIOL 2120	4
ENGL 1010, 1020 (Comm)	6	ENGL 2020 or 2030 or	
MATH 1910 (Math)*	4	HUM 2610 (Hum/FA)	3
PHYS 2010/2011	4	HIST 2010, 2020, or 2030	6
	<b>30</b>	COMM 2200 (Comm)	3
			<b>29</b>
JUNIOR		SENIOR	
CHEM 3020	4	Professional program	
CHEM 3530	4	credits (granted upon	
BIOL 3020, 4130	8	successful completion of	
Humanities and/or Fine Arts		first year of approved	
(2 prefixes)	6	program)	30
Social/Behavioral Sciences			<b>30</b>
(2 prefixes)	6		
Upper-division elective	3		
	<b>31</b>		

\*Prerequisite to MATH 1910 is MATH 1730 or Math ACT greater than or equal to 26.

**NOTE:** Total of 90 hours prior to professional program. Total upper-division hours must equal at least 21.

### Pre-medical Technology Curriculum (MT)

The medical technology degree program requires the successful completion of three years (minimum of 90 semester hours) academic work followed by a minimum of 12 months (30 semester hours or equivalent) in a medical technology program approved by a national accrediting agency and by Middle Tennessee State University. The academic program must fulfill all General Education requirements for a B.S. degree, include at least 21 semester hours of courses numbered 3000 or above, and at least the last two semesters (30 semester hours) must be in residence at MTSU. All other requirements for graduation given elsewhere in this catalog must be met. Specific course requirements are shown below.

Upon approval, a student with the MLT certification from a nationally accredited program at a community college or from any other nationally accredited MLT program may enroll at MTSU, follow the academic part of the medical technology curriculum, fulfill MTSU requirements for graduation, and receive credit (30 semester hours for programs with credit hours not assigned) for the MLT clinical work to be applied toward the B.S. degree. In addition to appropriate MLT certification, three years of full-time clinical laboratory experience are required, in accordance with state and national regulations.

#### Recommended Curriculum

FRESHMAN		SOPHOMORE	
CHEM 1110 (Nat Sci)	4	CHEM 3010, 3020	8
CHEM 1120	4	BIOL 2120, 2230	8
BIOL 1110 (Nat Sci)	4	HIST 2010, 2020, or 2030	6
BIOL 1120	4	ENGL 2020 or 2030 or	
ENGL 1010, 1020 (Comm)	6	HUM 2610 (Hum/FA)	3
MATH 1710 (Math)	3	COMM 2200 (Comm)	3
PHYS 2010/2011 or 1300	4	Humanities and/or Fine Arts	3
	<b>29</b>		<b>31</b>
JUNIOR		SENIOR	
CHEM 3530	4	Professional program	
BIOL 4110, 4300	8	credits granted upon	
BIOL upper-division elective*	4	successful completion	
Humanities and/or Fine Arts	3	of first year of approved	
Social/Behavioral Sciences		program)	30
(2 prefixes)	6		<b>30</b>
Electives	5		
	<b>30</b>		

Total of 90 hours prior to professional program.

\*At least 1 hour must be upper division; total upper-division hours must equal at least 21.

#### REGISTRATION PROCEDURE FOR THE FOURTH YEAR

Upper-division forms must have been completed and approved by the dean, College of Basic and Applied Sciences, at the end of the second year. After acceptance to an accredited medical technology program, the student will be considered registered for the professional year when the following procedures are completed:

1. A letter of recommendation is sent from the faculty advisor to the dean, College of Basic and Applied Sciences, stating the name of the program, the program being taken during the senior year, and dates of beginning and completion of the program.
2. Approval is given by the dean, College of Basic and Applied Sciences, of the advisor's recommendation by letter, authorizing the

student to attend the program indicated. Copies of the letters are sent to the Records Office, to the advisor, and to the professional program.

3. An Intent to Graduate Form is filed by the student in the Records Office at the beginning of the semester **before** the semester in which graduation is expected.

#### AFFILIATED MEDICAL TECHNOLOGY PROGRAMS

1. Vanderbilt Medical Center, Program of Medical Technology, Nashville, Tennessee
2. TSU-Meharry, Program of Medical Technology, Nashville, Tennessee
3. Austin Peay State University, Program of Medical Technology, Clarksville, Tennessee

Acceptance of work from nonaffiliated schools may also be arranged on an individual student basis.

### Pre-pharmacy Curriculum

The following curriculum is proposed for students planning to enter pharmacy school after three years of study at MTSU. Well-prepared students with advanced placement credits may be able to complete pharmacy admission requirements in two years and should consult with their advisors regarding course selection. The course schedule below meets prerequisites for the Pharm.D. programs at the University of Tennessee at Memphis, Samford University, and Mercer University. Students planning to enter other schools of pharmacy should consult regularly with their advisors and choose courses required by the particular school.

#### Recommended Curriculum

FRESHMAN		SOPHOMORE	
CHEM 1110 (Nat Sci)	4	CHEM 3010, 3020	8
CHEM 1120	4	BIOL 2010, 2020	8
BIOL 1110 (Nat Sci)	4	MATH 1530	3
BIOL 1120	4	ENGL 2020 or 2030 or	
MATH 1910 (Math)	4	HUM 2610 (Hum/FA)	3
PHYS 2010/2011	4	PSY 1410 (Soc/Beh Sci)	3
ENGL 1010, 1020 (Comm)	6	COMM 2200 (Comm)	3
	<b>30</b>	HIST 1010, 1020, 1110, or	
		1120 (Hum/FA)	3
			<b>31</b>
JUNIOR		SENIOR	
CHEM 4500, 4510, 4530	8	Professional program	
BIOL 2230	4	credits granted upon	
BIOL 4300	4	successful completion	
HIST 2010, 2020, or 2030	6	of first year of approved	
ECON 2410 (Soc/Beh Sci)	3	program)	30
Humanities and/or Fine Arts	3		<b>30</b>
Upper-division elective	1		
	<b>29</b>		

Total of 90 hours prior to professional program. Total upper-division hours must equal at least 21.

### Pre-nuclear Medicine Technology

The Nuclear Medicine Technology degree program requires a successful completion of three years (minimum of 90 semester hours) academic work at MTSU followed by a minimum of 12 months (30 semester hours or equivalent) in a nuclear medicine technology program approved by a national accrediting agency and by Middle Tennessee State University. The academic program must fulfill all General Education requirements for a B.S. degree, include at least 21 semester hours of courses numbered 3000 or above, and at least the

last two semesters (junior year, 30 semester hours) must be in residence at MTSU. All other requirements for graduation given elsewhere must be met.

**Recommended Curriculum**

<b>FRESHMAN</b>		<b>SOPHOMORE</b>	
CHEM 1110 (Nat Sci)	4	CHEM 3010, 3020 or 2030, 3530	8
CHEM 1120	4	PHYS 2010/2011, 2020/2021	8
BIOL 2010 (Nat Sci)	4	HLTH 3300	3
BIOL 2020	4	ENGL 2020 or 2030 or HUM 2610 (Hum/FA)	3
MATH 1730 or 1910 (Math)	4	HIST 2010, 2020, or 2030	6
ENGL 1010, 1020 (Comm)	6	COMM 2200 (Comm)	3
PSY 1410 (Soc/Beh Sci)	3		
Elective	1		
	<b>30</b>		<b>31</b>

**JUNIOR**

BIOL 2230, 3340, 4150	10	<b>SENIOR</b>	
CSCI 1000	1	Professional program	
BIOL 3350	3	credits (granted upon successful completion of first year of approved program)	30
Humanities and/or Fine Arts (2 prefixes)	6		<b>30</b>
PSY 4650	3		
SOC 4040	3		
Social/Behavioral Sciences	3		
	<b>29</b>		

Total of 90 hours prior to professional program. Total upper-division hours must equal at least 21.

**Pre-radiation Therapy Technology Curriculum**

The Radiation Therapy Technology degree program requires a successful completion of three years (minimum of 90 semester hours) academic work at MTSU followed by a minimum of 12 months (30 semester hours or equivalent) in a radiation therapy technology program approved by a national accrediting agency and by Middle Tennessee State University. The academic program must fulfill all General Education requirements for a B.S. degree, include at least 21 semester hours of courses numbered 3000 or above, and at least the last two semesters (junior year, 30 semester hours) must be in residence at MTSU. All other requirements for admission given elsewhere must be met.

**Recommended Curriculum**

<b>FRESHMAN</b>		<b>SOPHOMORE</b>	
ENGL 1010, 1020 (Comm)	6	Social/Behavioral Sciences	3
CHEM 1110 (Nat Sci)	4	PHYS 2010/2011, 2020/2021	8
MATH 1730	4	BIOL 2010 (Nat Sci)	4
MATH 1530 (Math)	3	BIOL 2020	4
HIST 2010, 2020, or 2030	6	HLTH 3300	3
COMM 2200 (Comm)	3	HLTH 4270	3
HUM 2130	3	N FS 1240	3
	<b>29</b>	PSY 1410 (Soc/Beh Sci)	3
			<b>31</b>

**JUNIOR**

BIOL 2230, 3340, 4150	10	<b>SENIOR</b>	
CSCI 1150	3	Professional program	
BIOL 3350	3	credits (granted upon successful completion of first year of approved program)	30
PSY 4650 or SOC 4040	3		<b>30</b>
HLTH 4280	2		
Humanities and/or Fine Arts (2 prefixes)	6		
ENGL 2020 or 2030 or HUM 2610 (Hum/FA)	3		
	<b>30</b>		

Total of 90 hours prior to professional program. Total upper-division hours must equal at least 21.

**Other Transfer Programs**

The following programs do not lead to an MTSU degree: pre-dental hygiene, pre-health information management, and pre-occupational therapy. Students apply to the professional school during the second or third year.

**Pre-dental Hygiene Curriculum**

The following curriculum is proposed for students planning to make application to the dental hygiene program in the College of Allied Health Sciences at the University of Tennessee-Memphis. Students who plan to apply for admission to other schools of dental hygiene should consult their advisors.

**Recommended Curriculum**

<b>FRESHMAN</b>		<b>SOPHOMORE</b>	
BIOL 1110	4	BIOL 2010, 2020, 2230	12
BIOL 1120 (recommended)	4	COMM 2200	3
ENGL 1010, 1020	6	HIST 2010, 2020	6
CHEM 1010, 1020	8	ENGL 2030	3
SOC 1010, 2010	6	Electives*	6
PSY 1410, 1420	6		
	<b>34</b>		<b>30</b>

\*The advisor should be consulted for elective recommendations.



### Pre-health Information Management Curriculum

The pre-health information management curriculum below is recommended for students planning to enter the health information management program at the University of Tennessee-Memphis. Information pertaining to pre-health information management is available in DSB 241. Students who plan to apply for admission to other health information programs should consult their advisors.

To gain the best first-hand knowledge about health information management, you should contact health information managers (medical record administrators), visit their facilities, and talk to them directly. Working in an office of health information management on a paid or volunteer basis is recommended.

#### Recommended Curriculum

FRESHMAN		SOPHOMORE	
BIOL 1110, 1120	8	BIOL 2010, 2020	8
ENGL 1010, 1020	6	ENGL 2030	3
PSY 1410	3	SOC or HIST or ECON	6
PSY elective*	3	COMM 2200	3
MATH 1710	3	PSY 3020	3
Electives*	6	HUM 2130	3
	<b>29</b>	Electives*	5
			<b>31</b>
JUNIOR			
INFS 2200 or 3100	3		
BMOM 3010	3		
BLAW 3400	3		
BMOM 3510	3		
BMOM 4350	3		
MGMT 3610	3		
Electives*	12		
	<b>30</b>		

\*For admission to University of Tennessee-Memphis, a minimum of fifteen (15) upper-division hours is required. The business courses and statistics courses listed above satisfy this requirement.

### Pre-occupational Therapy Curriculum

The following curriculum is proposed for students planning to enter the occupational therapy program at the College of Allied Health Sciences, University of Tennessee-Memphis. The program requires three (3) years of study (90 semester hours) at MTSU followed by two calendar years at UT-Memphis. While a bachelor's degree is not required, students are encouraged to obtain a bachelor's degree before attending the occupational therapy program at UT-Memphis. Successful completion of the program will entitle the student to receive a Master of Science degree in occupational therapy granted by UT-Memphis.

Students who plan to apply for admission to other schools of occupational therapy should consult with their advisors.

#### Recommended Curriculum

FRESHMAN		SOPHOMORE	
BIOL 1110, 1120	8	BIOL 2010, 2020	8
ENGL 1010, 1020	6	SOC 1010	3
Social Sciences elective	3	CSCI 1150	3
CHEM 1110*	4	PHYS 2010/2011	4
PSY 1410	3	PSY 2300, 3230	6
COMM 2200	3	HUM 2130	3
Elective**	3	ANTH 2010	3
	<b>30</b>		<b>30</b>

JUNIOR	
HUM 2130	3
PSY 3020	3
Humanities elective (note)	9
Electives**	15
	<b>30</b>

**NOTE:** Ninety semester hours must be completed prior to matriculation to include additional hours from ANTH (3), Social Sciences (3), and 9 hours of humanities.

\*Students with a weak background in chemistry should take CHEM 1010 before taking CHEM 1110.

\*\*Recommended electives: computer/technology skills, kinesiology, education, technical or critical writing, fine and performing arts, language and communication systems, philosophy, and up to 4 hours in industrial arts or activity-based courses (e.g., woodworking, ceramics, photography).

### Courses in Chemistry [CHEM]

**1010 Introductory General Chemistry I.** Four credits. For students with no prior courses in chemistry; to be taken before CHEM 1110. Fundamental concepts of chemistry: measurements, matter, chemical bonds, chemical reactions, nuclear chemistry, states of matter, solutions, and electrolytes. Three hours of lecture and one three-hour laboratory. Will not count toward a major or minor in Chemistry.

**1020 Introductory General Chemistry II.** Four credits. Prerequisite: CHEM 1010. Topics include hydrocarbons, organic functional groups, isomerism, carbohydrates, lipids, nucleic acids and proteins, enzymes, and metabolism. Three hours of lecture and one three-hour laboratory. Will not count toward a major or minor in Chemistry.

**1030 Chemistry for Consumers.** Four credits. Language, development, structure, and role of chemistry as it relates to the knowledge and activities of the educated person. Examples will be taken from medicine and human health, environmental pollution, energy and its costs, etc. Understanding of the relationship between chemistry and society will be enhanced using special subtopics: lectures, demonstrations, and inquiry-based laboratory work drawing from the expertise of the individual instructor. For non-science majors. Three hours lecture and one two-hour laboratory. **(Does not count toward any major or minor.)**

**1110 General Chemistry I.** Four credits. Prerequisites: High school chemistry; CHEM 1010 or equivalent. Fundamental concepts of atomic structure, molecular structure and bonding, chemical reactions, stoichiometric relationships, periodic properties of the elements, thermochemistry, and properties of gases. Three hours of lecture and one three-hour laboratory.

**1120 General Chemistry II.** Four credits. Prerequisites: CHEM 1110. Chemical equilibrium, solid and liquid states of matter, chemistry of acids and bases, principles of chemical kinetics, precipitation reactions, elementary thermodynamics, electrochemistry, and nuclear chemistry. Three hours of lecture and one three-hour laboratory.

**2030 Elements of Organic Chemistry.** Four credits. Prerequisites: CHEM 1020 or 1120. Aspects of organic chemistry fundamental to an understanding of reactions in living organisms. Three hours lecture and one three-hour laboratory.

**2230 Quantitative Analysis.** Five credits. Prerequisites: CHEM 1120. Gravimetric and volumetric determinations, an introduction to

optical and electrical methods of analysis, and the stoichiometry of analytical chemistry. Three hours lecture and two three-hour laboratories.

- 2880 Undergraduate Research I.** One to four credits. Prerequisite: Permission of the instructor. Student research allied with the instructor's research or designed specifically for the particular student. Minimum of three clock-hours work per week required for each credit hour. Up to four hours may count in the General Science major, but does not count for a major or minor in Chemistry. May be repeated for a total of four credits.
- 2930, 2940 Cooperative Education.** Three credits. Provides students with opportunities for on-the-job training in conjunction with on-campus academic experiences. Department chair should be consulted. Pass/Fail.
- 3010 Organic Chemistry I.** Four credits. Prerequisites: CHEM 1120 or equivalent. Types of carbon compounds, their nomenclature, reactions, and physical properties. Three hours lecture and one three-hour laboratory.
- 3020 Organic Chemistry II.** Four credits. Prerequisite: CHEM 3010. A continuation of CHEM 3010. Three hours lecture and one three-hour laboratory.
- 3530 Principles of Biochemistry.** Four credits. Prerequisite: CHEM 2030 or 3020. Structure, properties, and functions of carbohydrates, lipids, and proteins and their reactions in living organisms. Three-hour lecture and one three-hour laboratory.
- 3880 Undergraduate Research II.** One to four credits. Prerequisites: CHEM 2230 and permission of the instructor. Student research allied with the instructor's research or designed specifically for the particular student. Minimum of three clock-hours work per week required for each credit hour. Summary report or some other form of presentation required. A total of no more than four hours of research credits may be counted toward a major in chemistry. May be repeated for a total of four credits.
- 3890 Chemistry Instruction Internship.** One to three credits. Prerequisites: Successful completion of target courses and permission of instructor. A course to refine thinking, communication, and interpersonal skills through exposure to on-the-spot technical questions and a laboratory teaching experience as an assistant in an introductory chemistry laboratory. Course credits will count toward a major in General Science but will not count toward a major in Chemistry. May be repeated for a total of three credits.
- 3970, 3980 Cooperative Education.** Three credits. Provides students with opportunities for on-the-job training in conjunction with on-campus academic experiences. Department chair should be consulted. Pass/Fail.
- 4000 Medicinal Chemistry.** Three credits. Prerequisite: CHEM 3010/3020 or CHEM 2030 with permission of instructor. Drug design and development including structural changes involved in making drug analogs. Drug interaction with macromolecular targets including receptors, enzymes, and DNA. Various classes of drugs and their mechanisms for the treatment of specific therapeutic areas.
- 4100 Organic Spectroscopy.** Three credits. Prerequisite: CHEM 3020. Theory of and practice in the interpretation of mass, infrared, Raman, ultraviolet-visible, and nuclear magnetic resonance spectra. Three hours lecture.
- 4230 Instrumental Analysis.** Four credits. Prerequisites: CHEM 2230, 3020, and 4360. Potentiometric titration, polarographic, coulometric, gas chromatographic, ultraviolet, visible and infrared absorption, and atomic absorption techniques of analysis. Requirements and limitations of each technique for obtaining quantitative measurements; applications to various chemical systems from both theoretical and experimental standpoints. Three hours lecture and one three-hour laboratory.
- 4330 Physical Chemistry Fundamentals I.** Four credits. Prerequisites: PHYS 2020 and 2021; CHEM 2230; MATH 1910. Basic study of physical chemistry including modern theories of atomic and molecular structure, chemical thermodynamics, electrochemistry, chemical kinetics, and related theoretical topics. Three hours lecture and one three-hour laboratory.
- 4340 Physical Chemistry Fundamentals II.** Four credits. Prerequisite: CHEM 4330. A continuation of CHEM 4330. Three hours lecture and one three-hour laboratory.
- 4350 Physical Chemistry I.** Four credits. Prerequisites: CHEM 2230; MATH 1920; PHYS 2021 and 2120. Quantitative principles of chemistry involving extensive use of calculus. Thermodynamics, phase changes, chemical equilibria, electrochemistry, reaction kinetics, quantum chemistry, molecule structure, and statistical mechanics. Three hours lecture and one three-hour laboratory.
- 4360 Physical Chemistry II.** Four credits. Prerequisite: CHEM 4350. A continuation of CHEM 4350. Three hours lecture and one three-hour laboratory.
- 4400 Inorganic Chemistry.** Three credits. Prerequisites: CHEM 1120 or equivalent; CHEM 2030 or 3010 recommended. The basic concepts and theories of inorganic chemistry and how these are used to predict and understand the physical and chemical properties of compounds of the elements other than carbon. Inorganic compounds in the air, water, earth, and in the laboratory and in biochemistry, geochemistry, and industrial materials and processes.
- 4410 Advanced Inorganic Chemistry.** Three credits. Prerequisites: CHEM 3020 and 4400; prerequisite or corequisite: CHEM 4360. Atomic theory for chemical periodicity; symmetry and group theory; molecular orbital theory; coordination, organometallic, and bioinorganic chemistry of the transition metals.
- 4430 Advanced Synthetic Laboratory Techniques.** Two credits. Prerequisite: CHEM 3020. Techniques for synthesis and purification of organic, organometallic, and inorganic compounds. Practice in the measurement of NMR and IR spectra. Skills in library use for research. Four hours laboratory and one-hour lecture.
- 4500 Biochemistry I.** Three credits. Prerequisite/corequisite: CHEM 3020; not open to those who have had CHEM 3530. Chemical properties of biological molecules such as amino acids, proteins, enzymes, and carbohydrates. Chemical basis of enzyme catalysis and reactions of carbohydrate metabolism.
- 4510 Biochemistry II.** Three credits. Prerequisite: CHEM 4500. Structure and metabolism of lipids, amino acids, nucleotides, and nucleic acids at the molecular level. Emphasis on chemistry of metabolic reactions.
- 4530 Biochemical Techniques.** Two credits. Prerequisite/corequisite: CHEM 4500 or consent of instructor. CHEM 2230 recommended. Laboratory in biochemical techniques with emphasis on protein purification, enzyme kinetics, carbohydrate and lipid

analysis, and manipulation of DNA. One-hour lecture and four hours laboratory.

- 4580 Medical Technology Clinical Practicum.** Six credits. Intensive classroom and laboratory studies covering principles and techniques in the areas of clinical chemistry, microbiology, immunohematology, bloodbanking, and related areas. Pass/Fail.
- 4600 Introduction to Environmental Chemistry.** Three credits. Prerequisites: CHEM 1120; CHEM 2030 or 3010; CHEM 2230 strongly recommended. Quality of environment and of chemical changes in the environment through contaminations or modification of the air, water, and soil as they are affected by agricultural, industrial, and social activities. Three hours lecture.
- 4610 Environmental Soil Chemistry.** Three credits. Prerequisites: CHEM 2230 and 3020. Fundamental chemical principles applied to the fate and behavior of organic and inorganic contaminants in the soil-water environment. An overview of the soil medium; will include both the mineral component and the soil organic matter. Interaction between solid and liquid components introduced, followed by contaminant reactions between the phases, including sorption and redox reactions.
- 4630 Detection of Chemical Pollutants.** Four credits. Prerequisites: CHEM 2230 and one semester of organic chemistry or consent of instructor. Theory and practice of analytical chemistry methods used in pollution measurement. Three hours lecture and one three-hour laboratory.
- 4700 Polymers, an Introduction.** Three credits. Prerequisite: CHEM 3020; physical chemistry strongly recommended. Chemistry of polymers; their structure, properties, and applications. Three hours lecture.
- 4730 Advanced Physical Chemistry.** Four credits. Prerequisite: CHEM 4360 or permission of instructor. Modern chemical concepts as applied to the areas of thermodynamics, electrochemistry, and chemical kinetics. Three hours lecture and one three-hour calculation laboratory.
- 4780 Polymer and Materials Chemistry Laboratory.** One credit. Prerequisite: Organic chemistry; physical chemistry strongly recommended. Laboratory introduction to synthesis, kinetics, characterization, engineering, and applications of polymers and other modern materials. To be taken concurrently with CHEM 4700.
- 4800 Technical Writing for Chemists.** One credit. Prerequisite: Completion of undergraduate English requirements. Emphasis on improving communication skills using writing exercises. Students will develop writing skills necessary to transmit technical information effectively, construct persuasive proposals and resumes, and produce clearly written reports of laboratory results.
- 4880 Research.** Four credits. Prerequisites: 24 hours of ACS-approved chemistry courses. Student research allied with the instructor's research or designed specifically for the particular student. Minimum of twelve (12) hours a week. Student must write a formal report which is approved by the instructor to receive credit for this course.

## Courses in Chemical Instrumentation Techniques [CHEM]

- 4190 Mass Spectrometry.** One credit. Prerequisite: CHEM 2230 or consent of instructor. Mass spectrographic analysis emphasizing the use of the instrument in obtaining mass spectral data. Technique of obtaining spectra using gas chromatographic effluents as well as normal sampling procedures. Routine maintenance and an introduction to the interpretation of simple spectra.
- 4380 Nuclear Magnetic Resonance Experimental Methods.** One credit. Prerequisite: CHEM 3020 or 2030. NMR measurements, operation of the spectrometer, and evaluation of the quality of spectra produced.

## Courses in General Physical Science [PSCI]

- 1030 Topics in Physical Science.** Four credits. Language, development, structure, and role of physical science (physics, chemistry, astronomy, and geology) as it relates to the knowledge and activities of the educated person. For non-science majors. Three hours lecture and one two-hour laboratory. **(A General Education course [Nat Sci]. Does not count toward any major or minor.)**
- 3890 Physical Science Instruction Internship.** One credit. Prerequisite: Successful completion of the target course (PSCI 1030) or one semester of chemistry and one semester of physics and permission of instructor. Opportunity to refine thinking, communication, and interpersonal skills through exposure to on-the-spot technical questions and a laboratory teaching experience as an assistant in an introductory physical science laboratory. Course credits will not count toward a major or minor in Chemistry or General Science. May be repeated for up to three credits.
- 4030 Experimental Physical Science.** Four credits. Prerequisite: PSCI 1030. Basic concepts, laws, and principles of astronomy, chemistry, geology, and physics with particular emphasis on the utilization of equipment available or easily improvised in actual school situations to illustrate these concepts, laws, and principles.
- 4080 Problems in Physical Science.** Four credits. Prerequisite: Consent of instructor. A problem from chemistry, physics, or other physical science appropriate to the student's background and interest. A formal written report must be submitted and approved by the instructor to receive credit for this course.

## Honors College

The Department of Chemistry offers the following courses in Honors: CHEM 1110 and 1120 and PSCI 1030. See current class schedule and Honors information in this catalog.

## Graduate Study

The Department of Chemistry offers the Master of Science and Doctor of Arts degrees. The Graduate Catalog has degree requirements and course listings.