College of Basic and Applied Sciences

Greg Van Patten, Dean
Saeed Foroudastan, Associate Dean
Jennifer Danylo, Advising Manager (Aerospace, Agriculture, Concrete and Construction Management, Computer Science, Engineering Technology, Geosciences, Mathematical Sciences, Physics and Astronomy)
Eric Miller, Advising Manager (Pre-Professional Health Science, Biology, and Chemistry)
Tongia Key, Graduation Analyst

Teaching and research in the College of Basic and Applied Sciences (CBAS) are central to the mission and success of Middle Tennessee State University. The college will provide a transformative and experiential education to all MTSU students. The college will inspire, support, and mentor students, staff, and faculty to think critically and creatively, to confront challenges boldly, and to be ambitious. In implementing its mission, the college will

1. through a broad range of challenging undergraduate programs and distinctive graduate degrees offer preparation to students for leadership and successful careers in higher education positions as well as scientific and technical fields in industry, teaching, government, and health services;
2. employ a diverse faculty community of exceptional teacher-scholars, nationally and internationally recognized for their teaching and research; and
3. use its resources to help address scientific, environmental, educational, and health-related challenges in the middle Tennessee area, through the nation, and across the globe.

Microanalysis and Imaging Center (MIMIC)

The MTSU Microanalysis and Imaging Center (MIMIC) is a core microscopy center operated by the College of Basic and Applied Sciences.

Training in electron microscopy (EM) techniques, including scanning electron microscopy, transmission electron microscopy, and x-ray analysis is obtained by a trio of laboratory courses that are offered every year to undergraduate and graduate students: Scanning Electron Microscopy, BIOL 4290/6290; Energy Dispersive X-ray Analysis, BIOL 4360/6360; Transmission Electron Microscopy, BIOL 4270/6410; and Practical Training in Microanalysis Techniques IMIC 4820. The courses teach sample preparation, instrument theory, and hands on training on the electron microscopes and ancillary equipment.

MTeach

Heather Alai-Anor Green, Coordinator
Amy Phelps, Co-Director
Kim Evert, Co-Director
Brad Parton, Master Teacher
Fonya Scott, Master Teacher
Alexius Frost, Executive Aide

MTeach, MTSU's education program for aspiring secondary mathematics and science teachers, is a joint effort between the College of Basic and Applied Sciences and the College of Education. MTeach students pursue a major in Biology, Chemistry, Physics, Mathematics, Geosciences, or Agriculture and complete coursework toward a minor in Secondary Education through the program.
Following are the college departments/schools with a listing of programs offered.

Data Science Minor

Data Science

The Data Science minor requires 16 hours.

Required Courses (16 hours)

- MATH 1530 - Applied Statistics **3 credit hours** OR
- BIA 2610 - Statistical Methods **3 credit hours** OR
- MATH 2050 - Probability and Statistics **3 credit hours**

- CSCI 1170 - Computer Science I **4 credit hours**
- DATA 1500 - Introduction to Data Science **3 credit hours**
- DATA 3500 - Data Cleansing and Feature Engineering **3 credit hours**
- DATA 3550 - Applied Predictive Modeling **3 credit hours**

Data Science, B.S.

Sara Shirley, undergraduate program director
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615-898-2122

Data Science is an interdisciplinary field that covers the use of data to make decisions, gain insight, or develop knowledge. Data scientists combine skills from computer science, statistics, and business analytics. Students will start from a business understanding of the question at hand, using it to inform and understand the data available, then use skills in the preparation and display of data and in the modeling of data to evaluate the issue at hand. Finally, they will deploy the model they created in order to ensure that it is widely used. A capstone project or internship will allow students to follow the process of data science in a real-world setting and will ensure that they have a portfolio of work to show prospective employers.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Data Science, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**45 hours**
Data Science Electives	**12 hours**
Supporting Courses	**7 hours***
Electives	**15-21 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours may vary.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.
The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- ECON 2410 (HSSR)

Major Requirements (45 hours)

- BIA 3620 - Introduction to Business Analytics **3 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**
- DATA 1500 - Introduction to Data Science **3 credit hours**
- DATA 3500 - Data Cleansing and Feature Engineering **3 credit hours**
- DATA 3550 - Applied Predictive Modeling **3 credit hours**
- DATA 4950 - Data Science Capstone **3 credit hours**
- INFS 4790 - Database Design and Development **3 credit hours**

- MATH 2110 - Data Analysis **1 credit hour**
- MATH 2530 - Applied Statistics II **3 credit hours**

- BIA 2610 - Statistical Methods **3 credit hours** OR
- MATH 1530 - Applied Statistics **3 credit hours** OR
- MATH 2050 - Probability and Statistics **3 credit hours**

Data Science Cognate (12 hours)

Choose one cognate from the following:

Inferential Thinking

- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- STAT 4360 - Regression Analysis **3 credit hours**
- STAT 4380 - Experimental Design **3 credit hours**
- STAT 4700 - Analysis of Large-Scale Data Sets **3 credit hours**

Business Intelligence and Analytics

- BIA 3470 - Python for Business Applications **3 credit hours** OR
- INFS 3470 - Python for Business Applications **3 credit hours**

- BIA 4010 - Business Analytics and Visualization **3 credit hours**
- INFS 3900 - Business Data Communications **3 credit hours**
- STAT 4700 - Analysis of Large-Scale Data Sets **3 credit hours**

Machine Learning

- CSCI 3080 - Discrete Structures **3 credit hours**
- CSCI 3110 - Algorithms and Data Structures **3 credit hours**
- CSCI 4350 - Introduction to Artificial Intelligence **3 credit hours**
- CSCI 4850 - Neural Nets **3 credit hours**

Data Science Electives (12 hours)

- CSCI 3130 - Assembly and Computer Organization **4 credit hours**
- CSCI 3240 - Introduction to Computer Systems **4 credit hours**
- CSCI 4300 - Data Communication and Networks **3 credit hours**
- CSCI 4330 - Parallel Processing Concepts **3 credit hours**
- DATA 4500 - Internship in Data Science **1 to 3 credit hours**
- ECON 2420 - Principles of Economics, Microeconomics **3 credit hours (may be counted in the True Blue Core)**
- ECON 4620 - Econometrics and Forecasting **3 credit hours**
- FIN 4100 - Advanced Financial Data Analysis and Applications **3 credit hours**
- PGEO 4490 - Remote Sensing **4 credit hours**
- PGEO 4530 - Geographic Information Systems **3 credit hours**
- PGEO 4560 - Intermediate Geographic Information Systems **3 credit hours**

- ACSI 4600 - Problems in Actuarial Science **1 to 6 credit hours** OR
- STAT 4600 - Problems in Statistics **1 to 6 credit hours**

- BIA 4100 - Location Analytics **3 credit hours** OR
- INFS 4100 - Location Analytics **3 credit hours**

- Courses from cognate areas not selected above (in consultation with advisor)

Supporting Courses (7 hours)

- ECON 2410 - Principles of Economics, Macroeconomics **3 credit hours (may be counted in the True Blue Core)**
- MATH 1910 - Calculus I **4 credit hours (may be counted in the True Blue Core)**

Electives/Minor (15-21 hours)

- Minor strongly recommended

Curriculum: Data Science

Students should consult their advisors each semester to plan their schedules.

Freshman Fall

- DATA 1500 - Introduction to Data Science **3 credit hours**
- Written Communication **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **3 credit hours**

- BIA 2610 - Statistical Methods **3 credit hours** OR
- MATH 1530 - Applied Statistics **3 credit hours** OR
- MATH 2050 - Probability and Statistics **3 credit hours**

Subtotal: 15 Hours

Freshman Spring

- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **3 credit hours**
- ECON 2410 - Principles of Economics, Macroeconomics **3 credit hours** (HSSR)
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)

Subtotal: 16 Hours

Sophomore Fall

- CSCI 1170 - Computer Science I **4 credit hours**
- MATH 2530 - Applied Statistics II **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Scientific Literacy **4 credit hours**
- Human Society and Social Relationships **3 credit hours**

Subtotal: 17 Hours

Sophomore Spring

- CSCI 2170 - Computer Science II **4 credit hours**
- MATH 2110 - Data Analysis **1 credit hour**
- Non-Written Communication **3 credit hours**
- Elective/minor **3 credit hours**
- Scientific Literacy **4 credit hours**

Subtotal: 15 Hours

Junior Fall

- BIA 3620 - Introduction to Business Analytics **3 credit hours**
- DATA 3500 - Data Cleansing and Feature Engineering **3 credit hours**
- DS cognate **3 credit hours**
- Elective/minor **6 credit hours**

Subtotal: 15 Hours

Junior Spring

- DATA 3550 - Applied Predictive Modeling **3 credit hours**
- Elective/minor **6 credit hours**
- DS cognate **3 credit hours**
- DS elective **3 credit hours**

Subtotal: 15 Hours

Senior Fall

- INFS 4790 - Database Design and Development **3 credit hours**
- DS cognate **3 credit hours**
- DS elective **6 credit hours**
- Elective/minor **3 credit hours**

Subtotal: 15 Hours

Senior Spring

- DATA 4950 - Data Science Capstone **3 credit hours**
- DS cognate **3 credit hours**
- DS elective **3 credit hours**
- Elective/minor **3 credit hours**

Subtotal: 12 Hours

Forensic Science, B.S.

Dr. Frank Bailey, director
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www.mtsu.edu/programs/forensic-science/

The interdisciplinary major in Forensic Science consists of a strong interdisciplinary curriculum within the Departments of Biology, Chemistry, and Criminal Justice. The goals of the Forensic Science major are to provide a strong academic foundation that offers preparation for advanced study in forensic science or employment in public crime laboratories, specialized private laboratories, and law enforcement agencies; to understand the role of the forensic scientist in the criminal justice system and offer preparation to present oral and written findings to the court; and to provide student interaction with current forensic practitioners through seminars and internships.

Forensic Science is the application of techniques and principles of the natural and physical sciences to the analysis of evidence collected during criminal investigations. Career options exist with the federal, state, and local law enforcement agencies, forensic laboratories, medical examiner offices, hospitals, military, private firms, and universities.

No minor is required since this degree is highly interdisciplinary. The requirements for a major in Forensic Science can be found below or obtained from an advisor of the program.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Forensic Science, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**75 hours***
Supporting Courses	**15 hours***
TOTAL	**120-131 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)

Major Requirements (75 hours)

- ANTH 3650 - Forensic Anthropology **3 credit hours** OR
- ANTH 3660 - Forensic Sciences **3 credit hours** OR
- FSCJ 4360 - Crime Scene Photography and Documentation **3 credit hours**

- BIOL 1110 - General Biology I **4 credit hours (may be counted in the True Blue Core)**
- BIOL 1111 - General Biology I Lab **0 credit hours**
- BIOL 1120 - General Biology II **4 credit hours**
- BIOL 1121 - General Biology II Lab **0 credit hours**
- BIOL 2230 - Microbiology **4 credit hours**
- BIOL 2231 - Microbiology Lab **0 credit hours**
- BIOL 3250 - Genetics **4 credit hours**
- BIOL 3251 - Genetics Lab **0 credit hours**
- BIOL 4375 - Forensic Taphonomy **3 credit hours**
- BIOL 4570 - Principles of Toxicology **3 credit hours**
- BIOL 4571 - Principles of Toxicology Lab **0 credit hours**
- CHEM 1110 - General Chemistry I **4 credit hours (may be counted in the True Blue Core)**
- CHEM 1111 - General Chemistry I Lab **0 credit hours**
- CHEM 1120 - General Chemistry II **4 credit hours**
- CHEM 1121 - General Chemistry II Lab **0 credit hours**
- CHEM 2230 - Quantitative Analysis **3 credit hours**
- CHEM 2231 - Quantitative Analysis Lab **2 credit hours**
- CHEM 3010 - Organic Chemistry I **3 credit hours**
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**
- CHEM 3020 - Organic Chemistry II **3 credit hours**
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**
- CHEM 4125 - Forensic Chemistry **4 credit hours**
- CHEM 4126 - Forensic Chemistry Laboratory **0 credit hours**
- FRSC 1010 - Introduction to the Forensic Science Major **2 credit hours**
- FRSC 4010 - Forensics Senior Seminar **2 credit hours**
- FRSC 4020 - Forensics Internship **4 credit hours**
- FSBI 4550 - Biotechnology **3 credit hours**
- FSCH 3530 - Principles of Biochemistry **4 credit hours**
- FSCH 3531 - Principles of Biochemistry Lab **0 credit hours**
- FSCH 4230 - Instrumental Analysis in Forensic Science **4 credit hours**
- FSCH 4231 - Instrumental Analysis in Forensic Science Lab **0 credit hours**
- FSCJ 4330 - Criminal Investigations **3 credit hours**
- FSCJ 4340 - Crime Scene Investigation **3 credit hours**

Supporting Courses (15 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core)**
- MATH 2050 - Probability and Statistics **3 credit hours**
- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours**
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours**
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

Curriculum: Forensic Science

Freshman

- FRSC 1010 - Introduction to the Forensic Science Major **2 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 31 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- FSCJ 4330 - Criminal Investigations **3 credit hours**
- FSCJ 4340 - Crime Scene Investigation **3 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- CHEM 2230 - Quantitative Analysis **3 credit hours** AND
- CHEM 2231 - Quantitative Analysis Lab **2 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)

Subtotal: 30 Hours

Junior

- ANTH 3650 - Forensic Anthropology **3 credit hours** OR
- ANTH 3660 - Forensic Sciences **3 credit hours** OR
- FSCJ 4360 - Crime Scene Photography and Documentation **3 credit hours**

- Non-Written Communication **3 credit hours**
- Human Society and Social Relationships **3 credit hours**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

- FSCH 3530 - Principles of Biochemistry **4 credit hours** AND
- FSCH 3531 - Principles of Biochemistry Lab **0 credit hours**

- FSCH 4230 - Instrumental Analysis in Forensic Science **4 credit hours** AND
- FSCH 4231 - Instrumental Analysis in Forensic Science Lab **0 credit hours**

- BIOL 4570 - Principles of Toxicology **3 credit hours** AND
- BIOL 4571 - Principles of Toxicology Lab **0 credit hours**

Subtotal: 28 Hours

Senior

- BIOL 4375 - Forensic Taphonomy **3 credit hours**
- FRSC 4010 - Forensics Senior Seminar **2 credit hours**
- FRSC 4020 - Forensics Internship **4 credit hours**
- FSBI 4550 - Biotechnology **3 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- History and Civic Learning **6 credit hours**

- CHEM 4125 - Forensic Chemistry **4 credit hours** AND
- CHEM 4126 - Forensic Chemistry Laboratory **0 credit hours**

Subtotal: 31 Hours

College of Basic and Applied Sciences

CBAS 1110 - Science Seminar
1 credit hour Corequisite: Enrollment in dual enrollment CBAS course. Readings and discussion from scientific literature on a particular theme; discussion of ways science is communicated to the public and to the scientific community.

Data Science

DATA 1500 - Introduction to Data Science
3 credit hours (Same as BIA 1500.) Introduces basic principles and tools as well as its general mindset in data science. Concepts on how to solve a problem with data include business and data understanding, data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication.

DATA 2025 - Communicating with Data
3 credit hours
Understanding, analyzing, and communicating with real-world data through statistical concepts, data visualization, interpreting trends, creating data-driven narratives, and applying ethics.
TBC: Non-Written Communication

DATA 3500 - Data Cleansing and Feature Engineering
3 credit hours Prerequisite: CSCI 1170. Techniques and applications used to collect and integrate data, inspect the data for errors, visualize and summarize the data, clean the data, and prepare the data for modeling for various data types.

DATA 3550 - Applied Predictive Modeling
3 credit hours (Same as STAT 3550.) Prerequisite: CSCI 1170. An overview of the modeling process used in data science. Covers the ethics involved in data science, data preprocessing, regression models, classification models, and presenting the model.

DATA 4500 - Internship in Data Science
1 to 3 credit hours Prerequisites: Data Science major; approval of program director; a plan of activities with the associated employer prior to registration. Practical experience in a specific area of data science. Pass/Fail. May be repeated for a maximum of 6 credit hours; only 3 credit hours will count in the major.

DATA 4900 - Selected Topics in Data Science
3 credit hours Prerequisite: Permission of department. An in-depth study of a selected topic in data science to be chosen and announced at time of class scheduling. Repeatable up to 6 hours with permission of department.

DATA 4950 - Data Science Capstone
3 credit hours Prerequisites: Senior standing; Data Science major; DATA 3500 and DATA 3550. A project-based course that will utilize data science skills to prepare, display, model, analyze, and present data to solve a real-world problem.

Mathematics and Science Education

MSE 1010 - Step 1: Inquiry Approaches to Teaching
1 credit hour Prerequisite: An interest in exploring teaching. Readings, discussions, and activities associated with the planning and instruction of inquiry-based mathematics and/or science lessons. Includes field-based teaching.

MSE 2010 - Step 2: Inquiry Lesson Design
1 credit hour Prerequisite: MSE 1010. Builds on the lesson design skills developed in MSE 1010. Readings, discussions, and activities associated with the planning and instruction of inquiry-based mathematics or science lessons in the middle school. Includes field-based teaching.

MSE 2500 - Step 1/Step 2 Combination
2 credit hours Affords students seeking secondary school licensure in mathematics or the sciences a foundation in the planning, teaching, and delivering of instructional experiences. Includes field-based teaching.

MSE 3330 - Teaching Science in Secondary Grades
3 credit hours
Prerequisite: YOED 3520 required of all science majors seeking licensure in biology, chemistry, geosciences, and/or physics for grades 6-12 through the MTeach program. Must be completed prior to YOED 4400. Supports the development of prospective secondary science teachers' pedagogical content knowledge. Selected topics provide a foundation for inquiry-based instruction using three-dimensional learning.
NOTE: *MSE 3330 is required for biology, chemistry, geosciences, and physics majors with the MTeach minor. Agriculture majors minoring in MTeach with take AGRI 4740 in lieu of this course. Math students will take MATH 3340.*

Professional Seminar

PRSE 4910 - Professional Seminar
1 to 3 credit hours Prerequisites: Sixty credits and consent of instructor. A professional development seminar for students who want to learn about doing research and prepare for graduate school. May be repeated for up to six credits total.

Aerospace

Chaminda Prelis, Chair

Allen, Babb, Beckman, Callender, Corns, Craig, Fowler, Georgiou, Gossett, Hawkins, Lundberg, McDonald, Mosey, Neff, Rosser, Royster, Smith, Waters

Programs in the Department of Aerospace lead to the Bachelor of Science degree with a major in Aerospace and concentrations in Aviation Management, Flight Dispatch, Maintenance Management, Professional Pilot, Technology, Unmanned Aircraft Systems Operations (UAS), and Unmanned Aircraft Systems Technology (UAST). Minors in Aerospace and Unmanned Aircraft Systems are also available. All of these programs are designed to prepare students for professional positions in air transportation, aerospace manufacturing, or in operations supporting allied areas.

Accreditation

In addition to regional accreditation, the following programs are accredited by the Aviation Accreditation Board International: Aviation Management, Flight Dispatch, Maintenance Management, Professional Pilot, Technology, and USA Operations.

Academic Common Market

Since the Aerospace Department is a participant in the Academic Common Market, students from selected southern states may enroll at MTSU on an **in-state** fee basis. Further information is available from the department or Admissions Office.

Professional Relationships

MTSU holds membership in the Aviation Accreditation Board International, Aviation Technical Education Council, the National Business Aviation Association, the National Intercollegiate Flying Association, and the University Aviation Association.

Student Organizations

Recognized student organizations in Aerospace are Alpha Eta Rho, the international aviation fraternity (co-ed); AERO Maintenance Club of MTSU; Future Airport Executives (FAE), student chapter of the American Association of Airport Executives; Unmanned Aircraft Systems (UAS) Club; and Women in Aviation, the student chapter of Women in Aviation International.

Honors College

The Department of Aerospace regularly offers Honors sections of AERO 1010 and AERO 1020.

Graduate Study

The Aerospace Department offers a Master of Science in Aeronautical Science degree program. Requirements and a list of the courses offered for graduate credit are published in the Graduate Catalog.

Aerospace Minor

Department of Aerospace

A minimum of 18 semester hours is required for the minor. The minor may emphasize administrative or technical subject matter. Courses are chosen with the approval of the student's minor advisor.

Aerospace, Aviation Management Concentration, B.S.

Aerospace
615-898-2554
Alex Lundberg, program coordinator
Alex.Lundberg@mtsu.edu

The Aviation Management concentration offers instruction for students who are interested in careers in the various aspects of aviation management including airport management, air carrier management, fixed base operator (FBO) management, or aviation consulting. Selected True Blue Core and minor courses are interwoven with aerospace courses to provide students with a foundation for such careers. Students choosing a concentration in Aviation Management will select a specific segment of the industry in which to focus, either airport or airline management. A significant culminating experience, in the form of a capstone course appropriate to the area of focus, is required. Students in the Aviation Management concentration will complete several courses in the Business Administration minor .

NOTE: *All major courses, program accreditation, and/or Federal Aviation Administration (FAA) related coursework (physics, mathematics, and selected engineering technology courses) must be completed with a grade of C or better in order to graduate.*

Academic Map

Following is a printable, suggested four-year schedule of courses:
Aerospace, Aviation Management, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**52 hours**
Aerospace Core	*13 hours*
Aviation Mgmt. Concentration	*39 hours*
Supporting Courses	**28 hours***
Electives	**0-6 hours**
TOTAL	**120-127 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours may increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1530 or MATH 1710 or MATH 1810 (Quant Lit)
- CHEM 1010/CHEM 1011 or CHEM 1110/CHEM 1111 or PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111 (Sci Lit)

Major Requirements (52 hours)

Aerospace Core (13 hours)

- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**
- AERO 3020 - Aerospace Materials **3 credit hours**
- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 4040 - Professional Aviation Pathways **1 credit hour**

Aviation Management Concentration (39 hours)

- AERO 1230 - Aviation Laws and Regulations **3 credit hours**
- AERO 2010 - Aviation Weather **3 credit hours**
- AERO 2100 - Airline Management **3 credit hours**
- AERO 2230 - Professional Pilot I **3 credit hours**
- AERO 3110 - Airport Management **3 credit hours**
- AERO 3160 - Aviation Contracts and Leases **3 credit hours**
- AERO 3170 - Aviation Safety **3 credit hours**
- AERO 3230 - Crew Resource Management **3 credit hours**
- AERO 3510 - Instrument Operations in the National Airspace System **3 credit hours**
- AERO 4120 - Airport Operations **3 credit hours**
- AERO 4140 - Seminar in Airline Administration **3 credit hours**
- AERO 4150 - Fixed Base Operations Management **3 credit hours**
- AERO 4170 - Airport Capacity and Planning **3 credit hours**

Supporting Courses (28 hours)

- MATH 1530 - Applied Statistics **3 credit hours** OR
- MATH 1710 - College Algebra **3 credit hours** OR
- MATH 1810 - Applied Calculus I **3 credit hours (may be counted in the True Blue Core)**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** and
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours**
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** and
- CHEM 1111 - General Chemistry I Lab **0 credit hours**
  OR
- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** and
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** and
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours (may be counted in the True Blue Core)**

- MGMT 3810 - Human Resource Management **3 credit hours** OR
- MGMT 4710 - International Business **3 credit hours** OR
- Approved AERO UD elective **3 credit hours**

- MGMT 3620 - Supply Chain Operations **3 credit hours** OR
- MGMT 3890 - Managerial Decision Making **3 credit hours** OR
- Approved AERO UD elective **3 credit hours**

- BLAW 3400 - Legal Environment of Business **3 credit hours** OR
- BLAW 3430 - Commercial Law **3 credit hours**

- FIN 3000 - Survey of Finance **3 credit hours** OR
- FIN 3010 - Principles of Corporate Finance **3 credit hours**

- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
- INFS 2200 - Introduction to Microcomputing **3 credit hours**
- MGMT 3610 - Principles of Management **3 credit hours**

Electives (0-6 hours)

Curriculum: Aerospace, Aviation Management Concentration

Freshman Fall

- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**
- Written Communication **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**

- MATH 1530 - Applied Statistics **3 credit hours** (Quant Lit) OR
- MATH 1710 - College Algebra **3 credit hours** (Quant Lit) OR
- MATH 1810 - Applied Calculus I **3 credit hours** (Quant Lit)

Subtotal: 15 Hours

Freshman Spring

- AERO 1230 - Aviation Laws and Regulations **3 credit hours**
- AERO 2230 - Professional Pilot I **3 credit hours**
- Non-Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Human Society and Social Relationships **3 credit hours**

Subtotal: 15 Hours

Sophomore Fall

- AERO 2010 - Aviation Weather **3 credit hours**
- AERO 3510 - Instrument Operations in the National Airspace System **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **3 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours**
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours**
  OR
- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours**

Subtotal: 16 Hours

Sophomore Spring

- AERO 2100 - Airline Management **3 credit hours**
- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- History and Civic Learning **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Scientific Literacy **4 credit hours**

Subtotal: 16 Hours

Junior Fall

- AERO 3020 - Aerospace Materials **3 credit hours**
- AERO 3110 - Airport Management **3 credit hours**
- AERO 3170 - Aviation Safety **3 credit hours**
- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
- MGMT 3610 - Principles of Management **3 credit hours**

Subtotal: 15 Hours

Junior Spring

- AERO 3160 - Aviation Contracts and Leases **3 credit hours**
- AERO 3230 - Crew Resource Management **3 credit hours**
- AERO 4120 - Airport Operations **3 credit hours**

- FIN 3000 - Survey of Finance **3 credit hours** OR
- FIN 3010 - Principles of Corporate Finance **3 credit hours**

- BLAW 3400 - Legal Environment of Business **3 credit hours** OR
- BLAW 3430 - Commercial Law **3 credit hours**

Subtotal: 15 Hours

Senior Fall

- AERO 4140 - Seminar in Airline Administration **3 credit hours**
- AERO 4150 - Fixed Base Operations Management **3 credit hours**
- INFS 2200 - Introduction to Microcomputing **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**

- MGMT 3810 - Human Resource Management **3 credit hours** OR
- MGMT 4710 - International Business **3 credit hours**

Subtotal: 15 Hours

Senior Spring

- AERO 4040 - Professional Aviation Pathways **1 credit hour**
- AERO 4170 - Airport Capacity and Planning **3 credit hours**
- General electives **6 credit hours**

- MGMT 3620 - Supply Chain Operations **3 credit hours** OR
- MGMT 3890 - Managerial Decision Making **3 credit hours**

Subtotal: 13 Hours

Aerospace, Flight Dispatch Concentration, B.S.

Aerospace
615-898-2788
Andrea Georgiou, program coordinator
Andrea.Georgiou@mtsu.edu

The Flight Dispatch concentration offers instruction designed to meet the aviation industry's needs by preparing professional, corporate, and airline flight dispatchers. Selected True Blue Core and minor courses are interwoven with required aerospace courses to provide students with a foundation for careers in this area. Upon completion of the program, the FAA Flight Dispatch exam will be administered. Successful completion of this FAA exam is required for graduation. In addition to the academic requirements below, Flight Dispatch students must

1. adhere to the following requirements for these 14 CFR, Part 65 dispatch core courses: AERO 3080, AERO 3510, AERO 3630, AERO 4580, and AERO 4590;
    - online courses will not satisfy these requirements,
    - obtain at least a grade of 70 percent,
    - miss no more than 10 percent of the contact hours for each course,
    - make up all missed class time before the end of the semester,
    - retake a course if more than 10 percent is missed and/or obtain less than a 70 percent.
2. be at least 21 years of age before the Fall graduation date in order to enroll in AERO 4580.

NOTE: *All major courses, program accreditation, and/or Federal Aviation Administration (FAA) related coursework (physics, mathematics, and selected engineering technology courses) must be completed with a grade of C or better in order to graduate.*

Academic Map

Following is a printable, suggested four-year schedule of courses:
Aerospace, Flight Dispatch, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**43 hours**
Aerospace Core	*13 hours*
Flight Dispatch Concentration	*30 hours*
Supporting Courses	**32 hours***
Minor	**15-18 hours**
Electives	**0-6 hours**
TOTAL	**120-134 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1710 (Quant Lit)
- CHEM 1010/CHEM 1011 (Sci Lit)
- PHYS 2010/PHYS 2011 (Sci Lit)
- GEOG 2000 or PSY 1410 (HSSR)
- COMM 2200 (NWC)

Major Requirements (43 hours)

Aerospace Core (13 hours)

- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**
- AERO 3020 - Aerospace Materials **3 credit hours**
- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 4040 - Professional Aviation Pathways **1 credit hour**

Flight Dispatch Concentration (30 hours)

- AERO 2230 - Professional Pilot I **3 credit hours**
- AERO 1230 - Aviation Laws and Regulations **3 credit hours**
- AERO 2010 - Aviation Weather **3 credit hours**
- AERO 3080 - Aviation Weather II **3 credit hours**
- AERO 3170 - Aviation Safety **3 credit hours**
- AERO 3510 - Instrument Operations in the National Airspace System **3 credit hours**
- AERO 3230 - Crew Resource Management **3 credit hours**
- AERO 3630 - Introduction to Air Traffic Control **3 credit hours**
- AERO 4580 - Flight Dispatch and ATP Written Preparation **3 credit hours**
- AERO 4590 - Flight Dispatch **3 credit hours**

Supporting Courses (32 hours)

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CSCI 1150 - Computer Orientation **3 credit hours** OR
- INFS 2200 - Introduction to Microcomputing **3 credit hours** OR
- INFS 3100 - Principles of Management Information Systems **3 credit hours**

- GEOG 3410 - Cultures and Landscapes of the United States and Canada **3 credit hours** OR
- GEOL 4050 - Meteorology **3 credit hours**

- MATH 1710 - College Algebra **3 credit hours (may be counted in the True Blue Core)**
- MATH 1810 - Applied Calculus I **3 credit hours**
- COMM 2200 - Audience-Centered Communication **3 credit hours (may be counted in the True Blue Core)**
- MGMT 3610 - Principles of Management **3 credit hours**

- MGMT 3810 - Human Resource Management **3 credit hours** OR
- MGMT 3890 - Managerial Decision Making **3 credit hours** OR
- MGMT 4490 - Industrial Relations Legislation **3 credit hours** OR
- MGMT 4510 - Unions and Collective Bargaining **3 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours (may be counted in the True Blue Core)**

- GEOG 2000 - Introduction to Regional Geography **3 credit hours** OR
- PSY 1410 - General Psychology **3 credit hours (may be counted in the True Blue Core)**

Minor (15-18 hours)

Selected from Computer Science, Geology, Information Systems, Physical Geography, or other science- or business-related field approved by the program coordinator.

Electives (0-6 hours)

Curriculum: Aerospace, Flight Dispatch Concentration

Freshman

- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**
- AERO 1230 - Aviation Laws and Regulations **3 credit hours**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- MATH 1710 - College Algebra **3 credit hours** (Quant Lit)
- MATH 1810 - Applied Calculus I **3 credit hours**

- CSCI 1150 - Computer Orientation **3 credit hours** OR
- INFS 2200 - Introduction to Microcomputing **3 credit hours** OR
- INFS 3100 - Principles of Management Information Systems **3 credit hours**

- GEOG 2000 - Introduction to Regional Geography **3 credit hours** (HSSR) OR
- PSY 1410 - General Psychology **3 credit hours** (HSSR)

Subtotal: 30 Hours

Sophomore

- COMM 2200 - Audience-Centered Communication **3 credit hours** (NWC)
- AERO 2010 - Aviation Weather **3 credit hours**
- AERO 2230 - Professional Pilot I **3 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours** (Sci Lit)
- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)

- AERO 3510 - Instrument Operations in the National Airspace System **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**

Subtotal: 32 Hours

Junior

- AERO 3020 - Aerospace Materials **3 credit hours**
- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 3080 - Aviation Weather II **3 credit hours**
- AERO 3170 - Aviation Safety **3 credit hours**
- AERO 3230 - Crew Resource Management **3 credit hours**
- AERO 3630 - Introduction to Air Traffic Control **3 credit hours**

- GEOG 3410 - Cultures and Landscapes of the United States and Canada **3 credit hours** OR
- GEOL 4050 - Meteorology **3 credit hours**

- MGMT 3610 - Principles of Management **3 credit hours**
- History and Civic Learning **3 credit hours**
- Minor course **3 credit hours**

Subtotal: 30 Hours

Senior

- AERO 4040 - Professional Aviation Pathways **1 credit hour**
- AERO 4580 - Flight Dispatch and ATP Written Preparation **3 credit hours**
- AERO 4590 - Flight Dispatch **3 credit hours**

- MGMT 3810 - Human Resource Management **3 credit hours** OR
- MGMT 3890 - Managerial Decision Making **3 credit hours** OR
- MGMT 4490 - Industrial Relations Legislation **3 credit hours** OR
- MGMT 4510 - Unions and Collective Bargaining **3 credit hours**

- Minor courses **12 credit hours**
- Minor course/Elective **3 credit hours**
- Elective **3 credit hours**

Subtotal: 28 Hours

Aerospace, Maintenance Management Concentration, B.S.

Aerospace
615-898-2788
Joe Hawkins, program coordinator
joe.hawkins@mtsu.edu

The Maintenance Management concentration offers instruction for students who are interested in careers as skilled technicians or managers in aircraft manufacturing, aircraft repair, and engine overhaul. The fundamental skills needed in aerospace vehicle repair and maintenance are stressed together with management skills for such careers. MTSU is an approved Federal Aviation Administration (FAA) FAR Part 147 maintenance technician school for airframe and powerplant mechanics. In addition to the requirements listed below, the FAA Airframe and Powerplant Certification is required prior to graduation. Please see detailed maintenance training requirements following academic requirements (below).

NOTE: *All major courses, program accreditation, and/or Federal Aviation Administration (FAA) related coursework (physics, mathematics, and selected engineering technology courses) must be completed with a grade of C or better in order to graduate.*

Academic Map

Following is a printable, suggested four-year schedule of courses:
Aerospace, Maintenance Management, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**76 hours**
Aerospace Core	*13 hours*
Maintenance Mgmt. Concentration	*60 hours*
Capstone Couse	*3 hours*
Supporting Courses	**27 hours***
TOTAL	**133-144 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 133 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1710 (Quant Lit)
- CHEM 1010/CHEM 1011 or CHEM 1110/CHEM 1111 (Sci Lit)
- PHYS 2010/PHYS 2011 (Sci Lit)

Major Requirements (76 hours)

Aerospace Core (13 hours)

- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**
- AERO 3020 - Aerospace Materials **3 credit hours**
- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 4040 - Professional Aviation Pathways **1 credit hour**

Maintenance Management Concentration (60 hours)

- AERO 1340 - Introduction to Aerospace Maintenance **3 credit hours**
- AERO 1380 - Aerospace Maintenance Shop Practices **3 credit hours**
- AERO 2331 - Airframe Inspection **3 credit hours**
- AERO 2342 - Powerplant Inspection **3 credit hours**
- AERO 2371 - Aircraft Welding **3 credit hours**
- AERO 2381 - Non-Metallic Structures: Dope, Fabric, and Finishing **3 credit hours**
- AERO 3301 - Sheet Metal Repair **3 credit hours**
- AERO 3322 - Aerospace Reciprocating Engine Overhaul **3 credit hours**
- AERO 3362 - Advanced Aerospace Engine Systems Maintenance and Repair **3 credit hours**
- AERO 3371 - Aircraft Finishing and Non-Destructive Inspection **3 credit hours**
- AERO 3392 - Reciprocating Engine Maintenance Repair **3 credit hours**
- AERO 4301 - Advanced Aerospace Vehicle Structural Repair **3 credit hours**
- AERO 4310 - Aerospace Vehicle Systems **3 credit hours**
- AERO 4311 - Aerospace Accessory Systems Maintenance and Repair **3 credit hours**
- AERO 4312 - Turbine Engine System **3 credit hours**
- AERO 4332 - Reciprocating Engine Troubleshooting **3 credit hours**
- AERO 4342 - Turbine Engine Inspection and Troubleshooting **3 credit hours**
- AERO 4371 - Advanced Aerospace Vehicle Systems Overhaul **3 credit hours**
- AERO 4381 - Advanced Aerospace Accessory Systems Maintenance and Repair **3 credit hours**
- AERO 4392 - Aerospace Turbine Engine Maintenance and Overhaul **3 credit hours**

Capstone Course (3 hours)

- AERO 4340 - Maintenance Management Capstone **3 credit hours**

Supporting Courses (27 hours)

- ET 2310 - Computer-Assisted Drafting and Design I **3 credit hours**
- ET 3610 - Introduction to Electricity and Electronics **4 credit hours**
- MATH 1710 - College Algebra **3 credit hours (may be counted in the True Blue Core)**

- MATH 1810 - Applied Calculus I **3 credit hours** OR
- MATH 1910 - Calculus I **4 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)** OR
- CHEM 1110 - General Chemistry I **4 credit hours**
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- MGMT 3610 - Principles of Management **3 credit hours** OR
- ET 3910 - Introduction to Operations Management **3 credit hours**

- MGMT 3810 - Human Resource Management **3 credit hours** OR
- MGMT 4490 - Industrial Relations Legislation **3 credit hours** OR
- MGMT 4510 - Unions and Collective Bargaining **3 credit hours** OR
- ENTR 4920 - Small Business Management **3 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours (may be counted in the True Blue Core)**

Curriculum: Aerospace, Maintenance Management

Freshman

- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**
- AERO 1340 - Introduction to Aerospace Maintenance **3 credit hours**
- AERO 1380 - Aerospace Maintenance Shop Practices **3 credit hours**
- ET 2310 - Computer-Assisted Drafting and Design I **3 credit hours**
- MATH 1710 - College Algebra **3 credit hours** (Quant Lit)
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Non-Written Communication **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**

- MATH 1810 - Applied Calculus I **3 credit hours** OR
- MATH 1910 - Calculus I **4 credit hours**

Subtotal: 36 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- AERO 2331 - Airframe Inspection **3 credit hours**
- AERO 2342 - Powerplant Inspection **3 credit hours**
- AERO 2371 - Aircraft Welding **3 credit hours**
- AERO 2381 - Non-Metallic Structures: Dope, Fabric, and Finishing **3 credit hours**
- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 4310 - Aerospace Vehicle Systems **3 credit hours**

- ET 3610 - Introduction to Electricity and Electronics **4 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)

Subtotal: 35 Hours

Junior

- AERO 3020 - Aerospace Materials **3 credit hours**
- AERO 3301 - Sheet Metal Repair **3 credit hours**
- AERO 3322 - Aerospace Reciprocating Engine Overhaul **3 credit hours**
- AERO 4301 - Advanced Aerospace Vehicle Structural Repair **3 credit hours**
- AERO 4311 - Aerospace Accessory Systems Maintenance and Repair **3 credit hours**
- AERO 4312 - Turbine Engine System **3 credit hours**
- AERO 4332 - Reciprocating Engine Troubleshooting **3 credit hours**
- AERO 4342 - Turbine Engine Inspection and Troubleshooting **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **3 credit hours**

Subtotal: 30 Hours

Senior

- AERO 3362 - Advanced Aerospace Engine Systems Maintenance and Repair **3 credit hours**
- AERO 3371 - Aircraft Finishing and Non-Destructive Inspection **3 credit hours**
- AERO 3392 - Reciprocating Engine Maintenance Repair **3 credit hours**
- AERO 4040 - Professional Aviation Pathways **1 credit hour**
- AERO 4340 - Maintenance Management Capstone **3 credit hours**
- AERO 4371 - Advanced Aerospace Vehicle Systems Overhaul **3 credit hours**
- AERO 4381 - Advanced Aerospace Accessory Systems Maintenance and Repair **3 credit hours**
- AERO 4392 - Aerospace Turbine Engine Maintenance and Overhaul **3 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours** (Sci Lit)
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- MGMT 3810 - Human Resource Management **3 credit hours** OR
- MGMT 4490 - Industrial Relations Legislation **3 credit hours** OR
- MGMT 4510 - Unions and Collective Bargaining **3 credit hours** OR
- ENTR 4920 - Small Business Management **3 credit hours**

- MGMT 3610 - Principles of Management **3 credit hours** OR
- ET 3910 - Introduction to Operations Management **3 credit hours**

Subtotal: 32 Hours

Aircraft Maintenance Training Additional Requirements

The Aerospace Department offers maintenance training which will qualify students for the FAA's Airframe and Powerplant Mechanics Certificate. Students enrolled in the following courses and wanting to receive credit towards the FAA Airframe and Powerplant Certificate through the MTSU FAR 147 program must

1. complete a 147 program application with the program coordinator prior to registering for 147 courses;
2. miss no more than 10 percent of the contact hours of a course;
3. make up all class time missed;
4. ensure that all attendance/grading for 147 courses completed outside the Aerospace Department are recorded on MTSU Form 147-1 attendance record and submitted to the program coordinator;
5. receive at least 70 percent on all projects, final exams, and final course grades;
6. provide their own basic hand tools within thirty days of enrollment;
7. must retake the course if they 1) miss more than 10 percent of class time; 2) score below a 70 for the course grade; 3) score below a 70 on the final exam for a course after the approved number of retakes; 4) do not complete all practical exercises with a score of at last 70 percent.

The following courses are required for the Airframe and Powerplant Certificate qualification:

- AERO 1020 - Theory of Flight **3 credit hours**
- AERO 1340 - Introduction to Aerospace Maintenance **3 credit hours**
- AERO 1380 - Aerospace Maintenance Shop Practices **3 credit hours**
- AERO 2331 - Airframe Inspection **3 credit hours**
- AERO 2342 - Powerplant Inspection **3 credit hours**
- AERO 2371 - Aircraft Welding **3 credit hours**
- AERO 2381 - Non-Metallic Structures: Dope, Fabric, and Finishing **3 credit hours**
- AERO 3020 - Aerospace Materials **3 credit hours**
- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 3301 - Sheet Metal Repair **3 credit hours**
- AERO 3322 - Aerospace Reciprocating Engine Overhaul **3 credit hours**
- AERO 3362 - Advanced Aerospace Engine Systems Maintenance and Repair **3 credit hours**
- AERO 3392 - Reciprocating Engine Maintenance Repair **3 credit hours**
- AERO 4301 - Advanced Aerospace Vehicle Structural Repair **3 credit hours**
- AERO 4310 - Aerospace Vehicle Systems **3 credit hours**
- AERO 4311 - Aerospace Accessory Systems Maintenance and Repair **3 credit hours**
- AERO 4312 - Turbine Engine System **3 credit hours**
- AERO 4332 - Reciprocating Engine Troubleshooting **3 credit hours**
- AERO 4342 - Turbine Engine Inspection and Troubleshooting **3 credit hours**
- AERO 4371 - Advanced Aerospace Vehicle Systems Overhaul **3 credit hours**
- AERO 4381 - Advanced Aerospace Accessory Systems Maintenance and Repair **3 credit hours**
- AERO 4392 - Aerospace Turbine Engine Maintenance and Overhaul **3 credit hours**
- ET 2310 - Computer-Assisted Drafting and Design I **3 credit hours**
- ET 3610 - Introduction to Electricity and Electronics **4 credit hours**

- MATH 1710 - College Algebra **3 credit hours** OR
- MATH 1730 - Pre-Calculus **4 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

Maintenance Management Advanced Standing

Only students pursuing the Maintenance Management concentration may receive advanced standing for FAA Technician certificates held.

Students seeking advanced standing on the basis of possession of the Airframe or Powerplant (or both) Technician Certificates must produce documentation to substantiate prior training to the dean of the College of Basic and Applied Sciences through the chair of the Aerospace Department. In addition, each applicant will be required to pass an oral or written examination covering the course content of each course for which advanced standing is requested. Twenty-four semester hours will be the maximum credit allowed if both certificates are held.

Holders of an FAA Airframe Technician Certificate may be granted credit for the following courses:

- AERO 1020 - Theory of Flight **3 credit hours**
- AERO 1380 - Aerospace Maintenance Shop Practices **3 credit hours**
- AERO 3301 - Sheet Metal Repair **3 credit hours**
- AERO 4310 - Aerospace Vehicle Systems **3 credit hours**

Holders of an FAA Powerplant Technician Certificate may be granted credit for the following courses:

- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 3322 - Aerospace Reciprocating Engine Overhaul **3 credit hours**
- AERO 3362 - Advanced Aerospace Engine Systems Maintenance and Repair **3 credit hours**
- AERO 3392 - Reciprocating Engine Maintenance Repair **3 credit hours**

NOTE:

Holders of FAA Repairmen Certificates and former military mechanics who are not holders of an FAA Maintenance Technician Certificate may not be granted specific course credit for their experiences.

Aerospace, Professional Pilot Concentration, B.S.

Aerospace
615-898-2788
Tyler Babb, program coordinator
Tyler.Babb@mtsu.edu

The Professional Pilot concentration offers instruction for students who are interested in careers as commercial pilots. In addition to the requirements listed below, the Professional Pilot concentration requires completion of the Instrument Rating-Airplane, the Commercial Single-Engine Pilot Certificate, and the Commercial Multi-Engine Pilot Certificate with Instrument Rating, all at the MTSU Flight School and while enrolled in flight labs. Upon completion, MTSU has been authorized by the FAA to award 500 hours of flight time credit toward the R-ATP certificate. Please see **Additional Requirements** section below academic requirements for details on flight training requirements for this program.

NOTE: *All major courses, program accreditation, and/or Federal Aviation Administration (FAA) related coursework (physics, mathematics, and selected engineering technology courses) must be completed with a grade of C or better in order to graduate.*

Academic Map

Following is a printable, suggested four-year schedule of courses:
Aerospace, Professional Pilot, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**60 hours**
Aerospace Core	*13 hours*
Professional Pilot Concentration	*47 hours*
Supporting Courses	**26 hours***
Electives	**0-4 hours**
TOTAL	**120-127 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1710 (Quant Lit)
- CHEM 1010/CHEM 1011 (Sci Lit)
- PHYS 2010/PHYS 2011 (Sci Lit)

Major Requirements (60 hours)

Aerospace Core (13 hours)

- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**
- AERO 3020 - Aerospace Materials **3 credit hours**
- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 4040 - Professional Aviation Pathways **1 credit hour**

Professional Pilot Concentration (47 hours)

- AERO 1230 - Aviation Laws and Regulations **3 credit hours**
- AERO 2010 - Aviation Weather **3 credit hours**
- AERO 2230 - Professional Pilot I **3 credit hours**
- AERO 2201 - Professional Pilot Flight Lab I **2 credit hours**
- AERO 3170 - Aviation Safety **3 credit hours**
- AERO 3210 - Professional Pilot II **3 credit hours**
- AERO 3203 - Professional Pilot Flight Lab II **2 credit hours**
- AERO 3215 - Professional Pilot III **3 credit hours**
- AERO 3204 - Professional Pilot Flight Lab III **2 credit hours**
- AERO 3240 - Professional Pilot IV **3 credit hours**
- AERO 3261 - Professional Pilot Flight Lab IV **1 credit hour**
- AERO 3230 - Crew Resource Management **3 credit hours**
- AERO 3440 - Fundamentals of Aerodynamics **3 credit hours**
- AERO 4250 - Professional Pilot V **3 credit hours**
- AERO 4310 - Aerospace Vehicle Systems **3 credit hours**
- AERO 4440 - Aircraft Performance **3 credit hours**

Choose 4 credit hours from the following:

- AERO 3080 - Aviation Weather II **3 credit hours**
- AERO 3202 - Cross-Country Flight Lab (25 Hours) **1 credit hour**
- AERO 3205 - Conventional Landing Gear Airplane Laboratory **1 credit hour**
- AERO 3212 - Cross-Country Flight Lab (50 Flight Hours) **2 credit hours**
- AERO 3222 - High-Altitude Aircraft Operations Laboratory **1 credit hour**
- AERO 3223 - High-Performance Aircraft Flight Laboratory **1 credit hour**
- AERO 3241 - Air Charter Flight Laboratory **1 credit hour**
- AERO 3362 - Advanced Aerospace Engine Systems Maintenance and Repair **3 credit hours**
- AERO 3630 - Introduction to Air Traffic Control **3 credit hours**
- AERO 4130 - Aerospace Physiology **3 credit hours**
- AERO 4201 - Flight Instructor-Airplane Lab **1 credit hour**
- AERO 4202 - Flight Instructor-Instrument Lab **1 credit hour**
- AERO 4203 - Flight Instructor-Multi-Engine Lab **1 credit hour**
- AERO 4210 - Flight Instructor Fundamentals **3 credit hours**

Supporting Courses (26 hours)

- BCED 3510 - Business Communication **3 credit hours** OR
- ENGL 3620 - Professional Writing **3 credit hours**

- MATH 1710 - College Algebra **3 credit hours (may be counted in the True Blue Core)**
- MATH 1810 - Applied Calculus I **3 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours (may be counted in the True Blue Core)**

Choose 9 credit hours from the following:

- COMM 3220 - Small Group Communication **3 credit hours**
- COMM 3340 - Interviewing **3 credit hours**
- COMM 2560 - Intercultural Communication **3 credit hours**
- GS 2010 - Introduction to Cross-Cultural Experiences **3 credit hours**
- MGMT 3610 - Principles of Management **3 credit hours**
- MGMT 3940 - Ethical Leadership in Business **3 credit hours**
- PHIL 3150 - Ethics **3 credit hours**
- PSY 4330 - Industrial and Organizational Training and Development **3 credit hours**
- PSY 4370 - Motivation and Work Attitudes **3 credit hours**
- PSY 4380 - Group Dynamics **3 credit hours**

Electives (0-4 hours)

Curriculum: Aerospace, Professional Pilot

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**
- AERO 2010 - Aviation Weather **3 credit hours**
- AERO 2230 - Professional Pilot I **3 credit hours**
- AERO 2201 - Professional Pilot Flight Lab I **2 credit hours**
- MATH 1710 - College Algebra **3 credit hours** (Quant Lit)
- MATH 1810 - Applied Calculus I **3 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours** (Sci Lit)

Subtotal: 30 Hours

Sophomore

- AERO 1230 - Aviation Laws and Regulations **3 credit hours**
- AERO 3170 - Aviation Safety **3 credit hours**
- AERO 3210 - Professional Pilot II **3 credit hours**
- AERO 3203 - Professional Pilot Flight Lab II **2 credit hours**
- AERO 3215 - Professional Pilot III **3 credit hours**
- AERO 3204 - Professional Pilot Flight Lab III **2 credit hours**
- Human Society and Social Relationships **6 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)

Subtotal: 29 Hours

Junior

- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 3230 - Crew Resource Management **3 credit hours**
- AERO 3240 - Professional Pilot IV **3 credit hours**
- AERO 3261 - Professional Pilot Flight Lab IV **1 credit hour**
- AERO 3440 - Fundamentals of Aerodynamics **3 credit hours**
- AERO 4310 - Aerospace Vehicle Systems **3 credit hours**
- Non-Written Communication **3 credit hours**
- History and Civic Learning **3 credit hours**
- Supporting electives **6 credit hours**
- AERO elective **3-4 credit hours**
  (NOTE: CFI and Lab recommended - AERO 4210 and AERO 4201)

Subtotal: 31-32 Hours

Senior

- AERO 3020 - Aerospace Materials **3 credit hours**
- AERO 4040 - Professional Aviation Pathways **1 credit hour**
- AERO 4250 - Professional Pilot V **3 credit hours**
- AERO 4440 - Aircraft Performance **3 credit hours**

- BCED 3510 - Business Communication **3 credit hours** OR
- ENGL 3620 - Professional Writing **3 credit hours**

- Creativity and Cultural Expression **6 credit hours**
- History and Civic Learning **3 credit hours**
- Supporting elective **3 credit hours**
- Aerospace electives* **2-6 credit hours**
  (If PPL not earned at MTSU and/or open electives if needed)
  * May be selected from AERO 3080, AERO 3202, AERO 3205, AERO 3222, AERO 3223, AERO 3241, AERO 3362, AERO 3630, AERO 4201, AERO 4202, AERO 4203, or AERO 4210.

Subtotal: 27-29 Hours

Additional Requirements

In addition to all academic requirements, this concentration requires students to obtain pilot certificates through flight training conducted at the MTSU Flight School. All required flight training must be conducted in a flight lab, in University-owned and maintained aircraft, and by flight instructors screened and trained for their positions by MTSU. Admission to the University does not guarantee enrollment in a flight lab. To enroll in a flight lab, students must submit a Flight Lab Request Form for each and every semester they wish to fly. The deadlines to submit Flight Lab Request Forms are posted on the MTSU Aerospace webpage www.mtsu.edu/aerospace.

Flight Lab Request Forms submitted after the deadline may not be considered. Enrollment in flight labs is limited and selection is made from eligible candidates who are best qualified based on cumulative GPA. **Students must have completed 12 hours of college credit post high school graduation to be eligible for a flight lab.** To become eligible for a flight lab, candidates must meet the following minimum standards:

1. have a current Second Class FAA medical certificate with at least third class privileges;
2. must be in good standing within the department and University (if a transfer student, candidate cannot be on probation in any form);
3. have no physical limitation that would prohibit completion of the course requirements, including meeting weight and size limitations of training aircraft;
4. have the full required amount of flight lab funds deposited in their flight accounts **by the funding deadline listed in the lab award email (typically by 4:30 p.m. the Friday before classes start)**;
5. have completed all required prerequisite classes for the desired lab;
6. for US citizens or permanent green card holders, present a valid current passport OR an original state-issued birth certificate AND a valid government-issued picture ID on the first day of class; for international students, receive approval from the Transportation Security Administration and the Flight Training Security Program (FTSP) prior to the first day of class.

Completion of the Professional Pilot concentration is contingent upon completing all required flight labs. Students not meeting the above criteria may need to consider selecting another concentration.

Failure to maintain adequate progress as defined in the MTSU Flight Operations Manual, including but not limited to excessive flight time, multiple stage check failures, and multiple checkride failures, may result in referral to the Flight Review Board for determination of student continuation in flight training.

Students are expected to act professionally and hold themselves to a code of conduct. Failure to meet this requirement is determined by the Flight School management and may result in referral to the Flight Review Board for determination of student continuation in flight training.

Intentional violation of any MTSU safety practice or procedure or any FAA regulations will result in an immediate flight hold pending investigation and may result in termination from flight training.

Lab students are required to complete required-attendance events per seven-day week and will be held to an attendance policy. Details can be found in the Operations Manual. Failure to meet the attendance policy may result in removal from flight training.

There are substantial lab fees for each flight lab. Flight fees will be paid directly to MTSU, and students must maintain a positive balance in their training accounts at all times. Lab fee information and a complete explanation of all requirements for flight labs can be found in the Flight Lab Guide obtained through the MTSU Aerospace website, at the MTSU Flight School, or Aerospace Department main office.

Students admitted to the Professional Pilot program must receive all required flight training beyond the Private Pilot Certificate at the MTSU Flight School. Credit for flight time, including cross-country flight time obtained by the student after becoming a Private Pilot, is very limited and is determined by FAA and MTSU regulations. Students entering MTSU who already hold an FAA Instrument-Airplane Rating and/or an FAA Commercial Pilot Certificate are not eligible for the Professional Pilot Certification.

NOTE: Students interested in military flying careers should contact their local Armed Forces recruiting officer or MTSU's Reserve Officer Training Corps (ROTC) program representatives. Air Force ROTC program information can be obtained by calling (615) 963-5931. For information regarding the Army ROTC program, call (615) 898-2470. Please see Army ROTC for additional information.

Aerospace, Technology Concentration, B.S.

Aerospace
615-898-2788
Nate Callender, program coordinator
Nate.Callender@mtsu.edu

The Technology concentration is designed for students seeking preparation for advanced study at the graduate level. Students will receive a strong background in mathematics, the sciences, engineering technology, and the more technical courses in aerospace. In addition to aerospace specific coursework, the concentration's curriculum requires the completion of minors in Mathematics and Engineering Technology, two semesters of computer programming and calculus-based physics, and the completion of a senior research project. Aerospace Technology students have access to an array of research resources to include wind tunnels, water tunnels, small unmanned aircraft, computational fluid dynamics (CFD) software operating on workstation computers, and undergraduate grant funding provided by MTSU's Undergraduate Research and Creative Activities (URECA) program. Motivated Aerospace Technology students with high academic abilities are encouraged to choose a double major in either Professional Mathematics or Professional Physics.

NOTE: *All major courses, program accreditation, and/or Federal Aviation Administration (FAA) related coursework (physics, mathematics, and selected engineering technology courses) must be completed with a grade of C or better in order to graduate.*

Academic Map

Following is a printable, suggested four-year schedule of courses:
Aerospace, Technology Concentration, B.S.

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**28 hours**
Aerospace Core	*13 hours*
Technology Concentration	*15 hours*
Supporting Courses	**23 hours***
Mathematics Minor	**15 hours***
Engineering Technology Minor	**21 hours**
TOTAL	**120-128 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit) (Also counts in Mathematics minor)
- CHEM 1010/CHEM 1011 OR CHEM 1110/CHEM 1111 (Sci Lit)
- PHYS 2110/PHYS 2111 (Sci Lit)

Major Requirements (28 hours)

Aerospace Core (13 hours)

- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**
- AERO 3020 - Aerospace Materials **3 credit hours**
- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 4040 - Professional Aviation Pathways **1 credit hour**

Technology Concentration (15 hours)

- AERO 3170 - Aviation Safety **3 credit hours**
- AERO 3440 - Fundamentals of Aerodynamics **3 credit hours**
- AERO 4310 - Aerospace Vehicle Systems **3 credit hours**
- AERO 4410 - Aerospace Technology Research Capstone **3 credit hours**
- AERO 4440 - Aircraft Performance **3 credit hours**

Supporting Courses (23 hours)

- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**
- ENGR 2130 - Electrical Circuit Analysis I **3 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)** OR
- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours (may be counted in the True Blue Core)**

- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Mathematics Minor (15 hours)

- **MATH 1910**
- See **Mathematics Minor** for further information.

(**NOTE:** *MATH 1910 counts for the Quantitative Literacy True Blue Core requirement and for one hour in this minor.)*

Engineering Technology Minor (21 hours)
See **Engineering Technology Minor** for further information.

Curriculum: Aerospace, Technology Concentration

Freshman
- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**
- ENGR 1100 - Engineering Fundamentals **3 credit hours**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- History and Civic Learning **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**

Subtotal: 32 Hours

Sophomore
- AERO 3020 - Aerospace Materials **3 credit hours**
- Non-Written Communication **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **3 credit hours**
- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- ET 3810 - Engineering Thermodynamics **3 credit hours**
- ENGR 2110 - Statics **3 credit hours**

- PHYS 2110 - Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours** (Sci Lit)

- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Subtotal: 32 Hours

Junior
- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 3170 - Aviation Safety **3 credit hours**
- AERO 3440 - Fundamentals of Aerodynamics **3 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**
- ENGR 2120 - Dynamics **3 credit hours**
- MATH 3120 - Differential Equations I **3 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- Creativity and Cultural Expression **3 credit hours**

- ENGR 3590 - Kinematics and Dynamics of Machinery **3 credit hours** OR
- ET 4830 - Vibration **3 credit hours**

Subtotal: 29 Hours

Senior

- AERO 4040 - Professional Aviation Pathways **1 credit hour**
- AERO 4310 - Aerospace Vehicle Systems **3 credit hours**
- AERO 4410 - Aerospace Technology Research Capstone **3 credit hours**
- AERO 4440 - Aircraft Performance **3 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours** (Sci Lit)
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- ENGR 2130 - Electrical Circuit Analysis I **3 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**

- ENGR 3550 - Fluid Mechanics **3 credit hours** OR
- ET 4850 - Fluid Power **3 credit hours**

- ENGR 3560 - Mechanics of Materials **3 credit hours** OR
- ET 3860 - Strength of Materials **3 credit hours**

Subtotal: 27 Hours

Aerospace, Unmanned Aircraft Systems Operations Concentration, B.S.

Aerospace
615-898-2788
Kevin Corns, program coordinator
Kevin.Corns@mtsu.edu

The Unmanned Aircraft Systems Operations (UAS) concentration offers instruction for students who are interested in a career in unmanned aviation. Career opportunities include flying remotely piloted aircraft, providing support services (consulting, data analysis, UAS construction/modification /repair, etc.), or filling managerial roles at a company operating UAS. Students may choose to complete a Private Pilot Certificate at the MTSU Flight School or may complete Remote Pilot Certification as part of the AERO 2710 - sUAS Remote Pilot Certification.

NOTE: *All major courses, program accreditation, and/or Federal Aviation Administration (FAA) related coursework (physics, mathematics, and selected engineering technology courses) must be completed with a grade of C or better in order to graduate.*

Academic Map

Following is a printable, suggested four-year schedule of courses:

Aerospace, Unmanned Aircraft Systems Operations, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**43 hours***
Aerospace Core	*13 hours*
UAS Concentration	*30 hours*
Supporting Courses	**8-9 hours***
Geospatial Analysis Minor	**17 hours**
Second Minor	**15-18 hours**
Electives	**0-7 hours**
TOTAL	**120-127 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1710 or MATH 1810 or MATH 1910 (Quant Lit)
- PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111 (Sci Lit)
- PGEO 1030 (Sci Lit)

Major Requirements (43 hours)

Aerospace Core Requirement (13 hours)

- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**
- AERO 3020 - Aerospace Materials **3 credit hours**
- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 4040 - Professional Aviation Pathways **1 credit hour**

Unmanned Aircraft Systems (UAS) Operations Concentration (30 hours)

- AERO 1710 - Introduction to Unmanned Aircraft Systems **3 credit hours**
- AERO 2010 - Aviation Weather **3 credit hours**

- AERO 2201 - Professional Pilot Flight Lab I **2 credit hours** OR
- AERO 2710 - sUAS Remote Pilot Certification **2 credit hours**

- AERO 3170 - Aviation Safety **3 credit hours**

- AERO 3210 - Professional Pilot II **3 credit hours** OR
- AERO 3510 - Instrument Operations in the National Airspace System **3 credit hours**

- AERO 3710 - Unmanned Aircraft **1 credit hour** AND
- AERO 3711 - Unmanned Aircraft Lab **2 credit hours**

- AERO 3720 - Unmanned Aircraft Systems **1 credit hour** AND
- AERO 3721 - Unmanned Aircraft Systems Lab **2 credit hours**

- AERO 3730 - Unmanned Remote Sensing **1 credit hour** AND
- AERO 3731 - Unmanned Remote Sensing Lab **2 credit hours**

- AERO 4700 - Advanced UAS Operations and Applications **4 credit hours** AND
- AERO 4701 - Advanced UAS Operations and Applications Lab **0 credit hours**

- AERO 4710 - Unmanned Aircraft Systems Operations Capstone **3 credit hours**

Supporting Courses (8-9 hours)

- EXL 4000 - Experiential Learning Seminar **1 credit hour**

- MATH 1710 - College Algebra **3 credit hours** OR
- MATH 1810 - Applied Calculus I **3 credit hours** OR
- MATH 1910 - Calculus I **4 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours**

Geospatial Analysis Minor (17 hours)
See Geospatial Analysis Minor for requirements.

Minor (15-18 hours)
Choose from the following:
Agriculture Minor, Archaeology Minor, Business Administration Minor, Construction Management Minor, Engineering Technology Minor, Management Minor, Photography Minor, Precision Agriculture Minor, or Video and Film Production Minor.

Electives (0-7 hours)

Curriculum: Aerospace, Unmanned Aircraft Systems Operations Concentration

Freshman
- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**
- AERO 1710 - Introduction to Unmanned Aircraft Systems **3 credit hours**
- AERO 2010 - Aviation Weather **3 credit hours**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- History and Civic Learning **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- PGEO 1030 - Physical Geography **4 credit hours** (Sci Lit)

- MATH 1710 - College Algebra **3 credit hours** (Quant Lit) OR
- MATH 1810 - Applied Calculus I **3 credit hours** (Quant Lit) OR
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)

Subtotal: 31-32 Hours

Sophomore
- AERO 2201 - Professional Pilot Flight Lab I **2 credit hours** OR
- AERO 2710 - sUAS Remote Pilot Certification **2 credit hours**

- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 3170 - Aviation Safety **3 credit hours**

- AERO 3210 - Professional Pilot II **3 credit hours** OR
- AERO 3510 - Instrument Operations in the National Airspace System **3 credit hours**

- PGEO 4530 - Geographic Information Systems **3 credit hours**
- PGEO 4560 - Intermediate Geographic Information Systems **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**

Subtotal: 29 Hours

Junior

- AERO 3020 - Aerospace Materials **3 credit hours**

- AERO 3710 - Unmanned Aircraft **1 credit hour** AND
- AERO 3711 - Unmanned Aircraft Lab **2 credit hours**

- AERO 3720 - Unmanned Aircraft Systems **1 credit hour** AND
- AERO 3721 - Unmanned Aircraft Systems Lab **2 credit hours**

- PGEO 4490 - Remote Sensing **4 credit hours**
- Minor **6 credit hours**
- Non-Written Communication **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Elective **4 credit hours** (if needed)

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours**

Subtotal: 33 Hours

Senior

- AERO 3730 - Unmanned Remote Sensing **1 credit hour** AND
- AERO 3731 - Unmanned Remote Sensing Lab **2 credit hours**

- AERO 4700 - Advanced UAS Operations and Applications **4 credit hours** AND
- AERO 4701 - Advanced UAS Operations and Applications Lab **0 credit hours**

- AERO 4040 - Professional Aviation Pathways **1 credit hour**
- AERO 4710 - Unmanned Aircraft Systems Operations Capstone **3 credit hours**
- EXL 4000 - Experiential Learning Seminar **1 credit hour**
- PGEO 4511 - Advanced Remote Sensing **3 credit hours**
- Minor **9 credit hours**
- Minor/elective **3 credit hours**

Subtotal: 27 Hours

Additional Requirements

This concentration allows students who wish to do so to obtain manned pilot certificates through flight training conducted at the MTSU Flight School. All required flight training must be conducted in a flight lab, in University owned and maintained aircraft, and by flight instructors screened and trained for their positions by MTSU. All flight labs will be conducted from the Murfreesboro Municipal Airport. Admission to the University does not guarantee enrollment in a flight lab. To enroll in a flight lab, students must submit a Flight Lab Request Form for each and every semester they wish to fly. The deadlines to submit Flight Lab Request Forms are as follows:

Fall semester-June 30
Spring semester-November 15
Summer session-April 15

Flight Lab Request Forms submitted after the deadline will not be considered. Enrollment in flight labs is limited and selection is made from eligible candidates who are best qualified based on cumulative GPA. Incoming freshmen typically do not receive a flight lab for their first semester. Students must have completed 12 hours of college credit post high school graduation to be eligible for a flight lab. To become eligible for a flight lab, candidates must meet the following minimum standards:

1. have a college cumulative grade point average of 3.00;
2. have a current Second Class FAA medical certificate;
3. must be in good standing within the department and University (if a transfer student, candidate cannot be on probation in any form);
4. have no physical disability that would prohibit completion of the course requirements;
5. have the full required amount of flight lab funds deposited in their flight accounts by the first day of classes;
6. have completed all required prerequisite classes for the desired lab;
7. for US citizens or permanent green card holders, present a valid current passport OR an original state-issued birth certificate AND a valid government-issued picture ID on the first day of class; for international students, receive approval from the Transportation Security Administration and the Alien Flight Student Program (AFSP) prior to the first day of class.

Participation in MTSU flight labs is based on maintaining a cumulative GPA of 3.00 or better. Violation of any MTSU safety practice or procedure or any FAA regulations will result in immediate termination from the program. Flight fees will be paid directly to MTSU, and students must maintain a positive balance in their training accounts at all times. Lab fee information and a complete explanation of all requirements for flight labs can be found in the Flight Lab Guide obtained through the MTSU Aerospace website, at the MTSU Flight School, or Aerospace Department main office.

Aerospace, Unmanned Aircraft Systems Technology Concentration, B.S.

Aerospace
615-898-2788
Kevin Corns, program coordinator
Kevin.Corns@mtsu.edu

The Unmanned Aircraft Systems Technology (UAST) concentration is designed not only to give learners the knowledge, skills, and abilities (KSAs) as unmanned remote pilots, but also the knowledge and experience to fill roles in the technology aspect of the unmanned aircraft systems industry. UAST will be based on the Unmanned Aircraft Systems Operations (UAS) concentration to provide learners with the knowledge and experiences for unmanned aircraft systems operations in the National Airspace System (NAS).

NOTE: *All major courses, program accreditation, and/or Federal Aviation Administration (FAA) related coursework (physics, mathematics, and selected engineering technology courses) must be completed with a grade of C or better in order to graduate.*

Academic Map

Following is a printable, suggested four-year schedule of courses:

Aerospace, Unmanned Aircraft Systems Technology, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**43 hours***
Aerospace Core	*13 hours*
UAST Concentration	*30 hours*
Supporting Courses	**8-9 hours***
Approved Minor	**15-19 hours**
Electives	**8-20 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1810 or MATH 1910 (Quant Lit)
- PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111 (Sci Lit)

Major Requirements (43 hours)

Aerospace Core Requirement (13 hours)

- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**
- AERO 3020 - Aerospace Materials **3 credit hours**
- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- AERO 4040 - Professional Aviation Pathways **1 credit hour**

Unmanned Aircraft Systems Technology Concentration (30 hours)

- AERO 1710 - Introduction to Unmanned Aircraft Systems **3 credit hours**
- AERO 2710 - sUAS Remote Pilot Certification **2 credit hours**
- AERO 3440 - Fundamentals of Aerodynamics **3 credit hours**

- AERO 3710 - Unmanned Aircraft **1 credit hour** AND
- AERO 3711 - Unmanned Aircraft Lab **2 credit hours**

- AERO 3720 - Unmanned Aircraft Systems **1 credit hour** AND
- AERO 3721 - Unmanned Aircraft Systems Lab **2 credit hours**

- AERO 3730 - Unmanned Remote Sensing **1 credit hour** AND
- AERO 3731 - Unmanned Remote Sensing Lab **2 credit hours**

- AERO 4440 - Aircraft Performance **3 credit hours**

- AERO 4700 - Advanced UAS Operations and Applications **4 credit hours** AND
- AERO 4701 - Advanced UAS Operations and Applications Lab **0 credit hours**

- AERO 4720 - Unmanned Aircraft Systems Technology Research Capstone I **3 credit hours**
- AERO 4721 - Unmanned Aircraft Systems Technology Research Capstone II **3 credit hours**

Supporting Courses (8-9 hours)

- MATH 1810 - Applied Calculus I **3 credit hours** OR
- MATH 1910 - Calculus I **4 credit hours (may be counted in True Blue Core)**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours (may be counted in True Blue Core)**

- EXL 4000 - Experiential Learning Seminar **1 credit hour**

Minor (15-19 hours)

Choose one minor from the following:
Computer Science Minor, Data Science Minor, Electrical Engineering Minor, Electronics Minor, Engineering Systems Minor, Engineering Technology Minor, Mathematics Minor, or Physics Minor.

Electives (8-20 hours)

Curriculum: Unmanned Aircraft Systems Technology Concentration

Freshman Fall

- Written Communication **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- AERO 1010 - Introduction to Aerospace **3 credit hours**
- AERO 1020 - Theory of Flight **3 credit hours**

- MATH 1810 - Applied Calculus I **3 credit hours** OR
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)

Subtotal: 15-16 Hours

Freshman Spring

- AERO 1710 - Introduction to Unmanned Aircraft Systems **3 credit hours**
- Information Literacy **3 credit hours**
- History and Civic Learning **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Elective **3 credit hours**

Subtotal: 15 Hours

Sophomore Fall

- AERO 2710 - sUAS Remote Pilot Certification **2 credit hours**
- AERO 3030 - Propulsion Fundamentals **3 credit hours**
- History and Civic Learning **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**

- AERO 3710 - Unmanned Aircraft **1 credit hour** AND
- AERO 3711 - Unmanned Aircraft Lab **2 credit hours**

Subtotal: 14 Hours

Sophomore Spring

- AERO 3720 - Unmanned Aircraft Systems **1 credit hour** AND
- AERO 3721 - Unmanned Aircraft Systems Lab **2 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours** (Sci Lit)

- Creativity and Cultural Expression **3 credit hours**
- Quantitative Literacy/Elective **3 credit hours**
- Minor course **3 credit hours**

Subtotal: 16 Hours

Junior Fall

- AERO 3020 - Aerospace Materials **3 credit hours**
- AERO 3440 - Fundamentals of Aerodynamics **3 credit hours**
- Minor course **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**

- AERO 3730 - Unmanned Remote Sensing **1 credit hour** AND
- AERO 3731 - Unmanned Remote Sensing Lab **2 credit hours**

Subtotal: 15 Hours

Junior Spring

- AERO 4440 - Aircraft Performance **3 credit hours**
- Minor courses **6 credit hours**
- Scientific Literacy **4 credit hours**

- AERO 4700 - Advanced UAS Operations and Applications **4 credit hours** AND
- AERO 4701 - Advanced UAS Operations and Applications Lab **0 credit hours**

Subtotal: 17 Hours

Senior Fall

- AERO 4040 - Professional Aviation Pathways **1 credit hour**
- AERO 4720 - Unmanned Aircraft Systems Technology Research Capstone I **3 credit hours**
- Non-Written Communication **3 credit hours**
- Minor course **3 credit hours**
- Elective **3 credit hours**

Subtotal: 13 Hours

Senior Spring

- AERO 4721 - Unmanned Aircraft Systems Technology Research Capstone II **3 credit hours**
- EXL 4000 - Experiential Learning Seminar **1 credit hour**
- Scientific Literacy/elective **4 credit hours**
- Minor course or elective **4 credit hours**
- Elective **3 credit hours**

Subtotal: 15 Hours

Unmanned Aircraft Systems Minor

Aerospace
Advisor: Kevin Corns
The minor in Unmanned Aircraft Systems consists of 18 credit hours.

Required Courses (18 hours)

- AERO 1710 - Introduction to Unmanned Aircraft Systems **3 credit hours**
- AERO 3710 - Unmanned Aircraft **1 credit hour**
- AERO 3711 - Unmanned Aircraft Lab **2 credit hours**
- AERO 3720 - Unmanned Aircraft Systems **1 credit hour**
- AERO 3721 - Unmanned Aircraft Systems Lab **2 credit hours**
- AERO 3730 - Unmanned Remote Sensing **1 credit hour**
- AERO 3731 - Unmanned Remote Sensing Lab **2 credit hours**
- AERO 4710 - Unmanned Aircraft Systems Operations Capstone **3 credit hours**
- EXL 4000 - Experiential Learning Seminar **1 credit hour**

- AERO 2201 - Professional Pilot Flight Lab I **2 credit hours** OR
- AERO 2710 - sUAS Remote Pilot Certification **2 credit hours**

Aerospace

AERO 1010 - Introduction to Aerospace
3 credit hours History of aerospace, opportunities in the field, fundamentals of flight, navigation, meteorology, and Federal Aviation Regulations. Open to all students desiring a general and practical knowledge of aviation.

AERO 1020 - Theory of Flight
3 credit hours Topics include basic aerodynamics with emphasis on lift, weight, thrust, and drag forces and moments acting upon an airplane in flight. Provides students with the opportunity to become acquainted with technical aviation terminology, the physics and mathematics necessary to understand various aspects of flight, and personal experience with aircraft design and testing through a balsa wood glider project.

AERO 1230 - Aviation Laws and Regulations
3 credit hours Introduces students to aviation regulations needed to pass FAA knowledge exams, check rides, oral and practical exams, and interviews. Portions of Title 14 and 49 of the Code of Federal Regulations discussed with an emphasis on application of these regulations to airmen certification and aircraft operations.

AERO 1340 - Introduction to Aerospace Maintenance
3 credit hours Organization and operation of aircraft maintenance activities. Federal regulations and aviation maintenance law. Maintenance management function in practical settings. Lecture course that meets 45 contact hours a semester.

AERO 1380 - Aerospace Maintenance Shop Practices
3 credit hours Use of common tools, measuring devices, and special aircraft tools. Shop layout for aircraft maintenance management. Students must be equipped with the Part 147 minimum tools and safety equipment. Lecture/laboratory meets for 90 contact hours per semester.

AERO 1710 - Introduction to Unmanned Aircraft Systems
3 credit hours An overview of Unmanned Aircraft Systems (UAS), including UAS history, technology, and applications. Introduces methods of UAS operation, challenges to UAS integration, and regulations/standards governing UAS operation.

AERO 2010 - Aviation Weather
3 credit hours Introduces students to basic weather theory at all scales and applicable weather products associated with aviation operations. Some topics include meteorology, characteristics of the atmosphere, weather observations and forecasts, and weather phenomena affecting the safety of flight.

AERO 2100 - Airline Management
3 credit hours Introduces the organizational structure and economic characteristics of U.S. air carriers. Topics include passenger forecasting, route selection, marketing, scheduling, fleet planning, labor relations, and ticket pricing.

AERO 2201 - Professional Pilot Flight Lab I
2 credit hours
Prerequisite: AERO 2230 or simultaneous completion of AERO 2230. Flight instruction leading to the FAA Private Pilot Certificate; the first of four flight labs in the Professional Pilot concentration sequence. Private Pilot certificate must be completed during this course. Requires a minimum of four training sessions per week at the airport campus in the spring/fall semester and a minimum of five training sessions per week at the airport campus in the summer session. Fee required.

AERO 2230 - Professional Pilot I
3 credit hours First of five classes in the Professional Pilot concentration sequence. Provides students with aeronautical knowledge required for certification as a Private Pilot. Emphasis placed on acquisition of basic knowledge in the areas of aerodynamics, performance, systems, weather, Federal Aviation Regulations, and flight planning.

AERO 2331 - Airframe Inspection
3 credit hours Pre/corequisites: AERO 1340 and AERO 1380, both with minimum grade of C (2.0). Provides students with techniques, procedures, and requirements concerning aircraft airframe inspections. Topics include research, checklists, and repair phases of inspections required by the FARs. Students must be equipped with the Part 147 minimum tools and safety equipment. Lecture/laboratory meets for 90 contact hours per semester.

AERO 2342 - Powerplant Inspection
3 credit hours Pre/corequisites: AERO 1340 and AERO 1380, both with minimum grade of C (2.0). Basic requirements, techniques, and procedures for performing a 100-hour inspection on an aircraft reciprocating engine. Students must be equipped with the Part 147 minimum tools and safety equipment. Lecture/laboratory meets for 90 contact hours per semester.

AERO 2371 - Aircraft Welding
3 credit hours Prerequisite: AERO 1380 with minimum grade of C (2.0). Various types of aircraft welding techniques and procedures. Students must be equipped with the Part 147 minimum tools and safety equipment. Lecture/laboratory that meets for 45 contact hours.

AERO 2381 - Non-Metallic Structures: Dope, Fabric, and Finishing
3 credit hours
Prerequisite: AERO 1380 with minimum grade of C (2.0). Aircraft fabric covering and finishing. Students must be equipped with the Part 147 minimum tools and safety equipment. Lecture/laboratory that meets 45 contact hours a semester.

AERO 2710 - sUAS Remote Pilot Certification
2 credit hours Prerequisite: Permission of department. Offers preparation for students to take the FAA Remote Pilot Aeronautical Knowledge test. Topics will include regulations, airspace and requirements, weather, loading and performance, and small unmanned aircraft operations.

AERO 2715 - Small Unmanned Aircraft Systems Certification
3 credit hours
Prerequisite: AERO 1710 with minimum grade of C or permission of instructor. Offers preparation for non-UAS major students to take the FAA Part 107 Remote Pilot Aeronautical Knowledge test. Topics include regulations, airspace and requirements, weather, loading and performance, and small unmanned aircraft operations. FAA Remote Pilot Certificate must be completed during this course at student expense. **Note***: UAS majors must take AERO 2710 sUAS Remote Pilot Certificate.*

AERO 3020 - Aerospace Materials
3 credit hours Prerequisites: AERO 1010, AERO 1020, and MATH 1530, MATH 1710, MATH 1810, or MATH 1910, and CHEM 1010/CHEM 1011, or CHEM 1110/CHEM 1111, or PHYS 2010/PHYS 2011, or PHYS 2110/PHYS 2111, all with minimum grades of C (2.0). Explores materials used in aerospace applications throughout their development from the standpoint of their properties, economic impact, and future possibilities. The need for new materials to fill current requirements included. Lecture that meets for 45 contact hours a semester.

AERO 3030 - Propulsion Fundamentals
3 credit hours Prerequisites: AERO 1010 and AERO 1020, both with minimum grade of C (2.0). Principles of operations, major components, and important features of typical propulsion systems used in aircraft and missiles, from reciprocating to reaction. Lecture that meets for 45 contact hours a semester.

AERO 3080 - Aviation Weather II
3 credit hours Prerequisite: AERO 2010 with minimum grade of C (2.0). Provides students with an in-depth knowledge of weather types and characteristics, observation and forecast weather products, and aviation-related weather hazards. Spring only.

AERO 3100 - Aerospace in Our Lives
3 credit hours Open course for non-majors which allows exploration of the aerospace world in which we live. Credit not applicable to Aerospace major.

AERO 3110 - Airport Management
3 credit hours An overview of airport management functions, including regulatory requirements, service facilities, traffic control, financing, personnel, public relations, environmental issues, and impact of airports within their communities. Fall only.

AERO 3160 - Aviation Contracts and Leases
3 credit hours Prerequisites: AERO 2100 and AERO 3110, both with minimum grade of C (2.0). Examines the various agreements utilized by airports to define the terms and conditions for airlines, FBOs, concessionaires, air cargo operators, and other airport tenants. Analysis of the general provisions and requirements contained within airport leases and those specific to each tenant.

AERO 3170 - Aviation Safety
3 credit hours Prerequisite: AERO 1020 with minimum grade of C (2.0). Comprehensive analysis of the principles, practices, and regulatory environment of safety in aviation operations. These include human factors issues and best practices, approaches to

safety management, the role of government agencies in aviation safety, and the requirements of Safety Management Systems (SMS). Numerous case studies involving aircraft accidents or incidents examined to assist students in identifying potential risks and hazards in the flight environment.

AERO 3202 - Cross-Country Flight Lab (25 Hours)
1 credit hour Prerequisite: Commercial Pilot Certificate. Flight instruction leading to the completion of a minimum of 25 hours of flight time. Fee required. Students must apply for flight labs during the semester preceding the lab.

AERO 3203 - Professional Pilot Flight Lab II
2 credit hours Prerequisites: Private Pilot Certificate; AERO 3210 or simultaneous completion of AERO 3210. Flight instruction leading to the FAA Instrument Rating; second of four flight labs in the Professional Pilot concentration sequence. Instrument Rating must be completed during this course. Requires a minimum of four training sessions per week at the airport campus in the spring/fall semester and a minimum of five training sessions per week at the airport campus in the summer session. Fee required.

AERO 3204 - Professional Pilot Flight Lab III
2 credit hours Prerequisites: AERO 3203 and AERO 3215 or simultaneous completion of AERO 3215. Flight instruction leading to the FAA Commercial Pilot Certificate-Airplane Single-Engine Land; third of four flight labs in the Professional Pilot concentration sequence. Commercial Pilot Single-Engine Land Certificate must be completed during this course. Requires a minimum of four training sessions per week at the airport campus in the spring/fall semester and a minimum of five training sessions per week at the airport campus in the summer session. Fee required.

AERO 3205 - Conventional Landing Gear Airplane Laboratory
1 credit hour Prerequisite: Private Pilot Certificate. Flight and ground instruction leading to conventional landing gear operation endorsement. Course includes flight and ground instruction. Fee required. NOTE: This is not an FAA Part 141 course.

AERO 3210 - Professional Pilot II
3 credit hours Prerequisites: Private Pilot Certificate and AERO 2230 with minimum grade of C (2.0); prerequisite/corequisite: AERO 2010 with minimum grade of C (2.0); corequisite: AERO 3203. Second of five classes in the Professional Pilot concentration sequence. Provides students with aeronautical knowledge required for completion of the Instrument Rating. Emphasis on acquisition of basic knowledge in the area of instrument flight.

AERO 3212 - Cross-Country Flight Lab (50 Flight Hours)
2 credit hours Prerequisite: Commercial Pilot Certificate. Flight instruction leading to the completion of a minimum of 50 hours of flight time. Fee required. Students must apply for flight labs during the semester preceding the lab.

AERO 3215 - Professional Pilot III
3 credit hours Prerequisites: Instrument Rating, AERO 2010 with minimum grade of C (2.0), AERO 3210 with minimum grade of C (2.0), and AERO 3203 with minimum grade of C (2.0). Required corequisite: AERO 3204. Third of five classes in the Professional Pilot concentration sequence. Provides students with aeronautical knowledge required for certification as a Commercial Single-Engine and Multi-Engine Pilot. Emphasis placed on the acquisition of advanced knowledge of aerodynamics, performance, systems for single-engine and multi-engine aircraft, and Federal Aviation Regulations.

AERO 3222 - High-Altitude Aircraft Operations Laboratory
1 credit hour Prerequisite: AERO 3240. Simulator and ground instruction in an aircraft simulator leading to a high-altitude log book endorsement. Fees required: NOTE: This is not an FAA-approved Part 141 course.

AERO 3223 - High-Performance Aircraft Flight Laboratory
1 credit hour Prerequisite: AERO 3204. Flight and ground instruction in a high-performance aircraft leading to a log book endorsement in this type of aircraft. Fees required. NOTE: This is not an FAA-approved Part 141 course.

AERO 3230 - Crew Resource Management
3 credit hours Prerequisite: AERO 2230. Introduces and explores Crew Resource Management (CRM) as a cornerstone of modern aviation safety. Develops communication and non-technical skills. Investigates and fosters the effective use of human, hardware, software, and information resources related to all aviation professions. Emphasis on team building,

communication, decision making, situation awareness, and use of automation.

AERO 3240 - Professional Pilot IV
3 credit hours Prerequisites: Commercial Certificate, AERO 3204 with minimum grade of C (2.0); prerequisite/corequisite: AERO 3261 with minimum grade of C (2.0); AERO 3215 with minimum grade of C (2.0). Fourth class in the Professional Pilot concentration sequence. Introduces aircraft systems and procedures for a multi-engine, multiple crew, turbofan, transport-category aircraft typical of the type used in regional airline operations (CRJ 700). Covers major aircraft systems, operational procedures, and standard crew procedures for pilot-flying and pilot-monitoring roles, and requires flight simulator sessions. Fee required.

AERO 3241 - Air Charter Flight Laboratory
1 credit hour Prerequisites: AERO 3203, AERO 3204, AERO 3223, AERO 3240, all with minimum grade of C (2.0); consent of instructor. Air charter operation. Students will be utilized as co-pilots during transportation of university personnel. NOTE: This is not an FAA-approved Part 141 course.

AERO 3261 - Professional Pilot Flight Lab IV
1 credit hour Prerequisites: AERO 3204 and AERO 3215, both with minimum grade of C (2.0). Flight instruction leading to the FAA Commercial Pilot Airplane Multi-engine Land Certificate; last of four flight labs in the Professional Pilot concentration sequence. Commercial Pilot Multi-engine Land Certificate must be completed during this course. Fee required. Requires a minimum of three training sessions per week at the airport campus in the spring/fall semester and a minimum of four training sessions per week at the airport campus in the summer session. Fee required. NOTE: This is not an FAA Part 141 course.

AERO 3301 - Sheet Metal Repair
3 credit hours Prerequisites: AERO 1340 and AERO 1380, both with minimum grade of C (2.0); prerequisite/corequisite: AERO 3020 with minimum grade of C (2.0). Provides practical experience in the repair of sheet metal structures, including major repairs and alterations. Students must provide basic tools and safety equipment. Lecture/laboratory that meets for 90 contact hours a semester.

AERO 3322 - Aerospace Reciprocating Engine Overhaul
3 credit hours Prerequisites: AERO 1380 and AERO 3030, both with minimum grade of C (2.0). Completion of a major overhaul on an aircraft engine, including procedures and acceptable techniques used in engine disassembly, inspection, repair, reassembly, and operational testing. Lecture/laboratory that meets for 90 contact hours a semester.

AERO 3362 - Advanced Aerospace Engine Systems Maintenance and Repair
3 credit hours Prerequisites: AERO 1380 and AERO 3030, both with minimum grade of C (2.0). The operation of powerplant component systems; induction, exhaust, instrumentation, engine electrical, and propeller systems. Students must provide basic tools and safety equipment. Lecture/laboratory that meets for 90 contact hours a semester.

AERO 3371 - Aircraft Finishing and Non-Destructive Inspection
3 credit hours Prerequisite: AERO 1380 with minimum grade of C (2.0). Fundamentals of non-destructive inspection techniques including dye penetrant, magnetic particle, eddy current, and ultrasonic inspection. Students must provide basic tools and safety equipment. Lecture/laboratory that meets for 45 contact hours a semester.

AERO 3392 - Reciprocating Engine Maintenance Repair
3 credit hours Prerequisites: AERO 1340 and AERO 1380, both with minimum grade of C (2.0). Reciprocating engines including theory, construction, fuel metering, ignition, and operational maintenance procedures. Inspection and repair processes are applied to operating engine systems. Students must provide basic tools and safety equipment. Lecture/laboratory that meets for 90 contact hours a semester.

AERO 3440 - Fundamentals of Aerodynamics
3 credit hours Prerequisites: MATH 1810 or MATH 1910, PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111, all with minimum grade of C (2.0). Topics include the incompressible aerodynamics of powered flight to include theories of lift, drag and moments. Additional topics include stability and control, aircraft design, and compressible aerodynamics if time permits. A flight test exercise is conducted at student expense. The flight test requires that the class meet at the airport campus for several weeks during the

semester. Open class times before and/or after the class are recommended. Fee required.

AERO 3510 - Instrument Operations in the National Airspace System
3 credit hours Prerequisite: AERO 2230 or AERO 2710 with minimum grade of C (2.0). (Not open to Professional Pilot majors or students who have completed AERO 3210.) Introduces non-Professional Pilot students to flight in the instrument flight rules (IFR) environment. Topics include flight instrument systems, instrument navigation concepts, IFR communications, instrument charts and procedures (departure, enroute, arrival, and approach), and aviation weather in the IFR environment. A flight demonstration experience at the university Flight School is required at student expense. Fee required.

AERO 3630 - Introduction to Air Traffic Control
3 credit hours Prerequisites: AERO 1010, AERO 1020, AERO 1230, AERO 2010, AERO 2230, and AERO 3210 or AERO 3510, all with minimum grade of C (2.0). Introduces students to the many aspects of the Air Traffic Control System and the procedures and policies used in the National Airspace System.

AERO 3710 - Unmanned Aircraft
1 credit hour Prerequisite: AERO 2201, AERO 2710, or AERO 2715 with minimum grade of C or permission of instructor. Corequisite: AERO 3711. Introduces students to elements that comprise unmanned aircraft (UA). Students will apply concepts acquired during classroom sessions and construct different unmanned aircraft, train to operate unmanned aircraft using simulators, and conduct actual flight testing during the lab section of this course. *Note: AERO 3711 must be taken concurrently.*

AERO 3711 - Unmanned Aircraft Lab
2 credit hours Corequisite: AERO 3710. Students will apply concepts acquired during classroom sessions and construct different unmanned aircraft, train to operate unmanned aircraft using simulators, and conduct actual flight testing during the lab section. *Note: AERO 3710 must be taken concurrently.*

AERO 3720 - Unmanned Aircraft Systems
1 credit hour Prerequisite: AERO 2201 or AERO 2710, AERO 3710/AERO 3711 with minimum grade of C, and FAA Remote Pilot Certificate. Corequisite: AERO 3721. Introduces students to the elements of unmanned aircraft systems. Explores unmanned aircraft avionics, autopilot systems, first person video (FPV), on screen displays (OSD), communication systems, command and control (C2), ground control stations (GCS), flight control and mission planning software, and UAV launch and recovery systems. *Note: AERO 3721 must be taken concurrently.*

AERO 3721 - Unmanned Aircraft Systems Lab
2 credit hours Corequisite: AERO 3720. Students will apply concepts acquired during classroom sessions to upgrade and modify unmanned aircraft constructed in AERO 3711, train to operate unmanned aircraft using simulators, and conduct actual flight testing during the lab section of this course. *Note: AERO 3720 must be taken concurrently.*

AERO 3730 - Unmanned Remote Sensing
1 credit hour Prerequisite: AERO 3720/AERO 3721 with minimum grade of C. Corequisite: AERO 3731. Introduces students to long-range communication and data links, UAS sensors in use today, geospatial data collection, and still imaging mosaicking. Unmanned aircraft constructed in previous courses and tethered balloons will be used to lift sensor packages used for geospatial data collection and still imaging mosaicking applications. *Note: AERO 3731 must be taken concurrently.*

AERO 3731 - Unmanned Remote Sensing Lab
2 credit hours Corequisite: AERO 3730. Students will apply concepts acquired during classroom sessions to construct a ground control station, modify and upgrade existing unmanned aircraft with payloads/sensors, train to operate sensors using simulators, and conduct flight-testing during the lab section of this course. *Note: AERO 3730 must be taken concurrently.*

AERO 3745 - Aerial Cinematography I
3 credit hours (Same as VFP 3745.) Team-taught course gives students the knowledge and skills to fly and maneuver multirotor, remote-piloted aircraft with a specific emphasis on aerial cinematography and filmmaking applications . Students will construct and gain experience on a small drone before transitioning to other, prosumer-level unmanned aircraft systems (UAS). Dual focus on UAS operations, regulations, legal and ethical issues, alongside fundamental aspects specific to aerial filmmaking. Flight operations training and

filming will be conducted both on and off-campus. Uses a web-enhanced lecture and lab instructional methodology.

AERO 4040 - Professional Aviation Pathways
1 credit hour Prerequisites: Senior standing; filed Intent to Graduate form; AERO 1010, AERO 1020, AERO 3020, and AERO 3030 with minimum grades of C (2.0). Culminating career preparation experience for senior Aerospace students. Topics include professionalism and ethics, contemporary issues and trends within the industry, the necessity for lifelong learning, and the planning process for career goals including development of a job search portfolio and interview techniques. Department major field test administered in this course.

AERO 4050 - Aerospace Internship I
3 credit hours Prerequisites: Junior standing and consent of department chair. Student is employed by an acceptable airline, airport director, or aerospace industry for 300 hours of field work. Pass/Fail.

AERO 4060 - Aerospace Internship II
3 credit hours Prerequisites: Junior standing and consent of department chair. A continuation of the internship program with a different employer and place of work or a significant job category change. Pass/Fail.

AERO 4071 - Problems in Aerospace
1 to 3 credit hours Individual directed study in the field of aerospace.

AERO 4120 - Airport Operations
3 credit hours Prerequisite: AERO 3110 with minimum grade of C (2.0); at least junior standing. An overview of airport landside and airside operations. Topics include passenger terminal operations, airport security, FAA regulations and inspection programs,14 CFR Federal Aviation Regulations Part 139, Airport Certification Manual, and Aircraft Operations Areas.

AERO 4130 - Aerospace Physiology
3 credit hours Prerequisite: AERO 3204 with minimum grade of C (2.0). An investigation of physiological challenges as they relate primarily to flight crew, but also to cabin crew and passengers in the flight environment. Topics include oxygen processing and associated ailments, oxygen and pressurization systems, trapped and evolved gases, vision, visual and vestibular illusions, sleep, fatigue, orientation and disorientation, sustained acceleration, FAA medical standards, and industry drug testing programs.

AERO 4140 - Seminar in Airline Administration
3 credit hours Prerequisites: AERO 2100 with minimum grade of C (2.0) and senior standing. Capstone course for students selecting the airline management focus within Aviation Management. Individually directed course on a selected topic within the airline industry. Addresses specific airline industry issues and develops solutions to these issues in the global context within which airlines operate.

AERO 4150 - Fixed Base Operations Management
3 credit hours The FBO operator and the essential role played in general aviation.

AERO 4170 - Airport Capacity and Planning
3 credit hours Prerequisites: Senior standing and AERO 3110. An exploratory look at airport capacity and planning from a management perspective. Provides an overview of the methods utilized in airport capacity and future planning, including the study of existing facilities and future development. Students will have the opportunity to apply knowledge of airport management with the planning of a new airport in a major project.

AERO 4201 - Flight Instructor-Airplane Lab
1 credit hour Corequisite: AERO 4210 with minimum grade of C (2.0). Prerequisites: Current FAA Commercial Pilot Certificate, AERO 3215, and consent of instructor. Flight and ground instruction leading to the FAA Flight Instructor - Airplane Certificate. Covers all topics of the Flight Instructor - Airplane Practical Test Standards. Flight fees required.

AERO 4202 - Flight Instructor-Instrument Lab
1 credit hour Prerequisites: AERO 4201 or FAA Certified Flight Instructor Certificate. Flight and ground instruction leading to the FAA Flight Instructor - Instrument Certificate. Covers all topics of the Flight Instructor - Instrument Practical Test Standards. Flight fees required. NOTE: This is not an FAA Part 141 course.

AERO 4203 - Flight Instructor-Multi-Engine Lab
1 credit hour Prerequisites: AERO 4202 or Certified Flight Instructor - Instrument Certificate. Flight and ground instruction leading to the FAA Flight Instructor - Multiengine Certificate. Covers all topics of the Flight Instructor - Multiengine Practical Test Standards.

Flight fees required. NOTE: This is not an FAA Part 141 course.

AERO 4210 - Flight Instructor Fundamentals
3 credit hours Corequisite: AERO 4201. Prerequisites: Commercial Pilot Certificate, Instrument Rating-Airplane and AERO 3215. Ground instruction leading to the Certificated Flight Instructor - Airplane, Single Engine Land completed during the course. Fee required for FAA exams.

AERO 4250 - Professional Pilot V
3 credit hours Prerequisites: AERO 3240 with minimum grade of C (2.0); students must hold a Commercial Pilot Certificate with a Multi-Engine Rating. Capstone course in the Professional Pilot concentration sequence. Course meets for six hours per week using a lecture and flight training device (FTD) format. Provides students with an experiential view of the duties of a professional pilot. Topics include turbojet aircraft systems, advanced avionics and flight management systems, transport aircraft flight techniques (including operations in all flight regimes and in difficult operational conditions), and stall and upset recognition and recovery in transport category aircraft. Crew resource management skills, aeronautical decision making, and professionalism developed. Turbofan aircraft training conducted in the Advanced Qualification Program (AQP) format employed by air carriers to include Maneuvers Validation and Line Operations Simulation scenarios in the department's CRJ-700 flight training device. Fee required.

AERO 4301 - Advanced Aerospace Vehicle Structural Repair
3 credit hours Prerequisites: AERO 1340 and AERO 1380, both with minimum grade of C (2.0); prerequisite/corequisite: AERO 3020 with minimum grade of C (2.0). Non-typical structures including bonded and plastic structures. Includes planning and organizing of major structural repair projects and rebuilding of severely damaged aircraft. Students must provide basic tools and safety equipment. Lecture/laboratory that meets for 90 contact hours a semester.

AERO 4310 - Aerospace Vehicle Systems
3 credit hours Prerequisites: AERO 1010 and AERO 1020 with minimum grade of C (2.0). Design, use, and function of typical hydraulic, mechanical, and electrical systems used on transport category aircraft. Lecture that meets for 45 contact hours a semester.

AERO 4311 - Aerospace Accessory Systems Maintenance and Repair
3 credit hours Prerequisites: AERO 2331 (may be taken concurrently) and ET 3610, both with minimum grade of C (2.0). Practical experience in the maintenance, inspection, and repair of aircraft systems and components. Students must provide basic tools and safety equipment. Lecture/laboratory that meets for 90 contact hours per semester.

AERO 4312 - Turbine Engine System
3 credit hours Prerequisites: AERO 1340, AERO 1380, and AERO 3030, all with minimum grade of C (2.0). Advanced course in the maintenance of complex systems. Students must provide basic tools and safety equipment. Lecture/laboratory that meets for 90 contact hours a semester.

AERO 4332 - Reciprocating Engine Troubleshooting
3 credit hours Prerequisites: AERO 1340, AERO 1380, AERO 2342, and AERO 3030, all with minimum grade of C (2.0). Provides practical experience in inspecting and troubleshooting problems with reciprocating engines and powerplant systems. Students must provide basic tools and safety equipment. Lecture/laboratory that meets for 90 contact hours a semester.

AERO 4340 - Maintenance Management Capstone
3 credit hours Prerequisite: ET 3610 and PHYS 2011 with minimum grade of C (2.0); students must be in the last 18 hours of coursework before graduation. Students assigned a specific task directly related to the knowledge and skills gained during their progress through the Maintenance Management concentration. Students expected to complete assigned project with minimum guidance from the instructor. Pass/fail; passing grade required for graduation from the Maintenance Management program.

AERO 4342 - Turbine Engine Inspection and Troubleshooting
3 credit hours Prerequisites: AERO 1340, AERO 1380, AERO 3030, and AERO 4312, all with minimum grade of C (2.0). Provides practical experience in turbine engine inspection to include hot section inspection, engine operation, and troubleshooting. Students must provide basic tools and safety

equipment. Lecture/laboratory that meets for 90 contact hours a semester.

AERO 4371 - Advanced Aerospace Vehicle Systems Overhaul
3 credit hours Prerequisites: AERO 1340, AERO 1380, AERO 4310, and ET 3610, all with minimum grade of C (2.0). Complete repair and overhaul of complex aerospace vehicle systems including hydraulics, electric, pneumatics, fuel, and oil. Shop layout and quality control procedures stressed. Student must provide basic tools and safety equipment. Lecture/laboratory that meets for 90 contact hours a semester.

AERO 4381 - Advanced Aerospace Accessory Systems Maintenance and Repair
3 credit hours Prerequisites: AERO 1340, AERO 1380, AERO 4310, and ET 3610, all with minimum grade of C (2.0). Repair and overhaul of complex accessory systems and subsystems. Practical experience in overhaul of air conditioning, pressurization, oxygen, electrical power generation and control, electrical motors, electrical system configuration and troubleshooting. Student must provide basic tools and safety equipment. Lecture/laboratory that meets for 90 contact hours a semester. Special fee applies for an electronics project.

AERO 4392 - Aerospace Turbine Engine Maintenance and Overhaul
3 credit hours Corequisite: AERO 4312. Field maintenance and repair of turbine engines and components. Includes limited overhaul procedures and techniques. Management procedures stressed. Student must provide basic tools and safety equipment. Lecture/laboratory meets for 90 contact hours a semester.

AERO 4400 - Space
3 credit hours History of global space exploration and the successes and failures of manned and unmanned efforts in the race to the moon.

AERO 4410 - Aerospace Technology Research Capstone
3 credit hours Prerequisite or corequisite: AERO 4440. A directed research experience for Aerospace Technology students. Research guidance and mentorship provided by Aerospace Technology faculty. Students will utilize research equipment provided in the Aerospace Technology Laboratory.

AERO 4440 - Aircraft Performance
3 credit hours Prerequisite: AERO 3440 with minimum grade of C (2.0). Topics include determination of airplane performance given basic aerodynamic, propulsion, structural, and atmospheric characteristics/conditions. Provides students with experience in characterizing the performance of various aircraft ranging from small single engine driven trainers to multiengine, turbofan powered, high performance passenger carrying airplanes. Spreadsheet software used extensively. For Technology concentration students, a flight demonstration at student expense is required at the university Flight School. Fee required.

AERO 4490 - Aerospace Science for Teachers
3 credit hours An introduction to the total aviation and space effort.

AERO 4580 - Flight Dispatch and ATP Written Preparation
3 credit hours Prerequisites: AERO 1230, AERO 3080, and AERO 3510, all with minimum grade of C (2.0). Must be 21 years of age before the Fall graduation date. First of two classes providing students with the knowledge required for certification as an aircraft dispatcher. Topics include dispatch resource management, aircraft systems and limitations, weight and balance, and aircraft performance. The FAA computerized aircraft dispatcher (ADX) exam must be passed during this course. Fall only.

AERO 4590 - Flight Dispatch
3 credit hours Prerequisite: AERO 4580 with minimum grade of C (2.0). Second of two classes providing students with the knowledge required for certification as an aircraft dispatcher. Explores factors necessary to prepare a flight plan such as weather analysis, enroute charts, dispatch release, and emergency/abnormal procedures. As this is the capstone course for the Flight Dispatch concentration, students must obtain the aircraft dispatch certification upon course completion. Spring only.

AERO 4700 - Advanced UAS Operations and Applications
4 credit hours Prerequisite: AERO 3730/AERO 3731 with a grade of C (2.0) or better; corequisite: AERO 4701. Allows learners to gain knowledge and hands-on experience in topics relevant to the UAS industry such as beyond visual line of site (BVLOS) operations, swarming, UAS delivery, open source

flight controller advanced features, and advanced flight planning software. NOTE: AERO 4701 must be taken concurrently.

AERO 4701 - Advanced UAS Operations and Applications Lab
0 credit hours Corequisite: AERO 4700. This experiential lab allows learners to apply knowledge gained in AERO 4700 and get hands-on experience in topics relevant to the UAS industry such as beyond visual line of site (BVLOS) operations, swarming, UAS delivery, open source flight controller advanced features, and advanced flight planning software. Labs will be conducted both on and off-campus. NOTE: AERO 4700 must be taken concurrently.

AERO 4710 - Unmanned Aircraft Systems Operations Capstone
3 credit hours Prerequisites: AERO 3730 and AERO 3731 with a minimum grade of C. Capstone course in Unmanned Aircraft Systems (UAS) Operations concentration. Students will conduct and participate in actual UAS operations in the National Airspace System (NAS).

AERO 4719 - Unmanned Aircraft System Flight Lab-Multirotor
1 credit hour Prerequisite: AERO 3720/AERO 3721 with a grade of C or better or permission of instructor. Ground and flight instruction using advanced multirotor unmanned aircraft. Requires training sessions off-campus. Fee required.

AERO 4720 - Unmanned Aircraft Systems Technology Research Capstone I
3 credit hours Prerequisite: Permission of instructor. Learners will conduct directed research during this faculty-mentored course related to unmanned aircraft development, technology integration, command and control, or application topics in Unmanned Aircraft Systems.

AERO 4721 - Unmanned Aircraft Systems Technology Research Capstone II
3 credit hours Prerequisite: AERO 4720. Learners will apply knowledge gained in AERO 4720 to prototype equipment and/or software to enhance UAS operations and/or applications. Students will conduct and participate in actual UAS operations in the National Airspace System (NAS) using the equipment/software they developed.

AERO 4729 - Unmanned Aircraft System Flight Lab-Vertical Takeoff and Landing
1 credit hour Prerequisite: AERO 3720/AERO 3721 with a grade of C or better or permission of instructor. Ground and flight instruction using advanced vertical takeoff and landing unmanned aircraft. Requires training sessions off-campus. Fee required.

AERO 4730 - Honors Seminar in Aviation Psychology
3 credit hours Application and physiological testing and research techniques in aviation education, management, and technology.

AERO 4739 - Unmanned Aircraft System Flight Lab-Fixed-Wing
1 credit hour Prerequisite: AERO 3720 AERO 3721 with a grade of C or better or permission of instructor. Ground and flight instruction using advanced fixed-wing unmanned aircraft. Requires training sessions off-campus. Fee required.

AERO 4745 - Aerial Cinematography II
3 credit hours (Same as VFP 4745.) Prerequisites: AERO 3730/AERO 3731, AERO 3745, or VFP 3745. Designed to give students opportunity to gain knowledge and skills using multirotor platforms designed for professional aerial photography and industrial applications. Students will gain knowledge in UAS operations, regulations, legal and ethical issues, and various aspects of aerial cinematography. Flight operations training will be conducted off-campus locations. Focuses on advanced skills in working with lighting, depth, focal field, and storytelling through three axis camera movement.

AERO 4775 - Unmanned Aircraft Systems in Research and Applications
3 credit hours Provides an overview of the use of unmanned aircraft systems in research and applications. Special emphasis on regulatory requirements, legal and ethical issues, safety, types of unmanned aircraft, sensors, flight operations, and choosing the right system for research or application. In addition to classroom component, requires occasional meetings at MTSU's Experiential Learning and Research Center for UAS demonstrations and hands-on flight operations. Not for credit for UAS Operations concentration students.

AERO 4789 - Agroecosystem Remote Sensing using UAS

3 credit hours (Same as PLSO 4000.) Prerequisite: Junior standing. Multidisciplinary course to train students on the key concepts of agricultural remote sensing using unmanned aircraft systems (UAS). Precision agriculture and remote sensing concepts and the use of some open-source image processing software for analyzing UAS-based remote sensing data.

AERO 4799 - Small Unmanned Aircraft System Instructor

1 credit hour Prerequisite: Permission of instructor and current FAA Remote Pilot Certificate. Ground and flight instruction required to become an MTSU Unmanned Aircraft Systems (UAS) Flight Instructor. Requires training sessions off-campus. Students will be required to obtain an FAA Advanced Ground Instructor (AGI) certification to successfully complete this course. Fee required for FAA exams.

Agriculture

Director

Carter, Cui, Downs, Foley, Gao, Gardner, Haruna, Higgins, Hoffman, Logan, Mosley, O'Brien, Phillips, Rego, Vaught

Programs in the School of Agriculture lead to the Bachelor of Science degree with majors in Agribusiness, Animal Science, Fermentation Science, Horse Science, and Plant and Soil Science. Certification in Agricultural Education is available in Agribusiness, Animal Science, and Plant and Soil Science. A preparatory program is also offered for additional study in veterinary medicine.

Available minors include Agriculture, Fermentation Science, Poultry Science, and Precision Agriculture.

Graduate Study

A Master of Science in Horse Science is offered. Students choose from one of three concentrations: Equine Education, Equine Physiology, or Industry Management.

Other programs include

- a Master of Education in Administration and Supervision with a concentration in Agricultural Education Leadership;
- a Master of Professional Science with a concentration in Fermentation Science; and
- a graduate minor in Agriculture.

Requirements and a list of the courses offered for graduate credit are published in the Graduate Catalog.

Agribusiness, Agricultural Education Certification, B.S.

Agriculture
Chaney Mosley, program coordinator
615-904-8037
chaney.mosley@mtsu.edu

Agribusiness majors seeking certification to teach agricultural education in secondary schools (grades 7-12) must complete (1) the Agribusiness major, (2) a minor in MTeach, and (3) professional agricultural education courses.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Agribusiness, Agricultural Education Certification, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**43 hours**
Agribusiness Core	*13 hours*
Major Courses	*30 hours*
Supporting Courses	**17 hours***
MTeach Minor	**30 hours**
TOTAL	**120-131 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- PSCI 1030/PSCI 1031 (Sci Lit)
- BIOL 1030/BIOL 1031 (Sci Lit)
- ECON 2410 (HSSR)

Major Requirements (43 hours)

Agribusiness Core (13 hours)

- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- AGRI 1000 - Orientation in Agriculture **1 credit hour**
- ANSC 1410 - Introduction to Animal Science **3 credit hours**
- PLSO 1610 - Elements of Plant Science **3 credit hours**
- AGED 4000 - Foundations of Agricultural Engineering and Applied Technologies Education **3 credit hours**

Remaining Major Courses (30 hours)

- AGED 2230 - Introduction to School-Based Agricultural Education **3 credit hours**
- AGRI 3010 - Debate and Discussion in Agricultural Contexts **3 credit hours**
- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**
- ANSC 3440 - Livestock Management **3 credit hours**
- Agribusiness electives **12 credit hours**

- PLSO 3600 - Horticulture in Our Lives **3 credit hours** OR
- PLSO 4620 - Greenhouse Management **3 credit hours**

- AGBS 4190 - International Agriculture **3 credit hours** OR
- AGBS 4150 - Agricultural Policy **3 credit hours**

Supporting Courses (17 hours)

- AGED 4220 - Methods of Teaching Agriculture, Food, and Natural Resources **3 credit hours**
- AGED 4230 - Program Planning in School-Based Agricultural Education **3 credit hours**
- ECON 2410 - Principles of Economics, Macroeconomics **3 credit hours (may be counted in the True Blue Core)**

- BIOL 1030 - Exploring Life **4 credit hours** AND
- BIOL 1031 - Exploring Life Lab **0 credit hours (may be counted in the True Blue Core)**

- PSCI 1030 - Topics in Physical Science **4 credit hours** AND
- PSCI 1031 - Topics in Physical Science Lab **0 credit hours (may be counted in the True Blue Core)**

MTeach Minor (30 hours)

See MTeach minor for further information.

Curriculum: Agribusiness, Agricultural Education Certification

Freshman

- MSE 1010 - Step 1: Inquiry Approaches to Teaching **1 credit hour**
- MSE 2010 - Step 2: Inquiry Lesson Design **1 credit hour**
- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- AGRI 1000 - Orientation in Agriculture **1 credit hour**
- ANSC 1410 - Introduction to Animal Science **3 credit hours**
- AGED 2230 - Introduction to School-Based Agricultural Education **3 credit hours**
- ECON 2410 - Principles of Economics, Macroeconomics **3 credit hours** (HSSR)
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Quantitative Literacy **3 to 4 credit hours**
- Creativity and Cultural Expression **3 credit hours**

- BIOL 1030 - Exploring Life **4 credit hours** (Nat Sci) AND
- BIOL 1031 - Exploring Life Lab **0 credit hours** (Nat Sci)

Subtotal: 31-32 Hours

Sophomore

- Non-Written Communication **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- History and Civic Learning **6 credit hours**

- PSCI 1030 - Topics in Physical Science **4 credit hours** (Nat/Sci) AND
- PSCI 1031 - Topics in Physical Science Lab **0 credit hours** (Sci Lit)

- AGED 4000 - Foundations of Agricultural Engineering and Applied Technologies Education **3 credit hours**
- AGED 4230 - Program Planning in School-Based Agricultural Education **3 credit hours**
- AGRI 3010 - Debate and Discussion in Agricultural Contexts **3 credit hours**
- PLSO 1610 - Elements of Plant Science **3 credit hours**

Subtotal: 31 Hours

Junior

- AGED 4220 - Methods of Teaching Agriculture, Food, and Natural Resources **3 credit hours**
- ANSC 3440 - Livestock Management **3 credit hours**
- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**

- PLSO 3600 - Horticulture in Our Lives **3 credit hours** OR
- PLSO 4620 - Greenhouse Management **3 credit hours**

- AGBS 4150 - Agricultural Policy **3 credit hours** OR
- AGBS 4190 - International Agriculture **3 credit hours**

- AGBS electives **9 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- YOED 3520 - Knowing and Learning in Science and Mathematics **3 credit hours**
- YOED 3550 - Classroom Interactions in Mathematics and Science **3 credit hours**

Subtotal: 33 Hours

Senior

- AGBS elective **3 credit hours**
- AGRI 4740 - Research Methods **3 credit hours**
- YOED 4040 - Residency I: MTeach **4 credit hours**
- YOED 4050 - Project-Based Instruction in Mathematics and Science **3 credit hours**
- YOED 4400 - Residency II **12 credit hours**

Subtotal: 25 Hours

Agribusiness, B.S.

Agriculture
615-898-2418
Justin Gardner, program coordinator
Justin.Gardner@mtsu.edu

The program leading to a major in Agribusiness is designed for students who are interested primarily in the business of agriculture.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Agribusiness, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**43 hours**
Agribusiness Core	*10 hours*
Major Courses	*33 hours*
Supporting Courses	**35 hours***
Electives	**1-15 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- BIOL 1030/BIOL 1031 (Sci Lit)
- PSCI 1030 PSCI 1031 (Sci Lit)
- ECON 2410 (HSSR)
- Quantitative Literacy (MATH 1710 recommended)

Major Requirements (43 hours)

Agribusiness Core (10 hours)

- AGRI 1000 - Orientation in Agriculture **1 credit hour**
- ANSC 1410 - Introduction to Animal Science **3 credit hours**
- PLSO 1610 - Elements of Plant Science **3 credit hours**
- AGBS 3130 - Principles of Agricultural Economics **3 credit hours**

Remaining Major Courses (33 hours)

- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- AGBS 4130 - Agricultural Commodity Markets **3 credit hours**
- AGBS 4140 - Agribusiness Management **3 credit hours**
- AGBS 4145 - Agricultural Finance **3 credit hours**
- Agribusiness electives **9 credit hours**
  (Choose from: AGBS 3140, AGBS 3150, AGBS 3160, AGBS 3230, AGBS 4115, AGBS 4150, AGBS 4160, or AGBS 4190)
- AGRI, ANSC, FERM, PLSO, POUL electives **9 credit hours**

- AGBS 4190 - International Agriculture **3 credit hours** OR
- AGBS 4150 - Agricultural Policy **3 credit hours**

Supporting Courses (35 hours)

- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
  OR
- ACTG 2110 - Principles of Accounting I **3 credit hours** AND
- ACTG 2120 - Principles of Accounting II **3 credit hours**

- COMM 2200 - Audience-Centered Communication **3 credit hours (may be counted in the True Blue Core)**

- MATH 1530 - Applied Statistics **3 credit hours**

- Quantitative Literacy (MATH 1010, MATH 1630, MATH 1710, MATH 1720, MATH 1730, MATH 1810, or MATH 1910) **3 credit hours**
- INFS 2200 - Introduction to Microcomputing **3 credit hours** OR
- INFS 3100 - Principles of Management Information Systems **3 credit hours** OR
- CSCI 1150 - Computer Orientation **3 credit hours**

- BIOL 1030 - Exploring Life **4 credit hours** AND
- BIOL 1031 - Exploring Life Lab **0 credit hours (may be counted in the True Blue Core)**

- PSCI 1030 - Topics in Physical Science **4 credit hours** AND
- PSCI 1031 - Topics in Physical Science Lab **0 credit hours (may be counted in the True Blue Core)**

- ECON 2410 - Principles of Economics, Macroeconomics **3 credit hours (may be counted in the True Blue Core)**

Choose three, two from the same rubric:

- BIA, PGEO, ECON, FIN, MATH, MKT, MGMT, AERO, EST **9 credit hours**

Electives (1-15)

Curriculum: Agribusiness

Freshman

- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- AGRI 1000 - Orientation in Agriculture **1 credit hour**
- ANSC 1410 - Introduction to Animal Science **3 credit hours**
- PLSO 1610 - Elements of Plant Science **3 credit hours**
- COMM 2200 - Audience-Centered Communication **3 credit hours** (NWC)
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Quantitative Literacy **3 credit hours** (MATH 1710 recommended)
- Creativity and Cultural Expression **3 credit hours**

- BIOL 1030 - Exploring Life **4 credit hours** (Sci Lit) AND
- BIOL 1031 - Exploring Life Lab **0 credit hours** (Sci Lit)

Subtotal: 29 Hours

Sophomore

- AGBS 3130 - Principles of Agricultural Economics **3 credit hours**

- PSCI 1030 - Topics in Physical Science **4 credit hours** (Sci Lit) AND
- PSCI 1031 - Topics in Physical Science Lab **0 credit hours** (Sci Lit)

- MATH 1530 - Applied Statistics **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **6 credit hours**
- ECON 2410 - Principles of Economics, Macroeconomics **3 credit hours** (HSSR)

- INFS 2200 - Introduction to Microcomputing **3 credit hours** OR
- INFS 3100 - Principles of Management Information Systems **3 credit hours** OR
- CSCI 1150 - Computer Orientation **3 credit hours**

Subtotal: 31 Hours

Junior

- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
  OR
- ACTG 2110 - Principles of Accounting I **3 credit hours** AND
- ACTG 2120 - Principles of Accounting II **3 credit hours**

- AGBS 4140 - Agribusiness Management **3 credit hours**
- AGRI, ANSC, FERM, PLSO, POUL electives **6 credit hours**
- Agribusiness electives **6 credit hours**
- Elective **3 credit hours**
- Cognate courses **9 credit hours**

Subtotal: 30-33 Hours

Senior

- AGBS 4150 - Agricultural Policy **3 credit hours** OR
- AGBS 4190 - International Agriculture **3 credit hours**

- AGBS 4130 - Agricultural Commodity Markets **3 credit hours**
- AGBS 4145 - Agricultural Finance **3 credit hours**
- Agribusiness elective **3 credit hours**
- Upper-division electives **12 credit hours**
- AGRI, ANSC, FERM, PLSO, POUL elective **3 credit hours**
- Upper-division course* **3 credit hours**
  **Student should take 3 hour, upper-division elective during the semester AGBS 4150 or 4190 is not being taken.*

Subtotal: 30 Hours

Agriculture Minor

Agriculture

A minor in Agriculture consists of 18 semester hours, with at least 3 hours at the upper-division level, selected with the approval of the school director.

NOTE*: Course rubrics from AGRI, AGBS, AGED, ANSC, FERM, HORS, PLSO, and POUL can be applied to minor requirement.*

Animal Science, Agricultural Education Certification, B.S.

Agriculture
615-904-8037
Chaney Mosley, program coordinator
chaney.mosley@mtsu.edu

Animal Science majors seeking certification to teach agricultural education in secondary schools (grades 7-12) must complete (1) the Animal Science major, (2) an MTeach minor, and (3) professional agricultural education courses. The program leading to a major in Animal Science offers preparation for leadership careers in animal agriculture and related fields.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Animal Science, Agricultural Education Certification, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**43 hours**
Animal Science Core	*13 hours*
Major Courses	*30 hours*
Supporting Courses	**17 hours***
MTeach Minor	**30 hours**
TOTAL	**120-131 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning, which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.
The following courses required by the program meet True Blue Core requirements:

- BIOL 1030/BIOL 1031 (Sci Lit)
- PSCI 1030/PSCI 1031 (Sci Lit)
- COMM 2200 (NWC)
- Quantitative Literacy (MATH prefix required for major; MATH 1710 recommended)

Major Requirements (43 hours)

Animal Science Core (13 hours)

- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- AGRI 1000 - Orientation in Agriculture **1 credit hour**

- ANSC 1410 - Introduction to Animal Science **3 credit hours** OR
- ANSC 1401 - Introduction to Animal and Veterinary Sciences **3 credit hours**

- PLSO 1610 - Elements of Plant Science **3 credit hours**
- AGED 4000 - Foundations of Agricultural Engineering and Applied Technologies Education **3 credit hours**

Major Requirements (30 hours)

- AGED 2230 - Introduction to School-Based Agricultural Education **3 credit hours**
- AGRI 3010 - Debate and Discussion in Agricultural Contexts **3 credit hours**
- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**
- ANSC 3440 - Livestock Management **3 credit hours**
- Animal Science electives **9 credit hours**

- ANSC 3420 - Animal Breeding and Genetics **3 credit hours** OR
- ANSC 4510 - Domestic Animal Reproductive Physiology **3 credit hours**

- PLSO 3600 - Horticulture in Our Lives **3 credit hours** OR
- PLSO 4620 - Greenhouse Management **3 credit hours**

- ANSC 3550 - Animal Feeds and Feeding **3 credit hours** OR
- ANSC 4410 - Animal Nutrition **3 credit hours**

Supporting Courses (17 hours)

- AGED 4220 - Methods of Teaching Agriculture, Food, and Natural Resources **3 credit hours**
- AGED 4230 - Program Planning in School-Based Agricultural Education **3 credit hours**
- COMM 2200 - Audience-Centered Communication **3 credit hours (may be counted in the True Blue Core)**

- BIOL 1030 - Exploring Life **4 credit hours** AND
- BIOL 1031 - Exploring Life Lab **0 credit hours (may be counted in the True Blue Core)**

- PSCI 1030 - Topics in Physical Science **4 credit hours** AND
- PSCI 1031 - Topics in Physical Science Lab **0 credit hours (may be counted in the True Blue Core)**

MTeach Minor (30 hours)

See MTeach for further information.

Curriculum: Animal Science, Agricultural Education Certification

Freshman

- MSE 1010 - Step 1: Inquiry Approaches to Teaching **1 credit hour**
- MSE 2010 - Step 2: Inquiry Lesson Design **1 credit hour**
- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- AGRI 1000 - Orientation in Agriculture **1 credit hour**
- ANSC 1410 - Introduction to Animal Science **3 credit hours**
- PLSO 1610 - Elements of Plant Science **3 credit hours**
- AGED 2230 - Introduction to School-Based Agricultural Education **3 credit hours**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Quantitative Literacy (MATH prefix required for major; MATH 1710 recommended) **3 to 4 credit hours**

- BIOL 1030 - Exploring Life **4 credit hours** (Sci Lit) AND
- BIOL 1031 - Exploring Life Lab **0 credit hours** (Sci Lit)

Subtotal: 31-32 Hours

Sophomore

- AGED 4000 - Foundations of Agricultural Engineering and Applied Technologies Education **3 credit hours**
- AGED 4230 - Program Planning in School-Based Agricultural Education **3 credit hours**
- AGRI 3010 - Debate and Discussion in Agricultural Contexts **3 credit hours**
- COMM 2200 - Audience-Centered Communication **3 credit hours** (NWC)
- Creativity and Cultural Expression Literature **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- History and Civic Learning **6 credit hours**
- ANSC elective **3 credit hours**

- PSCI 1030 - Topics in Physical Science **4 credit hours** (Sci Lit) AND
- PSCI 1031 - Topics in Physical Science Lab **0 credit hours** (Sci Lit)

Subtotal: 31 Hours

Junior

- ANSC 3440 - Livestock Management **3 credit hours**
- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**
- AGED 4220 - Methods of Teaching Agriculture, Food, and Natural Resources **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- ANSC elective **3 credit hours**
- YOED 3520 - Knowing and Learning in Science and Mathematics **3 credit hours**
- YOED 3550 - Classroom Interactions in Mathematics and Science **3 credit hours**

- PLSO 3600 - Horticulture in Our Lives **3 credit hours** OR
- PLSO 4620 - Greenhouse Management **3 credit hours**

- ANSC 3420 - Animal Breeding and Genetics **3 credit hours** OR
- ANSC 4510 - Domestic Animal Reproductive Physiology **3 credit hours**

Subtotal: 30 Hours

Senior

- ANSC elective **3 credit hours**
- AGRI 4740 - Research Methods **3 credit hours**
- YOED 4040 - Residency I: MTeach **4 credit hours**
- YOED 4050 - Project-Based Instruction in Mathematics and Science **3 credit hours**
- YOED 4400 - Residency II **12 credit hours**

- ANSC 3550 - Animal Feeds and Feeding **3 credit hours** OR
- ANSC 4410 - Animal Nutrition **3 credit hours**

Subtotal: 28 Hours

NOTE:

**Electives must come from the following courses: ANSC 3450, ANSC 3470, ANSC 3480, ANSC 3500, ANSC 3540, ANSC 3710, ANSC 4260, ANSC 4470, ANSC 4490, ANSC 4520, ANSC 4860, HORS 3430, HORS 4090, POUL 3000, POUL 3490, POUL 3600.*

Animal Science, B.S.

Agriculture
615-898-2169
Jessica Carter, program coordinator
Jessica.Carter@mtsu.edu
The program leading to a major in Animal Science offers preparation for leadership careers in animal agriculture and related fields.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Animal Science, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**46 hours**
Supporting Courses	**27-28 hours***
Electives	**5-14 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours may increase.*

True Blue Core (41 hours)

True Blue Core requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning, which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.
The following courses required by the program meet True Blue Core requirements:

- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1010/CHEM 1011 or CHEM 1110/CHEM 1111 (Sci Lit)
- Quantitative Literacy (MATH 1710 recommended)

Major Requirements (46 hours)

- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- AGRI 1000 - Orientation in Agriculture **1 credit hour**

- ANSC 1410 - Introduction to Animal Science **3 credit hours** OR
- ANSC 1401 - Introduction to Animal and Veterinary Sciences **3 credit hours**

- ANSC 1411 - Introduction to Animal Science Lab **1 credit hour**
- ANSC 3000 - Careers in Animal and Veterinary Science **2 credit hours**
- PLSO 1610 - Elements of Plant Science **3 credit hours**

- PLSO 3340 - Fundamentals of Soil Science **3 credit hours** OR
- PLSO 4310 - Forage Crops **3 credit hours**

- ANSC 3420 - Animal Breeding and Genetics **3 credit hours**
- ANSC 3440 - Livestock Management **3 credit hours**
- ANSC 3550 - Animal Feeds and Feeding **3 credit hours**
- ANSC 4410 - Animal Nutrition **3 credit hours**
- ANSC 4510 - Domestic Animal Reproductive Physiology **3 credit hours**
- Upper-division Animal Science electives **12 credit hours**
- Agribusiness or Plant and Soil Science elective **3 credit hours**

Supporting Courses (27-28 hours)

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core) (pre-vet)**

- CHEM 1020 - Introductory General Chemistry II **4 credit hours** AND
- CHEM 1021 - Intro to General Chemistry II Lab **0 credit hours**
  OR
- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours (pre-vet)**

- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**
  OR
- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour (pre-vet)**

- MATH **3-4 credit hours**
  Choose one course from the True Blue Core Quantitative Literacy category **and** one course from MATH 1530, MATH 1710, MATH 1720, MATH 1730, MATH 1910, or AGRI 2210.

Electives (5-14 hours)

- Minimum of 9 (or 5) must be upper-division

Curriculum: Animal Science

Freshman

- AGRI 1000 - Orientation in Agriculture **1 credit hour**

- ANSC 1410 - Introduction to Animal Science **3 credit hours** OR
- ANSC 1401 - Introduction to Animal and Veterinary Sciences **3 credit hours**

- ANSC 1411 - Introduction to Animal Science Lab **1 credit hour**
- PLSO 1610 - Elements of Plant Science **3 credit hours**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Quantitative Literacy **3 to 4 credit hours** (MATH 1710 recommended)
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

Subtotal: 31-32 Hours

Sophomore

- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- ANSC 3000 - Careers in Animal and Veterinary Science **2 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **6 credit hours**
- Non-Written Communication **3 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours** (Sci Lit)
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit) (pre-vet)

- CHEM 1020 - Introductory General Chemistry II **4 credit hours** AND
- CHEM 1021 - Intro to General Chemistry II Lab **0 credit hours**
  OR
- CHEM 1120 - General Chemistry II **4 credit hours**
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Choose one:

- MATH 1530 - Applied Statistics **3 credit hours**
- MATH 1710 - College Algebra **3 credit hours**
- MATH 1720 - Plane Trigonometry **3 credit hours**
- MATH 1730 - Pre-Calculus **4 credit hours**
- MATH 1910 - Calculus I **4 credit hours**
- AGRI 2210 - Introduction to Agricultural Engineering **3 credit hours**

Subtotal: 31-32 Hours

Junior

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- PLSO 3340 - Fundamentals of Soil Science **3 credit hours** OR
- PLSO 4310 - Forage Crops **3 credit hours**

- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**
  OR
- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- ANSC 3440 - Livestock Management **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Upper-division Animal Science electives **6 credit hours**.*
- PLSO/AGBS elective **3 credit hours**
- ANSC 3550 - Animal Feeds and Feeding **3 credit hours**

Subtotal: 29 Hours

Senior

- ANSC 3420 - Animal Breeding and Genetics **3 credit hours**
- ANSC 4410 - Animal Nutrition **3 credit hours**
- ANSC 4510 - Domestic Animal Reproductive Physiology **3 credit hours**
- Upper-division Animal Science electives **6 credit hours***
- Upper-division electives **9 credit hours**
- Electives **5 credit hours**

Subtotal: 29 Hours

NOTE:

**Electives must come from the following courses: ANSC 3450, ANSC 3470, ANSC 3480, ANSC 3500, ANSC 3540, ANSC 3710, ANSC 4260, ANSC 4470, ANSC 4490, ANSC 4520, ANSC 4860, HORS 3430, HORS 4090, POUL 3000, POUL 3490, POUL 3600.*

Fermentation Science Minor

Agriculture
Dr. Tony Johnston, program coordinator
Tony.Johnston@mtsu.edu
615-898-2421

The Fermentation Science minor is 15 hours and is designed to introduce the non-Fermentation Science major to the non-technical high points of the major course content. Students will see the scope and range of the field of study and delve deeper into specific fermented food topics of interest. At least 9 hours in the minor must be completed at MTSU.

Note: *A student may not major and minor in Fermentation Science.*

Required Courses (6 hours)

- FERM 1000 - Introduction to Fermentation Science **3 credit hours**
- FERM 3700 - Consumer Motivation and Sensory Evaluation of Fermented Foods **3 credit hours**

Electives (9 hours)

- FERM 2500 - Wine Appreciation **3 credit hours**
- FERM 2900 - Legal Issues - Fermentation **3 credit hours**
- FERM 3710 - Brewing, Distilling, and Fermentation Safety and Sanitation **3 credit hours**
- FERM 3860 - Wine, Beer, and Spirits Industry **3 credit hours**
- FERM 3900 - Sensory Analysis of Beer **3 credit hours**
- FERM 4800 - International Fermented Foods **3 credit hours**

Fermentation Science, B.S.

Agriculture
615-898-5892
Keely O'Brien, program coordinator
Keely.Obrien@mtsu.edu

The program leading to a major in Fermentation Science is designed for students interested in the science and art of fermenting foods and beverages as well as developing practical research and outreach initiatives to answer questions facing the growing fermentation-related industries in Tennessee, the United States, and the world.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Fermentation Science, B.S.

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**57 hours**
Supporting Courses	**8 hours***
Business Foundations	**12 hours**
Electives	**2-10 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours may increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1110/CHEM 1111 or CHEM 1010/CHEM 1011 (Sci Lit)
- Quantitative Literacy (MATH 1730 recommended)

Major Requirements (57 hours)

- FERM 1000 - Introduction to Fermentation Science **3 credit hours**
- FERM 3700 - Consumer Motivation and Sensory Evaluation of Fermented Foods **3 credit hours**
- FERM 4910 - Fermentation Science Internship **1 to 3 credit hours (3 credit hours required)**
- FERM 4920 - Fermentation Science Research **1 to 3 credit hours (3 credit hours required)**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**
- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 4510 - Food and Industrial Microbiology **4 credit hours** AND
- BIOL 4511 - Food and Industrial Microbiology Lab **0 credit hours**

- CHEM 1020 - Introductory General Chemistry II **4 credit hours** AND
- CHEM 1021 - Intro to General Chemistry II Lab **0 credit hours**
  OR
- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**

- CHEM 3530 - Principles of Biochemistry **4 credit hours** AND
- CHEM 3531 - Principles of Biochemistry Lab **0 credit hours**

Specialized Track (21 hours)

Students will select 21 credit hours from the following areas of interest: wine industry, brewing or distillation, fermented dairy foods, fermented meat or baked foods

- AGRI 2010 - World Food and Society **3 credit hours**
- AGBS 3160 - Value Added Agriculture **3 credit hours**
- AGRI 3810 - Milk Processing and Marketing **3 credit hours**
- AGRI 4820 - Principles of Food Processing **3 credit hours**
- AGRI 4830 - Food Quality Control **3 credit hours**
- AGRI 4850 - Food Safety Issues from Production to Consumption **3 credit hours**
- FERM 2500 - Wine Appreciation **3 credit hours**
- FERM 2900 - Legal Issues - Fermentation **3 credit hours**
- FERM 3710 - Brewing, Distilling, and Fermentation Safety and Sanitation **3 credit hours**
- FERM 3750 - Facility Design and Operation **3 credit hours**
- FERM 3850 - Wine Science and Industry **3 credit hours**
- FERM 3860 - Wine, Beer, and Spirits Industry **3 credit hours**
- FERM 3900 - Sensory Analysis of Beer **3 credit hours**
- FERM 4550 - Brewing, Distilling, and Fermentation Science and Analysis **3 credit hours**
- FERM 4560 - Applied Fermentation: Biomass and Biofuels **3 credit hours**
- FERM 4570 - Applied Fermentation: Milk, Meat, and Grain **3 credit hours**
- FERM 4580 - Applied Fermentation: Fruits and Vegetables **3 credit hours**
- FERM 4600 - Probiotics, Prebiotics, and Bioprocessing **3 credit hours**
- FERM 4610 - Fermentation and Nutraceutical Production **3 credit hours**
- FERM 4800 - International Fermented Foods **3 credit hours**
- THM 4140 - Food and Beverage Tourism **3 credit hours**
- PLSO 4500 - Agroecology **3 credit hours**

- BIOL 4570 - Principles of Toxicology **3 credit hours** AND
- BIOL 4571 - Principles of Toxicology Lab **0 credit hours**

Business Foundations (12 hours)

NOTE: Students may count business foundations courses toward the requirements for a minor in Business Administration or Entrepreneurship.

- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
- BCED 3510 - Business Communication **3 credit hours**
- BLAW 3400 - Legal Environment of Business **3 credit hours**
- ENTR 2900 - Entrepreneurship **3 credit hours**
- FIN 3000 - Survey of Finance **3 credit hours**
- MGMT 3610 - Principles of Management **3 credit hours**
- MKT 3820 - Principles of Marketing **3 credit hours**

- ENTR 4920 - Small Business Management **3 credit hours** OR
- MGMT 4920 - Small Business Management **3 credit hours**

Supporting Courses (8 hours)

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)** OR
- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

Electives (2-10 hours)

Curriculum: Fermentation Science

Freshman

- FERM 1000 - Introduction to Fermentation Science **3 credit hours**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Quantitative Literacy **3 credit hours** (MATH 1730 recommended)
- Human Society and Social Relationships **6 credit hours**
- History and Civic Learning **3 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours** (Sci Lit) OR
- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1020 - Introductory General Chemistry II **4 credit hours** AND
- CHEM 1021 - Intro to General Chemistry II Lab **0 credit hours**
  OR
- CHEM 1120 - General Chemistry II **4 credit hours** (Sci Lit) AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours** (Sci Lit)

Subtotal: 29 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- Non-Written Communication **3 credit hours**
- FERM specialized course **3 credit hours**
- Creativity and Cultural Expression **6 credit hours**
- History and Civic Learning **3 credit hours**
- FERM 3700 - Consumer Motivation and Sensory Evaluation of Fermented Foods **3 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**

Subtotal: 33 Hours

Junior

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 4510 - Food and Industrial Microbiology **4 credit hours** AND
- BIOL 4511 - Food and Industrial Microbiology Lab **0 credit hours**

- CHEM 3530 - Principles of Biochemistry **4 credit hours** AND
- CHEM 3531 - Principles of Biochemistry Lab **0 credit hours**

- FERM specialized courses **9 credit hours**
- Business foundation courses **9 credit hours**

Subtotal: 30 Hours

Senior

- FERM 4910 - Fermentation Science Internship **1 to 3 credit hours (3 credit hours)**
- FERM 4920 - Fermentation Science Research **1 to 3 credit hours (3 credit hours)**
- Business foundation courses **3 credit hours**
- FERM specialized courses **9 credit hours**
- Scientific Literacy/Electives **8 credit hours**
- Elective **2 credit hours**

Subtotal: 28 Hours

Horse Science, B.S.

Agriculture
Rhonda Hoffman, program coordinator
615-898-2908
Rhonda.Hoffman@mtsu.edu

The B.S. in Horse Science is designed to enhance preparation of students for careers in the multidisciplinary U.S. horse industry. The Horse Science major provides comprehensive course work in horse care and health, horsemanship equitation, selection and evaluation, behavior and training, genetic, nutrition, reproductive physiology, exercise physiology, equine event and facility management, and equine-assisted activities and therapies.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Horse Science, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**46-47 hours**
Supporting Courses	**16 hours***
Electives	**16-25 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses recommended by the program meet True Blue Core requirements:

- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1010/CHEM 1011 or CHEM 1110/CHEM 1111 (Sci Lit)
- Quantitative Literacy (MATH 1710 recommended)

Major Requirements (46-47 hours)

- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- AGRI 1000 - Orientation in Agriculture **1 credit hour**

- ANSC 1410 - Introduction to Animal Science **3 credit hours** OR
- ANSC 1401 - Introduction to Animal and Veterinary Sciences **3 credit hours**

- PLSO 1610 - Elements of Plant Science **3 credit hours**
- ANSC 3440 - Livestock Management **3 credit hours**

- PLSO 3340 - Fundamentals of Soil Science **3 credit hours** OR
- PLSO 4310 - Forage Crops **3 credit hours**

- HORS 1110 - Introduction to Horse Care and Use **3 credit hours**
- HORS 2400 - Fundamentals of Horsemanship **3 credit hours**
- HORS 2480 - Equine Evaluation and Selection **3 credit hours**

- HORS 3040 - Stable Management **3 credit hours** OR
- HORS 3430 - Horse Production **3 credit hours**

- HORS 3300 - Equine Health **3 credit hours**
- HORS 3410 - Horse Breeds and Genetics **3 credit hours**

- HORS 4090 - Equine Reproduction and Breeding **3 credit hours** OR
- HORS 4550 - Equine Exercise Physiology **3 credit hours**

- ANSC, AGBS, HORS, or PLSO elective **3 credit hours**
- HORS 4440 - Equine Nutrition and Feeding **3 credit hours**

- HORS 4040 - Equine Event and Facility Management **3 credit hours** OR
- HORS 4170 - Equine Industry **3 credit hours** OR
- HORS 4450 - Techniques of Teaching Horsemanship **3 credit hours** OR
- HORS 4460 - Behavior and Training of Horses **4 credit hours** OR
- HORS 4540 - Equine Assisted Therapy **3 credit hours** OR
- HORS 4545 - Equine Assisted Activities and Therapies II **3 credit hours** OR
- HORS 4580 - Advanced Judging of Horses **3 credit hours**

Supporting Courses (16 hours)

- BIOL 1110 - General Biology I **4 credit hours**
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours**
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**
  OR
- CHEM 1110 - General Chemistry I **4 credit hours**
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1020 - Introductory General Chemistry II **4 credit hours** AND
- CHEM 1021 - Intro to General Chemistry II Lab **0 credit hours**
  OR
- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Electives (16-25 hours)

- Upper-division hours to make 36

Curriculum: Horse Science

Freshman

- ANSC 1410 - Introduction to Animal Science **3 credit hours**
- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- AGRI 1000 - Orientation in Agriculture **1 credit hour**
- HORS 1110 - Introduction to Horse Care and Use **3 credit hours**
- PLSO 1610 - Elements of Plant Science **3 credit hours**
- Quantitative Literacy **3 to 4 credit hours** (MATH 1710 recommended)
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

Subtotal: 30-31 Hours

Sophomore

- HORS 2400 - Fundamentals of Horsemanship **3 credit hours**
- HORS 2480 - Equine Evaluation and Selection **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Non-Written Communication **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **6 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours** (Sci Lit)
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1020 - Introductory General Chemistry II **4 credit hours** AND
- CHEM 1021 - Intro to General Chemistry II Lab **0 credit hours**
  OR
- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 32 Hours

Junior

- ANSC, AGBS, HORS, or PLSO elective **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- HORS 3300 - Equine Health **3 credit hours**
- HORS 4440 - Equine Nutrition and Feeding **3 credit hours**

- PLSO 3340 - Fundamentals of Soil Science **3 credit hours** OR
- PLSO 4310 - Forage Crops **3 credit hours**

- ANSC 3440 - Livestock Management **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Electives **6 credit hours**
- Upper-division elective **3 credit hours**

Subtotal: 30 Hours

Senior

- HORS 3040 - Stable Management **3 credit hours** OR
- HORS 3430 - Horse Production **3 credit hours**

- HORS 3410 - Horse Breeds and Genetics **3 credit hours**

- HORS 4090 - Equine Reproduction and Breeding **3 credit hours** OR
- HORS 4550 - Equine Exercise Physiology **3 credit hours**

- Scientific Literacy/Electives **8 credit hours**
- Elective **1 credit hour**
- Upper-division electives **6 to 7 credit hours**

- HORS 4040 - Equine Event and Facility Management **3 credit hours** OR
- HORS 4170 - Equine Industry **3 credit hours** OR
- HORS 4450 - Techniques of Teaching Horsemanship **3 credit hours** OR
- HORS 4460 - Behavior and Training of Horses **4 credit hours** OR
- HORS 4540 - Equine Assisted Therapy **3 credit hours** OR
- HORS 4545 - Equine Assisted Activities and Therapies II **3 credit hours**
- HORS 4580 - Advanced Judging of Horses **3 credit hours**

Subtotal: 28 Hours

Plant and Soil Science, Agricultural Education Certification, B.S.

Agriculture
615-904-8037
Chaney Mosley, program coordinator
chaney.mosley@mtsu.edu

Plant and Soil Science majors seeking certification to teach agricultural education in secondary schools (grades 7-12) must complete (1) the Plant and Soil Science major, (2) an MTeach minor, and (3) professional agricultural education courses.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Plant and Soil Science, Agricultural Education Certification, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**43 hours**
Supporting Courses	**17 hours***
MTeach Minor	**30 hours**
TOTAL	**120-131 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- BIOL 1030/BIOL 1031 (Sci Lit)
- PSCI 1030/PSCI 1031 (Sci Lit)
- COMM 2200 (NWC)
- Quantitative Literacy (MATH 1710) recommended

Major Requirements (43 hours)

Plant and Soil Science Core (13 hours)

- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- AGRI 1000 - Orientation in Agriculture **1 credit hour**
- ANSC 1410 - Introduction to Animal Science **3 credit hours**
- PLSO 1610 - Elements of Plant Science **3 credit hours**
- AGED 4000 - Foundations of Agricultural Engineering and Applied Technologies Education **3 credit hours**

Agricultural Education (30 hours)

- AGED 2230 - Introduction to School-Based Agricultural Education **3 credit hours**
- ANSC 3440 - Livestock Management **3 credit hours**

- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**
- Plant and Soil Science electives **6 credit hours**
- AGRI 3010 - Debate and Discussion in Agricultural Contexts **3 credit hours**

- PLSO 3600 - Horticulture in Our Lives **3 credit hours** OR
- PLSO 4620 - Greenhouse Management **3 credit hours**

- PLSO 3350 - Soil Fertility and Fertilizer **3 credit hours** OR
- PLSO 3370 - Soil Analysis **3 credit hours** OR
- PLSO 4350 - Soil Survey and Land Use **3 credit hours** OR
- PLSO 4370 - Soil and Water Conservation **3 credit hours**

- PLSO 3700 - Fundamentals of Precision Agriculture **3 credit hours** OR
- PLSO 4000 - Agroecosystems Remote Sensing Using UAS **3 credit hours** OR
- PLSO 4750 - Agricultural Biotechnology **3 credit hours**

- PLSO 4630 - Floriculture **3 credit hours** OR
- PLSO 4660 - Nursery Management **3 credit hours** OR
- PLSO 4670 - Plant Propagation **3 credit hours**

Supporting Courses (17 hours)

- AGED 4220 - Methods of Teaching Agriculture, Food, and Natural Resources **3 credit hours**
- AGED 4230 - Program Planning in School-Based Agricultural Education **3 credit hours**
- COMM 2200 - Audience-Centered Communication **3 credit hours (may be counted in the True Blue Core)**

- BIOL 1030 - Exploring Life **4 credit hours** AND
- BIOL 1031 - Exploring Life Lab **0 credit hours (may be counted in the True Blue Core)**

- PSCI 1030 - Topics in Physical Science **4 credit hours** AND
- PSCI 1031 - Topics in Physical Science Lab **0 credit hours (may be counted in the True Blue Core)**

MTeach Minor (30 hours)

See MTeach minor for further information.

Curriculum: Plant and Soil Science, Agricultural Education Certification

Freshman

- MSE 1010 - Step 1: Inquiry Approaches to Teaching **1 credit hour**
- MSE 2010 - Step 2: Inquiry Lesson Design **1 credit hour**
- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- AGRI 1000 - Orientation in Agriculture **1 credit hour**
- ANSC 1410 - Introduction to Animal Science **3 credit hours**
- PLSO 1610 - Elements of Plant Science **3 credit hours**
- AGED 2230 - Introduction to School-Based Agricultural Education **3 credit hours**
- Quantitative Literacy **3 to 4 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**

- BIOL 1030 - Exploring Life **4 credit hours** (Sci Lit) AND
- BIOL 1031 - Exploring Life Lab **0 credit hours** (Sci Lit)

Subtotal: 31 Hours

Sophomore

- AGED 4000 - Foundations of Agricultural Engineering and Applied Technologies Education **3 credit hours**
- AGED 4230 - Program Planning in School-Based Agricultural Education **3 credit hours**
- AGRI 3010 - Debate and Discussion in Agricultural Contexts **3 credit hours**
- ANSC 3440 - Livestock Management **3 credit hours**
- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **3 credit hours**

- PSCI 1030 - Topics in Physical Science **4 credit hours** (Sci Lit) AND
- PSCI 1031 - Topics in Physical Science Lab **0 credit hours** (Sci Lit)

Subtotal: 31 Hours

Junior

- AGED 4220 - Methods of Teaching Agriculture, Food, and Natural Resources **3 credit hours**
- COMM 2200 - Audience-Centered Communication **3 credit hours** (NWC)
- Plant and Soil Science electives **9 credit hours**
- Human Society and Social Relationships **3 credit hours**
- History and Civic Learning **3 credit hours**

- PLSO 3600 - Horticulture in Our Lives **3 credit hours** OR
- PLSO 4620 - Greenhouse Management **3 credit hours**

- YOED 3520 - Knowing and Learning in Science and Mathematics **3 credit hours**
- YOED 3550 - Classroom Interactions in Mathematics and Science **3 credit hours**

Subtotal: 30 Hours

Senior

- AGRI 4740 - Research Methods **3 credit hours**
- PLSO electives **6 credit hours**
- YOED 4040 - Residency I: MTeach **4 credit hours**
- YOED 4050 - Project-Based Instruction in Mathematics and Science **3 credit hours**
- YOED 4400 - Residency II **12 credit hours**

Subtotal: 28 Hours

NOTE:

For certification to teach agriscience, students should see advisor.

Plant and Soil Science, B.S.

Agriculture
615-494-8996
Nathan Phillips, program coordinator
Nate.Phillips@mtsu.edu

The program leading to a major in Plant and Soil Science is designed for students interested in agronomy, horticulture, and/or soil sciences.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Plant and Soil Science, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**43 hours**
Science and Mathematics Cognate	**15-16 hours**
Supporting Courses	**8 hours***
Electives	**12-20 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- CHEM 1010/CHEM 1011 OR CHEM 1110/CHEM 1111 (Sci Lit)
- BIOL 1110/BIOL 1111 (Sci Lit)
- Quantitative Literacy (MATH 1710 recommended)

Major Requirements (43 hours)

Plant and Soil Science Core (19 hours)

- AGRI 1000 - Orientation in Agriculture **1 credit hour**
- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- ANSC 1410 - Introduction to Animal Science **3 credit hours**
- PLSO 1610 - Elements of Plant Science **3 credit hours**
- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**
- PLSO 4690 - Crop Ecophysiology **3 credit hours**
- PLSO 4300 - Plant Protection **3 credit hours** OR
- PLSO 4670 - Plant Propagation **3 credit hours**

Electives (24 hours)

- Plant and Soil Science electives **21 credit hours**
- AGBS or ANSC elective **3 credit hours**

Science and Mathematics Cognate (15-16 hours)

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- CHEM 1020 - Introductory General Chemistry II **4 credit hours** AND
- CHEM 1021 - Intro to General Chemistry II Lab **0 credit hours**
  OR
- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- **6 hours** of Quantitative Literacy choosing one from the True Blue Core (Quant Lit) and choosing one from MATH 1530, MATH 1710, MATH 1720, MATH 1730, MATH 1910, or AGRI 4710

Supporting Courses (8 hours)

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

Electives (12-20 hours)

Curriculum: Plant and Soil Science

Freshman

- AGRI 1000 - Orientation in Agriculture **1 credit hour**
- ANSC 1410 - Introduction to Animal Science **3 credit hours**
- PLSO 1610 - Elements of Plant Science **3 credit hours**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Mathematics **3 to 4 credit hours** (MATH 1710 recommended)
- Human Society and Social Relationships **3 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

Subtotal: 30-31 Hours

Sophomore

- AGBS 1210 - Principles of Agribusiness **3 credit hours**
- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**
- Non-Written Communication **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Elective **3 credit hours**
- History and Civic Learning **6 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1020 - Introductory General Chemistry II **4 credit hours** AND
- CHEM 1021 - Intro to General Chemistry II Lab **0 credit hours**
  OR
- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 32 Hours

Junior

- PLSO 4690 - Crop Ecophysiology **3 credit hours**
- Agribusiness or Animal Science elective **3 credit hours**
- Plant and Soil Science upper-division electives **12 credit hours**
- Electives **6 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- MATH 1530 - Applied Statistics **3 credit hours** OR
- MATH 1710 - College Algebra **3 credit hours** OR
- MATH 1720 - Plane Trigonometry **3 credit hours** OR
- MATH 1730 - Pre-Calculus **4 credit hours** OR
- MATH 1910 - Calculus I **4 credit hours** OR
- AGRI 4710 - Agricultural Statistics and Data Analysis **3 credit hours**

Subtotal: 31-32 Hours

Senior

- PLSO 4300 - Plant Protection **3 credit hours** OR
- PLSO 4670 - Plant Propagation **3 credit hours**

- Human Society and Social Relationships **3 credit hours**
- Plant and Soil Science upper-division electives **9 credit hours**
- Upper-division electives **6 credit hours**
- Electives **5-6 credit hours**

Subtotal: 26-27 Hours

Poultry Science Minor

Agriculture
615-898-2523
Kevin Downs, program coordinator
Kevin.Downs@mtsu.edu

The minor in Poultry Science is designed to enhance the preparation of students for careers in the U.S. poultry industry and allied fields. Students interested in graduate studies in poultry science are also encouraged to complete the Poultry Science minor which requires 15 hours of poultry science coursework. At least 3 upper-division hours must be completed at MTSU.

Note: *Courses applied in the minor cannot also count as major electives.*

Required Courses (15 hours)

- POUL 1000 - Introduction to Poultry Science **3 credit hours**
- POUL 3490 - Commercial Poultry Production **3 credit hours**
- POUL 3700 - Poultry Nutrition and Feeding **3 credit hours**
- POUL 4000 - Poultry Reproduction and Breeder Management **3 credit hours**

- POUL 3600 - Poultry Evaluation **3 credit hours** OR
- POUL 3650 - Poultry Processing **3 credit hours**

Precision Agriculture Minor

Agriculture
(615) 898-2523
Song Cui, program coordinator
Song.Cui@mtsu.edu

The Precision Agriculture minor is designed for students who seek knowledge about fundamental concepts and application of modern technologies such as Geographic Information Systems (GIS), Global Positioning Systems (GPS), Remote Sensing, and other information systems in agricultural production. This 18-hour minor requires at least 3 upper-division hours be completed at MTSU.

Note: *Courses applied in the minor cannot also count as major requirements.*

Required Courses (9 hours)

- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**
- PLSO 3700 - Fundamentals of Precision Agriculture **3 credit hours**
- AERO 4775 - Unmanned Aircraft Systems in Research and Applications **3 credit hours**

Agriculture Electives (6 hours)

Choose two:

- AGBS 3230 - Fundamentals of Agricultural Producer Risk Management **3 credit hours**
- AGRI 2010 - World Food and Society **3 credit hours**
- AGRI 3400 - Fundamentals of Sustainable Agriculture **3 credit hours**
- PLSO 3330 - Field Crop Production **3 credit hours**
- PLSO 3350 - Soil Fertility and Fertilizer **3 credit hours**
- PLSO 4000 - Agroecosystems Remote Sensing Using UAS **3 credit hours**
- PLSO 4620 - Greenhouse Management **3 credit hours**
- PLSO 4680 - Internship in Plant and Soil Science **3 to 6 credit hours**
  NOTE: *Approved upper-division elective courses in AGRI, PLSO, AGBS, or ANSC may also be used to meet this required area of the minor.*

Geography Elective (3-4 hours)

Choose one:

- PGEO 4490 - Remote Sensing **4 credit hours**
- PGEO 4530 - Geographic Information Systems **3 credit hours**

Veterinary Medicine Study Preparation

Agriculture

Students who wish to pursue admission to a professional DVM program should follow the appropriate minimum admissions prerequisites for the institution(s) to which they intend to apply. The following curriculum will satisfy the admissions requirements for many, but not all, colleges of veterinary medicine. It is imperative that interested students fully apprise themselves of the specific admissions requirements.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Veterinary Study Academic Map

Minimum Requirements

- Written Communication
- Information Literacy

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- BIOL 4210 - Cell and Molecular Biology **4 credit hours** AND
- BIOL 4211 - Cell and Molecular Biology Lab **0 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

- CHEM 3530 - Principles of Biochemistry **4 credit hours** AND
- CHEM 3531 - Principles of Biochemistry Lab **0 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

- Humanities and Social Science **18 credit hours**
- Math **0-6 credit hours**

Subtotal: 72-78 hours

NOTE:

The above requirements represent the minimum. Those students with inadequate knowledge of and experience with food and fiber species should highly consider taking additional courses in the animal sciences. Most students accepted into a professional DVM program first complete the B.S. degree in Animal Science at MTSU.

Agribusiness

AGBS 1201 - Agribusiness: Fundamentals and Applications
3 credit hours Introduces key agribusiness principles and their application to the food industry. Major microeconomic, macroeconomics, and global forces influencing both producers' and consumers' decision of food and fiber products considered and discussed. Leading problems and current issues facing the industry discussed.

AGBS 1210 - Principles of Agribusiness
3 credit hours
An overview of the food and agriculture industry, agricultural markets, agriculture supply chains, and the structure of agribusinesses.

AGBS 3130 - Principles of Agricultural Economics
3 credit hours Applying the principles of economics to agricultural problems.

AGBS 3140 - Real Property Law for Commerce and Agriculture
3 credit hours (Same as BLAW 4470/FIN 4470.) Prerequisite: Junior standing. Legal rights and limitations of ownership of property, estates, titles, methods of transferring titles, abstract of titles, mortgages, leases, easements, restrictions on the use of property, real estate development, application of contract law to real property, and the role of real estate in the administration of estates. Emphasis on specific application to agricultural businesses and farms.

AGBS 3150 - Avocational Agriculture
3 credit hours Prerequisites: AGBS 1210 and AGBS 3130. Analyzes and evaluates potential opportunities, markets, and profitability of part-time agricultural enterprises. Examines potential advantages and disadvantages of part-time agriculture including cost, revenue, time restrictions and freedoms, management considerations, and profitable opportunities.

AGBS 3160 - Value Added Agriculture
3 credit hours A comprehensive analysis of the value-added agricultural industry including marketing farm products directly to consumers.

AGBS 3230 - Fundamentals of Agricultural Producer Risk Management
3 credit hours Prerequisite: Junior or senior standing. Fundamental concepts and principles of agriculture risk management to understand agriculture production risk, price risk, and its limitation and strategies.

AGBS 4115 - Agritourism
3 credit hours Prerequisite: AGBS 1210 or permission of instructor. Emphasis on any activity, enterprise, or business that combines primary elements and characteristics of Tennessee agriculture and tourism and provides an experience for visitors that stimulates economic activity and impacts both farm and community income.

AGBS 4130 - Agricultural Commodity Markets
3 credit hours Prerequisite: AGBS 3130. Analysis of the forces that drive agricultural markets, the risk inherent in these markets, and tools that can be used to defray agriculture-specific risk including production risk.

AGBS 4140 - Agribusiness Management
3 credit hours Prerequisite: AGBS 3130 or approval of instructor. Application of economic concepts to agribusiness firms.

AGBS 4145 - Agricultural Finance
3 credit hours Prerequisites: MATH 1010, MATH 1530, MATH 1630, MATH 1710, MATH 1720, MATH 1730, MATH 1810, or MATH 1910 and AGBS 1210 or AGBS 3130. Application of finance to farms and agribusiness; topics include farm real estate, financing farm inputs, and financing commodity marketing plans.

AGBS 4150 - Agricultural Policy
3 credit hours Prerequisite: AGBS 3130. Agricultural policy in a democratic society; relationship of farm groups to public policy; types of agricultural programs and appraisal of their results.

AGBS 4160 - Agricultural Cooperatives
3 credit hours Prerequisite: AGBS 3130. Role of agricultural cooperatives in collective bargaining for farmers; historical development, economic organization, and structural aspects.

AGBS 4180 - Internship in Agribusiness
3 to 6 credit hours Prerequisite: Approval of instructor. In-depth practical experience in a specific area of agribusiness. NOT OPEN TO STUDENTS WHO HAVE RECEIVED CREDIT FROM ANOTHER SCHOOL INTERNSHIP COURSE.

AGBS 4190 - International Agriculture
3 credit hours Prerequisite: AGBS 3130 or approval of instructor. Interdisciplinary experiential learning in a foreign country. Foreign agriculture and agribusiness explored in the classroom and onsite through a planned trip. Students required to hold (or acquire) a valid US passport and participate in a one- to two-week visit to a foreign country during the course. Combined lecture/lab.

Agricultural Education

AGED 2230 - Introduction to School-Based Agricultural Education
3 credit hours Provides a foundational resource that covers the three essential elements of school-based agricultural education: laboratory/classroom instruction, supervised agricultural experience, and FFA. Focuses on historical and current content, terminology, and practices.

AGED 4000 - Foundations of Agricultural Engineering and Applied Technologies Education
3 credit hours
Prerequisite: AGED 2230. Students pursuing agricultural education certification will explore theory and practice of common agricultural engineering and applied technologies concepts including carpentry, welding, plumbing, electricity, and others in a lecture/lab setting.

AGED 4220 - Methods of Teaching Agriculture, Food, and Natural Resources
3 credit hours Connects teaching and learning theory to agriculture, food, and natural resource education. Explores topics related to assessment strategies, differentiated instruction, lesson planning, and laboratory instruction.

AGED 4230 - Program Planning in School-Based Agricultural Education
3 credit hours Program development in school-based agricultural education. Conceptual understanding of agricultural education programs of study and course standards, course scope and sequence, unit lesson planning, advisory boards, and community engagement.

AGED 4240 - Workshops in Agricultural Education
1 to 6 credit hours Prerequisite: Teaching experience or approval of instructor. Designed to provide vocational agriculture teachers with intensive training in selected areas of agriculture. Check with your academic advisor.

AGED 4990 - Agricultural Education Internship
3 to 6 credit hours
Prerequisite: Permission of instructor. In-depth practical experience in a specific aspect of agricultural education pertinent to the individual's interest. Students work with organizations and agencies that have agreed to cooperate in the program and to provide adequate salary and guidance.

Agriculture

AGRI 1000 - Orientation in Agriculture
1 credit hour Covers topics related to agriculture including career opportunities, industry trends, and controversial issues. Familiarizes students with School of Agriculture facilities, extracurricular activities, faculty, and academic programs.

AGRI 1001 - Orientation in Agriculture and Agriscience
1 credit hour Introduces students to agriculture and provides insight for a career in the agriculture industry.

AGRI 1301 - Introduction to Agricultural Leadership
3 credit hours Introduces agricultural leadership and illustrates the relationship between leadership styles, personality types, communication styles, and career selection. Offers preparation for leadership positions in agricultural careers and communities.

AGRI 2010 - World Food and Society
3 credit hours A global examination of the economic, political, social, and cultural issues related to hunger including war, politics, inequities, malnutrition, population growth, food production, biotechnology, ecological destruction, and food aid. Students will examine personal and societal values concerning world food issues and explore possible directions and solutions for the future. Includes a service learning experience.

AGRI 2210 - Introduction to Agricultural Engineering
3 credit hours Prerequisite: MATH 1710 or MATH 1010 or approval of instructor. Basic principles, mechanics, combustion engines, electricity, building construction, and machinery with applications of problem solving techniques. Lecture/Lab.

AGRI 3010 - Debate and Discussion in Agricultural Contexts
3 credit hours Prerequisites: AGRI 1000, ANSC 1410, or PLSO 1610 or approval of instructor. Debate and discussion strategies related to agriculture industries and organizations; fundamentals of parliamentary law, principles of debate, group discussion techniques; review of local, state, and national agricultural organization meeting and policy creating structures.

AGRI 3400 - Fundamentals of Sustainable Agriculture
3 credit hours Prerequisites: PLSO 1610 and ANSC 1410 or permission of instructor. Fundamental knowledge and concepts of sustainable agriculture and an exploration of the production, environmental, and social issues that affect sustainability.

AGRI 3810 - Milk Processing and Marketing
3 credit hours (Same as ANSC 3810.) Prerequisite: PSCI 1030/PSCI 1031 or CHEM 1010/CHEM 1011 and CHEM 1020/CHEM 1021 or CHEM 1110/CHEM 1120 and CHEM 1120/CHEM 1121. Biological, chemical, and physical properties of cow's milk and its value as an animal food source; techniques of processing and marketing; governmental regulations; laboratory testing. Lecture/lab.

AGRI 4100 - Microcomputer Applications in Agriculture
3 credit hours Includes use of agricultural software, agricultural communications networks, computer dairy feeding systems, and farm records.

AGRI 4200 - Fruit and Vegetable Marketing
3 credit hours (Same as PLSO 4200.) Prerequisites: PSCI 1030/PSCI 1031 and BIOL 1030/BIOL 1031, CHEM 1110/CHEM 1120, CHEM 1010/CHEM 1011 or CHEM 1020/CHEM 1021 or approval of instructor. Basic biochemistry of respiration, handling techniques and practices, quality assessment and marketing of fruit and vegetable crops. Both domestic and international marketing of fruit and vegetable products discussed. Examines the economic impact of improper handling on both the local producer and the end user.

AGRI 4250 - Leadership in Agricultural Industries
3 credit hours Prerequisite: Junior or senior standing or consent of instructor. A capstone course to enhance students' leadership and human relation skills in the workplace. Topics include leadership styles, theories, characteristics of leaders (conceptual, technical, human relations), communication styles, group dynamics, conducting successful meetings, problem solving, goal setting, attitudes, motivation, self-concept, learning styles, time management, and employability skills.

AGRI 4700 - Agriculture in Our Lives
3 credit hours Everyone who eats and wears clothes is affected by agriculture, yet only a small percentage of the population actively farms. Course allows exploration of various organizations, both private and public, that support agriculture, provide career opportunities, and regulate the safety and fair trade upon which agribusiness depends. Issues that affect the lives of farmers and which may affect the future of many aspects of agriculture are explored. Local travel will be required. Combined lecture/lab.

AGRI 4710 - Agricultural Statistics and Data Analysis
3 credit hours Prerequisites: MATH 1530, MATH 1710, MATH 1720, MATH 1730, or MATH 1910; junior or senior level. Focuses on applied statistics and experimental design and analysis in both animal and plant science domains. Topics include agricultural units conversion, descriptive/inferential statistics, experimental design and analysis, and agricultural case study analysis.

AGRI 4740 - Research Methods
3 credit hours (Same as BIOL/CHEM/GEOL/PHYS/MATH 4740.) Prerequisite: YOED 3520. Provides secondary science and mathematics teacher candidates with the tools that scientists use to solve scientific problems. Students will use these tools in a laboratory setting, communicate findings, and understand how scientists develop new knowledge.

AGRI 4810 - The Food Industry
3 credit hours (Same as NFS 4810.) An overview from production to processing to marketing. Covers the current status of the world's largest employer,

including where and how foods are produced, distributed, and marketed and where the industry is heading in the future.

AGRI 4820 - Principles of Food Processing
3 credit hours Prerequisite: PSCI 1030/PSCI 1031 or CHEM 1010/CHEM 1011, and CHEM 1020/CHEM 1021 or CHEM 1110/CHEM 1111 or CHEM 1120/CHEM 1121. Principles used in the modern food industry, including thermal, refrigerated, frozen, and irradiation methods. Includes coverage of the techniques used to process major food commodities such as meats, cereal grains, and fats and oils. Lecture/lab.

AGRI 4830 - Food Quality Control
3 credit hours Prerequisite: PSCI 1030/PSCI 1031 or BIOL 1030/BIOL 1031 or approval of instructor. Quality control and sensory evaluation techniques utilized in food processing. Instrumental and physical methods of quality determination of raw and processed food products, hazard analysis and critical control point (HACCP), and quality philosophies employed in the industry. Sensory evaluation techniques and statistical analysis of evaluation results covered.

AGRI 4850 - Food Safety Issues from Production to Consumption
3 credit hours (Same as NFS 4260.)
Prerequisite: BIOL 2230/BIOL 2231 or permission of instructor. Issues impacting food production, food storage and transportation, food processing, and food consumption within food production facilities, the home, and food service facilities. Consumer concerns evaluated based on risk theory and scientific evaluation of safety, including decision-making through critical thinking. Food standards and regulations designed to improve safety of the food supply discussed.

AGRI 4910 - Problems in Agriculture
1 to 6 credit hours Problem or problems selected from one of the major disciplines. May involve conferences with instructor, library work, field study and/or laboratory activity. Students can take from one to three credits with a maximum of three per semester.

Animal Science

ANSC 1401 - Introduction to Animal and Veterinary Sciences
3 credit hours Focuses on the introduction and overview of the animal and veterinary sciences disciplines. Reproduction, breeding and genetics, nutrition and feeding, animal health, management, and products processing and marketing of beef cattle, dairy cattle, sheep, goats, swine, poultry, horses, and companion animals included.

ANSC 1410 - Introduction to Animal Science
3 credit hours Overview of the science, production, and management of domestic animal species, including beef cattle, dairy cattle, sheep, goats, swine, poultry, horses, and companion animals. Topics include reproduction; breeds, breeding, and genetics; nutrition and feeding; animal health; management; and products processing and marketing.

ANSC 1411 - Introduction to Animal Science Lab
1 credit hour Focuses on applied learning concepts presented at the introductory animal science level. Topics include livestock, poultry, and companion animal breed identification; animal nutrition, feeds, and forages; reproductive science and management techniques; animal breeding and genetics; and basic experiential aspects of beef cattle, dairy cattle, swine, sheep, goats, horses, poultry, and companion animal production and management.

ANSC 3000 - Careers in Animal and Veterinary Science
2 credit hours Prerequisite: Sophomore standing. Explores career opportunities in various areas of animal agriculture, allied fields, and some non-traditional career paths in the animal and veterinary sciences.

ANSC 3310 - Animal Care and Welfare
3 credit hours Prerequisite: ANSC 1401 or ANSC 1410 or permission of the instructor. Applied aspects of animal care and welfare, including physical condition, feeding, proper housing, and environmental adaptation of animals to human interaction.

ANSC 3420 - Animal Breeding and Genetics
3 credit hours Prerequisites: ANSC 1401 or ANSC 1410; BIOL 1110/BIOL 1111 and BIOL 1120/BIOL 1121; junior-level classification or higher. Basic principles of genetics, crossbreeding, inbreeding, and molecular genetics. Animal breeding topics include

use of quantitative traits, prediction of breeding value, methods of selection, and genetic evaluations including genomic-enhanced selection. *Offered fall only.*

ANSC 3440 - Livestock Management
3 credit hours Prerequisites: ANSC 1401 or ANSC 1410; junior or senior standing. Management practices for farm animal species. Practices include animal handling, restraint techniques, feeding, milking, castrations, identification methods, and herd health problems. Lecture/lab.

ANSC 3450 - Anatomy and Physiology of Domestic Animals
3 credit hours Prerequisites: BIOL 1110/BIOL 1111, BIOL 1120/BIOL 1121; ANSC 1401 or ANSC 1410; junior or senior level. The parts, functions, and anatomical relationships of various organs and systems of domestic animals. Lecture/lab.

ANSC 3470 - Beef Cattle Production
3 credit hours Prerequisites: ANSC 1401 or ANSC 1410; junior-level classification or higher. Management practices essential for economic beef production including breeding, feeding, and herd health. Purebred, commercial, stocker, feedlot, and processing segments evaluated. Lecture/lab. *Offered fall only.*

ANSC 3480 - Swine Production
3 credit hours Prerequisites: ANSC 1401 or ANSC 1410; junior-level classification or higher. Understanding management of the pig's environment and genetics to maximize profits. Includes nutrition, reproduction, genetics, housing, herd health, and management practices. Lecture/lab.

ANSC 3500 - Small Ruminant Production
3 credit hours Prerequisite: ANSC 1401 or ANSC 1410. The study of efficient sheep and goat production and management in the U.S. Topics include genetics and selection, reproduction, health and parasite control, nutrition, forages and grazing management, and product quality and marketing. Lecture/lab.

ANSC 3540 - Dairy Production
3 credit hours Prerequisite: ANSC 1401 or ANSC 1410; juniors and seniors only. Feeding and management, ruminant digestion, physiology of milk secretion, production testing and official records, sanitary regulations, handling and marketing of raw milk. Lecture/lab.

ANSC 3550 - Animal Feeds and Feeding
3 credit hours Prerequisites: ANSC 1401 or ANSC 1410; ANSC 1411; junior-level classification or higher. Focuses on practical application of nutrition to the feeding of domestic animal species. Topics include identification and characteristics of common feedstuffs; computer ration formulation procedures; life cycle nutritional management of beef cattle, dairy cattle, swine, small ruminants, poultry, and companion animals; feed stuff composition analysis procedures; feed processing, evaluation, and grading; feed control laws; and nutrition research methodology.

ANSC 3710 - Rabbit Production
3 credit hours Prerequisites: ANSC 1401 or ANSC 1410; sophomore-level or higher. Principles of rabbit production and management focused on the commercial, show, and pet sectors. Topics include rabbit breeds and genetics; nutrition and feeding; reproduction; management; health and diseases; and rabbit products.

ANSC 3810 - Milk Processing and Marketing
3 credit hours Prerequisite: PSCI 1030/PSCI 1031 or CHEM 1010/CHEM 1011 and CHEM 1020/CHEM 1021, or CHEM 1110/CHEM 1120. Biological, chemical, and physical properties of cow's milk and its value as an animal food source; techniques of processing and marketing; governmental regulations; laboratory testing. Lecture/lab.

ANSC 4260 - Behavior of Domestic Animals
3 credit hours Behavior aspects of raising and managing domestic animals to include equine, swine, goats, cattle, sheep, dogs, and cats. Communication, ingestive, sexual, social, aggressive, and abnormal behaviors emphasized. Lecture/lab.

ANSC 4410 - Animal Nutrition
3 credit hours Prerequisites: ANSC 1401 or ANSC 1410; CHEM 1020/CHEM 1021 or CHEM 1120/CHEM 1121; junior-level classification or higher. Advanced study of the processes of digestion and nutrient utilization in domestic animal species. Topics include monogastric and ruminant digestive anatomy and physiology; carbohydrate, lipid, protein, vitamin, and mineral utilization.

ANSC 4430 - Internship in Animal Science
3 to 6 credit hours Prerequisite: Approval of instructor. In-depth practical experience in a specific area of animal science pertinent to the individual's interest. Students work with producers and agencies that have agreed to cooperate in the program and to provide adequate salary and guidance.

ANSC 4470 - Advanced Beef Production
3 credit hours Prerequisites: ANSC 1401 or ANSC 1410; ANSC 3470 or approval of instructor. In-depth analysis of various systems of beef production. Extensive field trips to cow-calf, feedlot, stocker, and purebred operations. *Offered Spring only.*

ANSC 4490 - Livestock Evaluation
3 credit hours Prerequisite: Approval of instructor. Comparative evaluation of beef cattle, swine, sheep, and horses. Develops defense of placing through an organized set of reasons involving terms describing the animal's characteristics. Importance of these characteristics to the animal function stressed. Lecture/lab.

ANSC 4500 - Reproductive Management Techniques for Livestock
1 credit hour Prerequisite: ANSC 1401 or ANSC 1410; junior or senior standing. Training in artificial insemination (A.I.) techniques for livestock species, including certification in cattle A.I. Includes study of estrous synchronization methods and embryo transfer. Lecture and lab activities.

ANSC 4510 - Domestic Animal Reproductive Physiology
3 credit hours Prerequisites: ANSC 1401 or ANSC 1410; BIOL 1110/BIOL 1111, BIOL 1120/BIOL 1121; junior-level classification or higher. Advanced study of the anatomy, physiology, and endocrinology of reproduction in domestic animal species. Topics include male and female reproductive anatomy, hormonal control of reproductive processes, reproductive development, the estrus cycle, male physiology, and lactation. Current techniques to control animal reproduction described. *Offered Spring only*.

ANSC 4520 - Companion Animal Management
3 credit hours A comprehensive study of dog and cat management. Topics include canine and feline history; selective breeding; functional anatomy; reproductive physiology and management; nutrition and feeding management; diseases and health management; behavior, communication, and training. Service role of the dog and cat highlighted.

ANSC 4860 - Meat Science and Technology
3 credit hours Prerequisites: ANSC 1401 or ANSC 1410 and junior-level classification or higher. Selecting, inspecting, grading, fabricating, packaging, preserving, and cooking red meat products. Other topics include anatomy, structure, and composition of muscle, food safety, and microbiology. Offered Spring only.

ANSC 4900 - Undergraduate Research in Animal Science
1 to 3 credit hours Prerequisite: Junior or senior standing. Faculty-student collaboration to gain independent research experience in an animal science discipline area.

Fermentation Science

FERM 1000 - Introduction to Fermentation Science
3 credit hours Survey of fermentation as a means of food preservation, the history of intentional fermentation by mankind, the range of human and animal foodstuffs produced by fermentation, the production of energy by fermentation, and the cultural/social implications of fermentation.

FERM 2500 - Wine Appreciation
3 credit hours The fundamentals of wine appreciation, wine label interpretation, and wine judging. Students will evaluate wine products and must be 21 years of age to enroll. Lecture/lab.

FERM 2900 - Legal Issues - Fermentation
3 credit hours Prerequisite: FERM 1000. Discussion of the spectrum of law governing alcoholic and non-alcoholic fermentation at the federal, state, and local levels; includes the Federal Food, Drug, and Cosmetic Act of 1938 (and its successors), the three-tier alcoholic beverage system, and compliance responsibility.

FERM 3200 - International Wine Industry
3 credit hours Prerequisite: FERM 2500 or permission of instructor. Introduces the wine industry of a country other than the U.S; taught onsite in the host country. Wine industry from the ground up explored--from the nurseries which propagate grapevines, to the vineyards that produce the grapes, to the wineries that produce and market the wines. Marketing of host country wines, domestically and

abroad, studied. Participants must be 21 years of age to enroll. Combined lecture/lab.

FERM 3700 - Consumer Motivation and Sensory Evaluation of Fermented Foods
3 credit hours Prerequisite: FERM 1000 and completion of at least 60 hours college credit or 21 years of age at start of class. Fundamentals of sensory evaluation of food and sensory-driven consumer motivation leading to the purchase of fermented foods. Scientific methods of sensory evaluation introduced and practiced and their use in determining critical factors in consumer purchase decisions discussed.

FERM 3710 - Brewing, Distilling, and Fermentation Safety and Sanitation
3 credit hours Prerequisites: FERM 1000 and BIOL 4510. Critical principles involved in safely operating and maintaining proper sanitation in a brewing, distilling, or fermenting facility. Participation in class tours of local processing facilities required.

FERM 3750 - Facility Design and Operation
3 credit hours Prerequisites: FERM 1000 and FERM 3710. Layout, design, and operation of facilities devoted to the production of fermented foods and beverages. Efficiency, safety, control of contamination, and simultaneous retail operations discussed.

FERM 3850 - Wine Science and Industry
3 credit hours (Same as PLSO 3850.) Prerequisites: PLSO 1610 and CHEM 1020/CHEM 1021 or CHEM 1120/CHEM 1121 or PSCI 1030/PSCI 1031. The science and marketing of wine, including grape production, fruit processing, and fermentation technologies. Explores wine marketing in Tennessee, the U.S., and the world. Student must be 21 years of age to enroll. Lecture/lab.

FERM 3860 - Wine, Beer, and Spirits Industry
3 credit hours Prerequisite: FERM 1000 or permission of instructor. Introduces and explores the wine, beer, and spirits industries. Focused on the distribution and economic impact of these industries on individual countries and the world.

FERM 3900 - Sensory Analysis of Beer
3 credit hours Prerequisites: FERM 1000 and FERM 3700. Introduces and explores beer leading to Level 1 Cicerone testing. Focuses on the sensory properties and identification of beer via aroma and taste evaluation.

FERM 4550 - Brewing, Distilling, and Fermentation Science and Analysis
3 credit hours Prerequisites: FERM 1000, BIOL 4510, and CHEM 3530. Lecture/lab course covering the science of brewing, distilling, and fermentation and the analysis of in-process and finished products.

FERM 4560 - Applied Fermentation: Biomass and Biofuels
3 credit hours
Prerequisites: FERM 1000, CHEM 2030/CHEM 2031, CHEM 3010/CHEM 3011, and CHEM 3530/CHEM 3531; junior or senior standing. Survey of fermentation as a means of bioenergy production. Downstream processing to purify bioenergy and the range of biofuels produced by various biomass (e.g., grains, algae, and renewable sources) covered in detail. Mathematical evaluation of product recovery and energy balance included.

FERM 4570 - Applied Fermentation: Milk, Meat, and Grain
3 credit hours Prerequisites: FERM 1000, CHEM 2030/CHEM 2031 or CHEM 3010/CHEM 3011, and CHEM 3530/CHEM 3531 or permission of instructor. Practical applications of fermentation to produce dairy, meat, and grain products. Lecture and laboratory exercises provide real-world experience in the production of these products.

FERM 4580 - Applied Fermentation: Fruits and Vegetables
3 credit hours Prerequisites: FERM 1000, CHEM 2030/CHEM 2031 or CHEM 3010/CHEM 3011, and CHEM 3530/CHEM 3531 or permission of instructor. Practical applications of fermentation to produce fruit and vegetable products. Lecture and laboratory exercises provide real-world experience in the production of these products.

FERM 4600 - Probiotics, Prebiotics, and Bioprocessing
3 credit hours Prerequisites: FERM 1000, BIOL 1120/BIOL 1121, BIOL 2230/BIOL 2231, CHEM 3530/CHEM 3531 or permission of instructor. Lecture course discusses details on probiotics, prebiotics, their molecular mechanisms, commercial uses, and regulation and safety assessments of the effects of nutraceuticals on humans and animals.

FERM 4610 - Fermentation and Nutraceutical Production
3 credit hours Prerequisites: FERM 1000,BIOL 1120/BIOL 1121, BIOL 2230/BIOL 2231, and CHEM 3530/CHEM 3531. Scientific principles of fermentation employed for the production of value-added, functional food products with specific emphases on bioprocessing, bio-catalysis, and bio-separation.

FERM 4800 - International Fermented Foods
3 credit hours Prerequisites: FERM 1000, FERM 2900, and FERM 3700; junior standing. Study abroad course introducing students to the range of fermented food products produced worldwide. Students tour fermented food production facilities, explore the marketing of fermented foods, and visit with principal business leaders involved in the fermented foods industry.

FERM 4910 - Fermentation Science Internship
1 to 3 credit hours Prerequisites: Junior status and departmental approval. Industry-based experience with a company that utilizes fermentation to produce a product for sale to the public.

FERM 4920 - Fermentation Science Research
1 to 3 credit hours Prerequisites: Junior status and departmental approval. MTSU faculty or industry-based researcher mentored research experience.

Horse Science

HORS 1110 - Introduction to Horse Care and Use
3 credit hours Survey of basic equine care, breeds, use, management, and behavior.

HORS 2110 - Basic Horsemanship
1 credit hour Preparation and orientation for students interested in taking horse science courses with an animal handling component. Topics include facility safety, horse control and handling, grooming, saddling, daily care considerations, and facility maintenance. Lecture and one two-hour laboratory each week.

NOTE: For Horse Science majors, Animal Science majors, Agriculture minors, or permission of instructor.

HORS 2400 - Fundamentals of Horsemanship
3 credit hours Behavior, philosophy, and language for communicating with and influencing the equine athlete. Develops basic control skills, balance and coordination, gaits; use of equipment; understanding equestrian competition. Two-hour lecture and two-hour laboratory each week.

HORS 2480 - Equine Evaluation and Selection
3 credit hours Individual parts, conformation, and gaits of the horse as they relate to selecting and judging horses for production, recreation, and sport.

HORS 3040 - Stable Management
3 credit hours Prerequisite: HORS 2400 or approval of instructor. Business aspects of horse facility management and ownership emphasized. Practical approaches to management of horses and responsible horse ownership also covered. Lecture/lab.

HORS 3300 - Equine Health
3 credit hours Familiarizes students with normal physiologic parameters and how to recognize and deal with health issues of horses. Topics include care of the pregnant broodmare, foal care, routine health maintenance, infectious diseases, commonly used medications, dentistry, lameness, neurological diseases, colic, parasites, ophthalmology, dermatology, reproduction, geriatrics, and alternative therapies. Lecture/lab.

HORS 3400 - Horsemanship-Equitation
3 credit hours Prerequisite: HORS 2400 and approval of instructor. Understanding, recognizing, and producing lateral control in the horse. Lateral exercises; lateral movements; developing lateral balance and control, track, gait, pace, impulsion, and rhythm. Two hour lecture and two-hour laboratory each week.

HORS 3410 - Horse Breeds and Genetics
3 credit hours A review of the history of the horse from the prehistoric era to present day with a focus on the development and contributions of horse breeds in the U.S. and state horse industry. Roles of breed associations, principles of genetics, selection of desired traits, genetic abnormalities associated with specific breeds, and matching breeds to disciplines discussed.

HORS 3430 - Horse Production
3 credit hours Prerequisite: HORS 1110 or ANSC 1401 or ANSC 1410 or approval of instructor. Scientific principles relevant to production requirements of horses as related to behavior, exercise physiology, reproductive physiology, growth, age, and clinical support. Facilities management,

marketing, legal aspects of horse ownership, and career opportunities covered. Lecture/lab.

HORS 3900 - Horses and Horsemanship
3 credit hours Basic requirements of horse ownership, care and associated expenses, inherent risks and safety around horses, and resources available in the horse industry. For non-horse-science majors. Lecture/lab.

HORS 4040 - Equine Event and Facility Management
3 credit hours Prerequisite: HORS 3040 or ANSC 3440 or approval of instructor. Fundamentals of managing equine and other livestock events and facilities covered. Involves active participation in preparing for and conducting equine events held on campus. Lecture/lab.

HORS 4090 - Equine Reproduction and Breeding
3 credit hours Prerequisite: HORS 2110 or HORS 3040 or HORS 3430 or approval of instructor. Reproductive anatomy and physiology of the stallion and mare as they relate to modern breeding practices. Vocational training in semen handling, artificial insemination, and neonatal care. Two hours lecture and two hours laboratory each week.

HORS 4170 - Equine Industry
3 credit hours Prerequisites: AGBS 1210 or AGBS 3130 and HORS 3040 or approval of instructor. Operational strategies and management issues facing the equine enterprises. Financial, legal, and taxation issues pertaining to the U.S. and international equine industry. Lecture/lab.

HORS 4400 - Advanced Horsemanship-Equitation
3 credit hours Prerequisites: HORS 2400 and HORS 3400 and approval of instructor. Coordination and refinement of skills from previous horsemanship courses. Understanding, recognizing, and producing longitudinal flexion in the horse. Collection, extension, and stride control. Two-hour lecture and two-hour laboratory each week.

HORS 4440 - Equine Nutrition and Feeding
3 credit hours Prerequisites: HORS 1110 and HORS 2110 or HORS 2400 and CHEM 1020/CHEM 1021 or CHEM 1120/CHEM 1121 with grades of C- or better, or approval of instructor. Equine digestion and utilization of nutrients, appropriate feeds and feeding management, and diseases with a nutritional component. Nutrient requirements for the horse at various stages, including maintenance, reproduction, growth, performance, age, and clinical support discussed.

HORS 4450 - Techniques of Teaching Horsemanship
3 credit hours Prerequisites: HORS 2400, HORS 3400, and HORS 4400 or approval of instructor. Development of communication, evaluation, and presentation skills for teaching horsemanship. Two-hour lecture and two-hour laboratory each week.

HORS 4460 - Behavior and Training of Horses
4 credit hours Prerequisites: HORS 2400, HORS 3400, HORS 4400, and approval of instructor. The psychology, theory, and practice of training and behavior modification in horses. Students assigned a project horse for the semester. Two hours lecture and four hours laboratory per week.

HORS 4470 - Advanced Western Competition
3 credit hours Prerequisites: HORS 2480 and HORS 4400. Preparation for students interested in competing in a variety of western horse show events such as trail, pleasure, reining, cowhorse, horsemanship and showmanship; understanding of rules, scoring, performing, and preparing for each event. Two hours of lecture and two hours of lab per week.

HORS 4540 - Equine Assisted Therapy
3 credit hours Focuses on the effective modality of the horse/human bond as it relates to various forms of equine-assisted therapy with an emphasis on therapeutic riding for people with disabilities. Management of a NARHA-approved therapeutic program and instructor certification also covered. One hour classroom lecture, online, and experiential learning components.

HORS 4545 - Equine Assisted Activities and Therapies II
3 credit hours In-depth education for equine assisted activities and therapies (EAAT), including business planning and administration, lesson planning and structure, and equine selection and management. Offers preparation for those seeking a career within EAAT services and organizations. Two one-hour lectures and one two-hour laboratory per week.

HORS 4550 - Equine Exercise Physiology
3 credit hours Prerequisite: HORS 2400 or approval of instructor. Applied aspects of equine exercise

physiology, including physical, physiological, metabolic and mental adaptation to athletic training, exercise metabolism, thermoregulation, biomechanics of movement, effects of surface and footing, common unsoundnesses observed during training and competition, exercising testing, and an overview of shoeing for performance.

HORS 4580 - Advanced Judging of Horses
3 credit hours Prerequisite: HORS 2480. Systems of judging for current horse show disciplines and exercises for students who aspire to become professional judges. Ethics, contracts with management, and procedures for becoming a judge are part of focus.

Plant and Soil Science

PLSO 1101 - Introduction to Ornamental Horticulture
3 credit hours Ornamental horticulture from the scientific basis to commercial operations and management systems. Emphasis on the role of horticulture in everyday living through the introductory study of growing, maintenance, and utilization of plants to benefit people and the environment. Topics include basis of plant science and history, scope, and nature of ornamental horticulture including coverage of such diverse topics as production, craftsmanship, and business management skills.

PLSO 1610 - Elements of Plant Science
3 credit hours Fundamental plant processes; plant tissues, structures, environment, growth, development, reproduction, and propagation. Lecture/Lab.

PLSO 3330 - Field Crop Production
3 credit hours Economic importance, adaptation, origin, and history; botanical characteristics; cultural methods, uses, breeding, and pests of field crops. Lecture/Lab.

PLSO 3340 - Fundamentals of Soil Science
3 credit hours Introduces soil science with emphasis placed on soil physical, biological, and chemical properties. Relates soil conditions to land use applications, plant growth, and environmental quality. Lecture/Lab.

PLSO 3350 - Soil Fertility and Fertilizer
3 credit hours Fundamentals of managing plant nutrients in soils for crop, horticulture, and other plant production. Nutrient requirements, nutrient availability in soils, soil acidity and liming, organic and inorganic fertilizers, and environmental effects of fertilizers. Lecture/Lab.

PLSO 3360 - Irrigation and Drainage
3 credit hours Prerequisite: PLSO 3340. Comparative evaluation and interpretation of irrigation and drainage systems; water supply development; interrelationships of the environment and plants; scheduling irrigation; examination of economic and legal factors. Lecture/lab.

PLSO 3370 - Soil Analysis
3 credit hours Prerequisite: PLSO 3340. Analysis of soils in laboratory. Lecture/lab.

PLSO 3600 - Horticulture in Our Lives
3 credit hours Emphasis on the role of horticulture in everyday living, through principles of growing plants in the home, floral design, home landscaping, and gardening. Lecture/lab.

PLSO 3630 - Agroforestry
3 credit hours Culture, conservation, management, and utilization of forest stands. Lecture/lab.

PLSO 3640 - Woody Landscape Plants
3 credit hours Distribution, characteristics, relationships, and adaptation of native and exotic trees shrubs, and vines for landscape use. One-hour lecture and four-hour lab.

PLSO 3660 - Vegetable Gardening
3 credit hours Principles of home and commercial vegetable production; adaptation, culture, fertility, diseases, and insects of vegetables. Lecture/lab.

PLSO 3670 - Fruit Production
3 credit hours Prerequisite: PLSO 1610 or 4 hours of biology. Introduces art and science of fruit production in the United States. Focuses on temperate fruit production, but also includes a general overview of citrus production. Conveys a general understanding of fruit production in the United States including propagation, orchard management, pollination, harvest, cultural practices, pests, and trends in the industry.

PLSO 3700 - Fundamentals of Precision Agriculture
3 credit hours Prerequisite: PLSO 1610. Fundamental concepts and principles of site-specific farming, current technology, and its capabilities and limitations in precision agricultural practices.

PLSO 3850 - Wine Science and Industry
3 credit hours (Same as FERM 3850.) The science and marketing of wine, including grape production, fruit processing, and fermentation technologies. Explores wine marketing in Tennessee, the U.S., and the world. Student must be 21 years of age to enroll. Lecture/lab.

PLSO 4000 - Agroecosystems Remote Sensing Using UAS
3 credit hours Multidisciplinary course to train students on the key concepts of agricultural remote sensing using unmanned aircraft systems (UAS). Precision agriculture and remote sensing concepts and the use of some open-source image processing software for analyzing UAS-based remote sensing data.

PLSO 4200 - Fruit and Vegetable Marketing
3 credit hours (Same as AGRI 4200.) Prerequisite: BIOL 1030/BIOL 1031 or CHEM 1010/CHEM 1011 or CHEM 1020/CHEM 1021 or CHEM 1110/CHEM 1111 or CHEM 1120/CHEM 1121 or PSCI 1030/PSCI 1031 or approval of instructor. Basic biochemistry of respiration, handling techniques and practices, quality assessment and marketing of fruit and vegetable crops. Both domestic and international marketing of fruit and vegetable products discussed. Examines the economic impact of improper handling on both the local producer and the end user.

PLSO 4300 - Plant Protection
3 credit hours Prerequisite: PLSO 1610 or 4 hours of biology. Principles of protecting crop plants from damage by weeds, insects, diseases, and other biotic factors. Pest control by chemical, cultural, and biological methods with an emphasis on integrated pest management.

PLSO 4310 - Forage Crops
3 credit hours Adaptation, distribution, establishment, management, culture, and utilization of forage legumes and grasses. Lecture/lab.

PLSO 4320 - Plant Physiology
4 credit hours (Same as BIOL 4500.) Prerequisites:BIOL 1110/BIOL 1111, BIOL 1120/BIOL 1121, CHEM 1020/CHEM 1021, PLSO 3340. Plant mineral nutrition, photosynthesis, growth, development, and metabolism at the cellular and whole plant levels. Three hours lecture and three hours laboratory.

PLSO 4330 - Turf Management
3 credit hours Prerequisite: PLSO 1610 or BIOL 1120/BIOL 1121 or PLSO 1101. Establishment and management of turf grasses for lawns, golf courses, and parks. Lecture/lab.

PLSO 4340 - Genesis of Soil Landscapes
3 credit hours Prerequisite: PLSO 3340 or instructor approval. The co-evolution of soil landscapes, important morphological soil properties, and influence of geologic and geomorphic settings on soil development. The role of water in the development of soil horizons. Factors and processes of soil genesis. Lecture/Lab.

PLSO 4350 - Soil Survey and Land Use
3 credit hours Prerequisite: PLSO 3340 or instructor approval. Soil properties used to determine the suitability of soils for various uses.Tasks and reports involved in soil survey. Methods of soil evaluation and interpretation. Use of electronic database for land use decisions. Lecture/Lab.

PLSO 4370 - Soil and Water Conservation
3 credit hours History of soil conservation/soil problems in ancient civilizations. Conservation practices with respect to topsoil, soil productivity, and fertility. Land management practices for soil and water conservation. Current issues in soil and water conservation and environmental sustainability. Lecture/Lab.

PLSO 4380 - Interior Landscaping
3 credit hours Principles and practices of designing, installing, and maintaining landscapes in malls, public buildings, and other indoor environments. Lecture/lab.

PLSO 4390 - Urban and Sports Turf Soils
3 credit hours Describe, design, manage, and evaluate urban and sports turf soils. Lecture/lab.

PLSO 4500 - Agroecology
3 credit hours Prerequisites: PLSO 1610 or 4 hours of biology. Theories of agroecology; focuses on

sustainable agricultural practices and concepts. The impact of specific agricultural technologies and land use practices on the productivity of agricultural ecosystems, environmental quality, and human health. Examines the environmental science and agronomy of both conventional and alternative sustainable practices including benefits and limitations. Lecture/lab.

PLSO 4610 - Arboriculture
3 credit hours Prerequisite: PLSO 1610 or BIOL 1120/BIOL 1121. The culture of trees, shrubs, and vines in the landscape. Planting, transplanting, fertilizing, irrigation, pruning, problem diagnosis, and damage repair included. Lecture/lab.

PLSO 4620 - Greenhouse Management
3 credit hours Prerequisite: PLSO 1610 or BIOL 1120/BIOL 1121. Analysis of soils, fertilizers, irrigation techniques, container preparation, ventilation, growth regulation, and carbon dioxide enrichment for greenhouse operation. Two-hour lecture and two-hour lab.

PLSO 4630 - Floriculture
3 credit hours Propagation and other cultural practices for the production and maintenance of plants and flowers in the home. Two-hour lecture and two-hour lab.

PLSO 4640 - Landscaping
3 credit hours Application of the principles of design, the use of proportionate-sized woody landscape plants, and other practices to produce low-maintenance-cost landscapes. One-hour lecture and four-hour lab.

PLSO 4660 - Nursery Management
3 credit hours Prerequisite: PLSO 1610 or BIOL 1120/BIOL 1121. Principles and practices of nursery management as a business. Nursery administration, financial management, and marketing. Cultural management of field- and container-grown nursery plants. Lecture/lab.

PLSO 4670 - Plant Propagation
3 credit hours Prerequisite: PLSO 1610 or BIOL 1120/BIOL 1121. Anatomical features and physiological principles involved in propagating plants from seed and by division, cutting, budding, and grafting. Use of growth regulators and environmental factors. Two-hour lecture and two-hour lab.

PLSO 4680 - Internship in Plant and Soil Science
3 to 6 credit hours Prerequisite: Approval of instructor. Practical experience in a specific area of agronomy, horticulture, or soils. Classroom material related to practical application.

PLSO 4690 - Crop Ecophysiology
3 credit hours Prerequisite: Junior standing or higher. Focuses on crop/plant physiology and crop/plant-environment interaction. Topics include plant canopy architecture, plant root morphology, physiology of growth and yield, photosynthesis and crop yield, source-sink relationships and crop yield, carbon dioxide and crop yield, physiology of drought in crop plants, and physiology of mineral nutrition.

PLSO 4730 - Soil Physical Properties
3 credit hours Prerequisites: PLSO 3340; MATH 1010, MATH 1530, or MATH 1710; junior standing or higher. Study of concepts related to soil physical properties and processes important for crop productivity and environmental quality. Topics include soil water content and energy, water infiltration, transport of solutes, gas, and heat.

PLSO 4750 - Agricultural Biotechnology
3 credit hours
Prerequisites: BIOL 1110/BIOL 1111, BIOL 1120/BIOL 1121, BIOL 3250/BIOL 3251; PLSO 1610. Introduces the process and reasoning behind the human manipulation of plant and animal species for agricultural purposes. Focuses on plant biotechnology with an introduction to animal biotechnology. Topics include plant tissue culture, plant cell transformation, general molecular biology techniques, and molecular marker-assisted breeding techniques. Three hours lecture and two hours lab.

PLSO 4760 - Herbs, Spices, and Medicinal Plants in Our Lives
3 credit hours Prerequisite: PLSO 1610 or BIOL 1120/BIOL 1121. The history, traditional uses, biological basis, botany, cultivation, and applications of specialized plants used as culinary herbs, spices, and in medicine.

Poultry Science

POUL 1000 - Introduction to Poultry Science
3 credit hours Provides introductory knowledge of the major areas within poultry science and the commercial poultry industry. Provides a framework upon which students can build further poultry

knowledge in subsequent Poultry Science courses at MTSU. May also serve as an exploratory course for student considering a career in poultry. Both lecture and laboratory activities incorporated.

POUL 3000 - Backyard and Small Poultry Flock Production
3 credit hours
Prerequisite: Sophomore classification or above. Principles of backyard and small poultry flock production and management.

POUL 3490 - Commercial Poultry Production
3 credit hours Prerequisite: POUL 1000 or ANSC 1401 or ANSC 1410; junior or senior classification. Principles of managing commercial poultry, including housing and equipment; hatchery, broiler breeder, broiler and table egg layer management; role of live production in an integrated company.

POUL 3600 - Poultry Evaluation
3 credit hours Prerequisite: Junior or senior classification or approval of instructor. Training in selection standards for meat and egg strains of live poultry; grading standards for table eggs and poultry carcasses, parts, and further processed products. Lecture and lab activities.

POUL 3650 - Poultry Processing
3 credit hours Prerequisite: Junior or senior level. Principles of modern poultry meat and egg processing including first, second, and further processing of poultry meat; poultry and egg inspection and food safety regulations; and marketing of poultry products. Lecture and lab activities.

POUL 3700 - Poultry Nutrition and Feeding
3 credit hours Prerequisites: POUL 1000; PSCI 1030 or CHEM 1010 or CHEM 1110; junior or senior level; or consent of instructor. Practical aspects of poultry nutrition including avian digestive anatomy and physiology; nutrient utilization; poultry feedstuffs; poultry feed formulation; feeding programs for broiler breeders, broilers, and table egg layers. Lecture and lab activities.

POUL 4000 - Poultry Reproduction and Breeder Management
3 credit hours Prerequisites: POUL 1000; BIOL 1030/BIOL 1031 or BIOL 1110/BIOL 1111; junior or senior level; or consent of instructor. Applied aspects of poultry reproduction and breeder bird management including basic avian reproductive anatomy and physiology; female breeder management; male breeder management; and embryonic development and the management of hatching eggs. Lecture and lab activities.

POUL 4900 - Undergraduate Research in Poultry Science
1 to 3 credit hours Prerequisite: Junior or senior standing. Faculty-student collaboration to gain independent research experience in a poultry science discipline area.

Biology

Dennis Mullen, Chair

Altman, Arbour, Bailey, Barnes, Bergemann, Cobb, Easson, Elrod-Erickson, A. Farone, M. Farone, Gardner, Herlihy, Howard, Jessen, Jetton, Klukowski, Leblond, Miller, Nelson, Newsome, Ormerod, Robertson, Rutledge, Sadler, Seipelt-Thiemann, Stewart, Walck, Walker, Weissmiller, Zamora

The Department of Biology offers preparation for teachers of biology, for biologists in industrial and governmental employment, and for students planning for graduate study in biology or for advanced professional courses in health sciences. The program for the Biology major leads to the Bachelor of Science degree. Students choose from concentrations in Organismal Biology and Ecology, Genetics and Biotechnology, Microbiology, and Physiology. Students interested in the health professions, such as medicine, pharmacy, dentistry, etc. most commonly select the Physiology concentration. A minor in Secondary Education is suggested for those persons planning to teach. A minor in Biology is also available.

The Department of Biology also offers an interdisciplinary major in Forensic Science in conjunction with Chemistry and Criminal Justice Administration.

MTSU is an affiliate of the Gulf Coast Research Laboratory (GCRL) in Ocean Springs. For information on attendance or course offerings visit the GCRL website at www.usm.edu/gcrl/summer_field/index.php.

Honors College

The Department of Biology offers the following courses in Honors:
BIOL 1030/BIOL 1031 (Fall Semester)
BIOL 1110/BIOL 1111 (Fall Semester)
BIOL 1120/BIOL 1121 (Spring Semester)
BIOL 2230/BIOL 2231 (Spring Semester)
BIOL 3250/BIOL 3251 (Fall Semester)
BIOL 3400/BIOL 3401 (Spring Semester)

Graduate Study

The Master of Science is offered in Biology. Requirements for this degree and a list of the courses offered for graduate credit are published in the Graduate Catalog.

Biology Minor

Biology

The minor in Biology requires 19 semester hours. An overall GPA of 2.00 or higher is required for courses satisfying the minor in biology. At least 3 semester hours at the upper-division level must be completed through MTSU. Additionally, no course used to satisfy a requirement in a major or minor may be used in another major or minor. All Biology minors are assigned an advisor by contacting the Biology Department at (615) 898-2847 or emailing biology@mtsu.edu.

Required (16 hours)

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

Electives (3 hours)

- Three or more semester hours chosen from upper-division courses
  OR
- BIOL 2010 - Human Anatomy and Physiology I **4 credit hours** AND
- BIOL 2011 - Human Anatomy and Physiology I Lab **0 credit hours** AND
- BIOL 2020 - Human Anatomy and Physiology II **4 credit hours** AND
- BIOL 2021 - Human Anatomy and Physiology II Lab **0 credit hours**

Biology, Genetics and Biotechnology Concentration, B.S.

Biology
615-898-2847
Matt Elrod-Erickson, program coordinator
Matt.Elrod-Erickson@mtsu.edu

Every Biology major is required to declare a concentration area. Each area requires semester hours to be selected from a set of designated courses.

All Biology majors are assigned a professional advisor. The student is responsible for seeking the assistance of the advisor. This catalog is not intended to provide the detail necessary for self-advising.

Academic Map

Following is a printable, suggested four-year schedule of courses:

Biology, Genetics and Biotechnology, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**42 hours***
Major Core	*29 hours*
Concentration	*10-11 hours*
Major UD Electives	*2-3 hours*
Supporting Courses	**19-20 hours***
Electives	**17-29 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)

Major Requirements (42 hours)

Biology Core (29 hours)

- BIOL 1000 - Introduction to the Biology Major **1 credit hour**

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3060 - Diversity of Eukaryotic Life **2 credit hours** AND
- BIOL 3061 - Diversity of Eukaryotic Life Lab **1 credit hour**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- BIOL 3400 - General Ecology **4 credit hours** AND
- BIOL 3401 - General Ecology Lab **0 credit hours**

- BIOL 4200 - Senior Seminar **1 credit hour**

- BIOL 4110 - General Physiology **4 credit hours** AND
- BIOL 4111 - General Physiology Lab **0 credit hours**
  OR
- BIOL 4210 - Cell and Molecular Biology **4 credit hours** AND
- BIOL 4211 - Cell and Molecular Biology Lab **0 credit hours**
  OR
- BIOL 4500 - Plant Physiology **4 credit hours**

Genetics/Biotechnology Concentration (10-11 hours)

- BIOL 4550 - Biotechnology **3 credit hours**

- BIOL 4450 - Molecular Genetics **4 credit hours**
  OR
- BIOL 4460 - Human Genetics **3 credit hours** AND
- BIOL 4461 - Human Genetics Lab **0 credit hours**

Choose one course from the following:

- BIOL 4270 - Transmitting Electron Microscopy **4 credit hours**

- BIOL 4290 - Scanning Electron Microscopy **4 credit hours**

- BIOL 4300 - Immunology **4 credit hours** AND
- BIOL 4301 - Immunology Lab **0 credit hours**

- BIOL 4450 - Molecular Genetics **4 credit hours**

- BIOL 4460 - Human Genetics **3 credit hours** AND
- BIOL 4461 - Human Genetics Lab **0 credit hours**

- BIOL 4510 - Food and Industrial Microbiology **4 credit hours** AND
- BIOL 4511 - Food and Industrial Microbiology Lab **0 credit hours**

- BIOL 4570 - Principles of Toxicology **3 credit hours** AND
- BIOL 4571 - Principles of Toxicology Lab **0 credit hours**

- BIOL 4720 - Animal Development **4 credit hours** AND
- BIOL 4721 - Animal Development Lab **0 credit hours**

- BIOL 4750 - Plant Biotechnology **4 credit hours**

BIOL UD electives (2-3 hours)

Supporting Courses (19-20 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**
  OR
- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- MATH 1920 - Calculus II **4 credit hours** OR
- MATH 2050 - Probability and Statistics **3 credit hours** *
  OR
- BIOL 4350 - Biometry **4 credit hours** AND
- BIOL 4351 - Biometry Lab **0 credit hours**
  **Must take a 1 hour elective if MATH 2050 is chosen.*

Electives (17-29 hours)

Curriculum: Biology, Genetics and Biotechnology

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Non-Written Communication **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- BIOL 1000 - Introduction to the Biology Major **1 credit hour**

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 30 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **6 credit hours**
- Electives **6 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**
  OR
- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**

Subtotal: 30 Hours

Junior

- BIOL 4550 - Biotechnology **3 credit hours**
- Human Society and Social Relationships **6 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Electives **6 credit hours**

- BIOL 3060 - Diversity of Eukaryotic Life **2 credit hours** AND
- BIOL 3061 - Diversity of Eukaryotic Life Lab **1 credit hour**

- BIOL 3400 - General Ecology **4 credit hours** AND
- BIOL 3401 - General Ecology Lab **0 credit hours**

- BIOL 4110 - General Physiology **4 credit hours** AND
- BIOL 4111 - General Physiology Lab **0 credit hours**
  OR
- BIOL 4210 - Cell and Molecular Biology **4 credit hours** AND
- BIOL 4211 - Cell and Molecular Biology Lab **0 credit hours**
  OR
- BIOL 4500 - Plant Physiology **4 credit hours**

- BIOL 4350 - Biometry **4 credit hours** AND
- BIOL 4351 - Biometry Lab **0 credit hours**
  OR
- MATH 1920 - Calculus II **4 credit hours**
  OR
- MATH 2050 - Probability and Statistics **3 credit hours**

Subtotal: 32-33 Hours

Senior

- BIOL 4200 - Senior Seminar **1 credit hour**

- BIOL 4450 - Molecular Genetics **4 credit hours**
  OR
- BIOL 4460 - Human Genetics **3 credit hours** AND
- BIOL 4461 - Human Genetics Lab **0 credit hours**

- Concentration elective (choose from list above) **3-4 credit hours**
- Upper-division BIOL **4 credit hours**
- Electives* **15-16 credit hours**

Subtotal: 27-28 Hours

NOTE:

**Only if needed to meet 36 upper-division credit hours or 120 total credit hours.*

Biology, Microbiology Concentration, B.S.

Biology
615-898-2847
Mary Farone, program coordinator
Mary.Farone@mtsu.edu

Every Biology major is required to declare a concentration area selected from a set of designated courses.
All Biology majors are assigned a professional advisor. The student is responsible for seeking the assistance of the advisor. This catalog is not intended to provide the detail necessary for self-advising.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Biology, Microbiology, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**42 hours***
Major Core	*29 hours*
Concentration	*10 hours*
Major UD Electives	*3 hours*
Supporting Courses	**19-20 hours***
Electives	**17-29 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)

Major Requirements (42 hours)

Biology Core (29 hours)

- BIOL 1000 - Introduction to the Biology Major **1 credit hour**

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3060 - Diversity of Eukaryotic Life **2 credit hours** AND
- BIOL 3061 - Diversity of Eukaryotic Life Lab **1 credit hour**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- BIOL 3400 - General Ecology **4 credit hours** AND
- BIOL 3401 - General Ecology Lab **0 credit hours**

- BIOL 4200 - Senior Seminar **1 credit hour**

- BIOL 4110 - General Physiology **4 credit hours** AND
- BIOL 4111 - General Physiology Lab **0 credit hours**
  OR
- BIOL 4210 - Cell and Molecular Biology **4 credit hours** AND
- BIOL 4211 - Cell and Molecular Biology Lab **0 credit hours**
  OR
- BIOL 4500 - Plant Physiology **4 credit hours**

Microbiology Concentration (10 hours)

Select from:

- BIOL 3050 - Parasitology **3 credit hours** AND
- BIOL 3051 - Parasitology Lab **0 credit hours**

- BIOL 3210 - Environmental Microbiology **3 credit hours** AND
- BIOL 3211 - Environmental Microbiology Lab **0 credit hours**

- BIOL 4080 - Mycology **4 credit hours** AND
- BIOL 4081 - Mycology Lab **0 credit hours**

- BIOL 4300 - Immunology **4 credit hours** AND
- BIOL 4301 - Immunology Lab **0 credit hours**

- BIOL 4430 - Diagnostic Microbiology **4 credit hours**
- BIOL 4440 - General Virology **4 credit hours**
- BIOL 4450 - Molecular Genetics **4 credit hours**
- BIOL 4510 - Food and Industrial Microbiology **4 credit hours**
- BIOL 4550 - Biotechnology **3 credit hours**
- BIOL 4730 - Microbial Physiology and Biochemistry **4 credit hours**

BIOL UD elective (3 hours)

Supporting Courses (19-20 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours counted in the True Blue Core, 1 credit hour remaining)**

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**
  OR
- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- MATH 1920 - Calculus II **4 credit hours** OR
- MATH 2050 - Probability and Statistics **3 credit hours**
  OR
- BIOL 4350 - Biometry **4 credit hours** AND
- BIOL 4351 - Biometry Lab **0 credit hours**

Electives (17-29 hours)

Curriculum: Biology, Microbiology

Freshman

- BIOL 1000 - Introduction to the Biology Major **1 credit hour**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Non-Written Communication **3 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)

Subtotal: 30 hours

Sophomore

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**
  OR
- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- Creativity and Cultural Expression Literature **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Electives **6 credit hours**
- History and Civic Learning **3 credit hours**

Subtotal: 30 Hours

Junior

- BIOL 3060 - Diversity of Eukaryotic Life **2 credit hours** AND
- BIOL 3061 - Diversity of Eukaryotic Life Lab **1 credit hour**

- BIOL 3400 - General Ecology **4 credit hours** AND
- BIOL 3401 - General Ecology Lab **0 credit hours**

- BIOL 4350 - Biometry **4 credit hours** AND
- BIOL 4351 - Biometry Lab **0 credit hours**
  OR
- MATH 2050 - Probability and Statistics **3 credit hours**
  OR
- MATH 1920 - Calculus II **4 credit hours**

- BIOL 4110 - General Physiology **4 credit hours** AND
- BIOL 4111 - General Physiology Lab **0 credit hours**
  OR
- BIOL 4210 - Cell and Molecular Biology **4 credit hours** AND
- BIOL 4211 - Cell and Molecular Biology Lab **0 credit hours**
  OR
- BIOL 4500 - Plant Physiology **4 credit hours**

- BIOL concentration **3-4 credit hours**
- Electives **6 credit hours**
- Human Society and Social Relationships **6 credit hours**
- Creativity and Cultural Expression **3 credit hours**

Subtotal: 32-34 Hours

Senior

- BIOL 4200 - Senior Seminar **1 credit hour**
- BIOL concentration courses **6-8 credit hours**
- Upper-division BIOL elective **3-4 credit hours**
- Electives* **15-16 credit hours**

Subtotal: 25-28 Hours

NOTE:

**Only if needed to meet 36 upper-division credit hours or 120 total credit hours.*

Biology, Organismal Biology and Ecology Concentration, B.S.

Biology
615-898-2847
Dennis Mullen, program coordinator
Dennis.Mullen@mtsu.edu

Every Biology major is required to declare a concentration area. Each area requires hours to be selected from a set of designated courses. Four tracks are available under the Organismal Biology and Ecology concentration: botany, zoology, ecology, or general.

All Biology majors are assigned a professional advisor. The student is responsible for seeking the assistance of the advisor. This catalog is not intended to provide the detail necessary for self-advising.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Biology, Organismal Biology and Ecology, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**42 hours***
Major Core	*29 hours*
Concentration	*10 hours*
Major UD Electives	*3 hours*
Supporting Courses	**19-20 hours***
Electives	**17-29 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)

Major Requirements (42 hours)

Biology Core (29 hours)

- BIOL 1000 - Introduction to the Biology Major **1 credit hour**

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3060 - Diversity of Eukaryotic Life **2 credit hours** AND
- BIOL 3061 - Diversity of Eukaryotic Life Lab **1 credit hour**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- BIOL 3400 - General Ecology **4 credit hours** AND
- BIOL 3401 - General Ecology Lab **0 credit hours**

- BIOL 4200 - Senior Seminar **1 credit hour**

- BIOL 4110 - General Physiology **4 credit hours** AND
- BIOL 4111 - General Physiology Lab **0 credit hours**
  OR
- BIOL 4210 - Cell and Molecular Biology **4 credit hours** AND
- BIOL 4211 - Cell and Molecular Biology Lab **0 credit hours**
  OR
- BIOL 4500 - Plant Physiology **4 credit hours**

Organismal Biology and Ecology Concentration (10 hours)

Students may select from the Organismal Biology and Ecology concentration courses or may choose to follow one of the tracks below.

- BIOL 3500 - Evolution **3 credit hours** (required)

  Select at least seven additional credit hours from the following:

- BIOL 3020 - Comparative Anatomy of the Vertebrates **4 credit hours** AND
- BIOL 3021 - Comparative Anatomy of the Vertebrates Lab **0 credit hours**
  NOTE: *Biology majors passing BIOL 2020/2021 with a C (2.0) or better can use it as an elective option to BIOL 3020/3021. This substitution is not recommended for pre-med students and does not count for upper-division hours.*

- BIOL 3040 - Entomology **3 credit hours**

- BIOL 3050 - Parasitology **3 credit hours** AND
- BIOL 3051 - Parasitology Lab **0 credit hours**

- BIOL 4080 - Mycology **4 credit hours** AND
- BIOL 4081 - Mycology Lab **0 credit hours**

- BIOL 4090 - Forest Ecology **4 credit hours**

- BIOL 4140 - Invertebrate Zoology **4 credit hours** AND
- BIOL 4141 - Invertebrate Zoology Lab **0 credit hours**

- BIOL 4180 - Vertebrate Zoology **4 credit hours** AND
- BIOL 4181 - Vertebrate Zoology Lab **0 credit hours**

- BIOL 4220 - Ichthyology **4 credit hours** AND
- BIOL 4221 - Ichthyology Lab **0 credit hours**

- BIOL 4330 - Biome Analysis **1 to 4 credit hours**

- BIOL 4390 - Ethology (Animal Behavior) **4 credit hours** AND
- BIOL 4391 - Ethology (Animal Behavior) Lab **0 credit hours**

- BIOL 4420 - Plant Ecology and Evolution **4 credit hours**

- BIOL 4570 - Principles of Toxicology **3 credit hours** AND
- BIOL 4571 - Principles of Toxicology Lab **0 credit hours**

- BIOL 4580 - Marine Biology **4 credit hours** AND
- BIOL 4581 - Marine Biology Lab **0 credit hours**

- BIOL 4590 - Principles of Environmental Toxicology **4 credit hours**

Botany Track (12 hours)

- BIOL 4080 - Mycology **4 credit hours** AND
- BIOL 4081 - Mycology Lab **0 credit hours**

- BIOL 4090 - Forest Ecology **4 credit hours**
- BIOL 4420 - Plant Ecology and Evolution **4 credit hours**

Ecology Track (10 hours)

- BIOL 4580 - Marine Biology **4 credit hours** AND
- BIOL 4581 - Marine Biology Lab **0 credit hours**

Choose two of the following:

- BIOL 3020 - Comparative Anatomy of the Vertebrates **4 credit hours** AND
- BIOL 3021 - Comparative Anatomy of the Vertebrates Lab **0 credit hours**

- BIOL 3040 - Entomology **3 credit hours**

- BIOL 3050 - Parasitology **3 credit hours** AND
- BIOL 3051 - Parasitology Lab **0 credit hours**

- BIOL 4080 - Mycology **4 credit hours** AND
- BIOL 4081 - Mycology Lab **0 credit hours**

- BIOL 4140 - Invertebrate Zoology **4 credit hours** AND
- BIOL 4141 - Invertebrate Zoology Lab **0 credit hours**

- BIOL 4180 - Vertebrate Zoology **4 credit hours** AND
- BIOL 4181 - Vertebrate Zoology Lab **0 credit hours**

- BIOL 4220 - Ichthyology **4 credit hours** AND
- BIOL 4221 - Ichthyology Lab **0 credit hours**

- BIOL 4390 - Ethology (Animal Behavior) **4 credit hours** AND
- BIOL 4391 - Ethology (Animal Behavior) Lab **0 credit hours**

- BIOL 4570 - Principles of Toxicology **3 credit hours** AND
- BIOL 4571 - Principles of Toxicology Lab **0 credit hours**

- BIOL 4590 - Principles of Environmental Toxicology **4 credit hours**

General Biology Track (11-12 hours)

This track satisfies teacher education requirements.

Area One (4 hours)

Choose one:

- BIOL 3020 - Comparative Anatomy of the Vertebrates **4 credit hours** AND
- BIOL 3021 - Comparative Anatomy of the Vertebrates Lab **0 credit hours**
  OR
- BIOL 4180 - Vertebrate Zoology **4 credit hours** AND
- BIOL 4181 - Vertebrate Zoology Lab **0 credit hours**

Area Two (4 hours)

- BIOL 4080 - Mycology **4 credit hours** AND
- BIOL 4081 - Mycology Lab **0 credit hours**
  OR
- BIOL 4090 - Forest Ecology **4 credit hours**
  OR
- BIOL 4420 - Plant Ecology and Evolution **4 credit hours**

Area Three (3-4 hours)
Choose one:

- BIOL 3040 - Entomology **3 credit hours**
  OR
- BIOL 3050 - Parasitology **3 credit hours** AND
- BIOL 3051 - Parasitology Lab **0 credit hours**
  OR
- BIOL 4140 - Invertebrate Zoology **4 credit hours** AND
- BIOL 4141 - Invertebrate Zoology Lab **0 credit hours**

Zoology Track (10 hours)

- BIOL 3020 - Comparative Anatomy of the Vertebrates **4 credit hours** AND
- BIOL 3021 - Comparative Anatomy of the Vertebrates Lab **0 credit hours**

- BIOL 3040 - Entomology **3 credit hours**

- BIOL 3050 - Parasitology **3 credit hours** AND
- BIOL 3051 - Parasitology Lab **0 credit hours**

- BIOL 4140 - Invertebrate Zoology **4 credit hours** AND
- BIOL 4141 - Invertebrate Zoology Lab **0 credit hours**

- BIOL 4180 - Vertebrate Zoology **4 credit hours** AND
- BIOL 4181 - Vertebrate Zoology Lab **0 credit hours**

- BIOL 4220 - Ichthyology **4 credit hours** AND
- BIOL 4221 - Ichthyology Lab **0 credit hours**

- BIOL 4390 - Ethology (Animal Behavior) **4 credit hours** AND
- BIOL 4391 - Ethology (Animal Behavior) Lab **0 credit hours**

BIOL UD elective (3 hours)

Supporting Courses (19-20 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours counted in the True Blue Core, 1 credit hour remaining)**

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**
  OR
- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- BIOL 4350 - Biometry **4 credit hours** AND
- BIOL 4351 - Biometry Lab **0 credit hours**
  OR
- MATH 1920 - Calculus II **4 credit hours**
  OR
- MATH 2050 - Probability and Statistics **3 credit hours**

Electives (17-29 hours)

Curriculum: Biology, Organismal Biology and Ecology

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Non-Written Communication **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- BIOL 1000 - Introduction to the Biology Major **1 credit hour**

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 30 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **6 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Electives **6 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**
  OR
- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**

Subtotal: 30 Hours

Junior

- BIOL 3060 - Diversity of Eukaryotic Life **2 credit hours** AND
- BIOL 3061 - Diversity of Eukaryotic Life Lab **1 credit hour**

- BIOL 3400 - General Ecology **4 credit hours** AND
- BIOL 3401 - General Ecology Lab **0 credit hours**

- BIOL 4110 - General Physiology **4 credit hours** AND
- BIOL 4111 - General Physiology Lab **0 credit hours**
  OR
- BIOL 4210 - Cell and Molecular Biology **4 credit hours** AND
- BIOL 4211 - Cell and Molecular Biology Lab **0 credit hours**
  OR
- BIOL 4500 - Plant Physiology **4 credit hours** (strongly recommended for Botany track students)

- BIOL 4350 - Biometry **4 credit hours** AND
- BIOL 4351 - Biometry Lab **0 credit hours**
  OR
- MATH 1920 - Calculus II **4 credit hours**
  OR
- MATH 2050 - Probability and Statistics **3 credit hours**

- Human Society and Social Relationships **6 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Electives **6 credit hours**
- BIOL concentration course **3-4 credit hours**

Subtotal: 32-34 Hours

Senior

- BIOL 4200 - Senior Seminar **1 credit hour**
- BIOL upper-division **3-4 credit hours**
- Electives* **15-16 credit hours**
- BIOL concentration courses **6-8 credit hours**

Subtotal: 25-28 Hours

Biology, Physiology Concentration, B.S.

Biology
615-898-2847
Amy Jetton, program coordinator
Amy.Jetton@mtsu.edu

Every Biology major is required to declare a concentration area. Each area requires semester hours to be selected from a set of designated courses.

All Biology majors are assigned a professional advisor. The student is responsible for seeking the assistance of the advisor. This catalog is not intended to provide the detail necessary for self-advising.

Academic Map

Following is a printable, suggested four-year schedule of courses:

Biology, Physiology Concentration, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**42 hours***
Major Core	*29 hours*
Concentration	*10 hours*
Major UD Electives	*3 hours*
Supporting Courses	**19-20 hours***
Electives	**17-29 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)

Major Requirements (42 hours)

Biology Core (29 hours)

- BIOL 1000 - Introduction to the Biology Major **1 credit hour**

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3060 - Diversity of Eukaryotic Life **2 credit hours** AND
- BIOL 3061 - Diversity of Eukaryotic Life Lab **1 credit hour**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- BIOL 3400 - General Ecology **4 credit hours** AND
- BIOL 3401 - General Ecology Lab **0 credit hours**

- BIOL 4200 - Senior Seminar **1 credit hour**

- BIOL 4110 - General Physiology **4 credit hours** AND
- BIOL 4111 - General Physiology Lab **0 credit hours**
  OR
- BIOL 4210 - Cell and Molecular Biology **4 credit hours** AND
- BIOL 4211 - Cell and Molecular Biology Lab **0 credit hours**
  OR
- BIOL 4500 - Plant Physiology **4 credit hours**

Physiology Concentration (10 hours)

Select from:

- BIOL 3010 - Embryology **4 credit hours** AND
- BIOL 3011 - Embryology Lab **0 credit hours**

- BIOL 3020 - Comparative Anatomy of the Vertebrates **4 credit hours** AND
- BIOL 3021 - Comparative Anatomy of the Vertebrates Lab **0 credit hours**
  Note: Biology majors passing BIOL 2020/2021 with a C (2.0) or better can use it as an elective option to BIOL 3020/3021. This substitution is not recommended for pre-med students and does not count for upper-division hours.

- BIOL 3340 - Human Pathophysiology **3 credit hours**

- BIOL 4110 - General Physiology **4 credit hours** * AND
- BIOL 4111 - General Physiology Lab **0 credit hours** *

- BIOL 4130 - Histology **4 credit hours** AND
- BIOL 4131 - Histology Lab **0 credit hours**

- BIOL 4170 - Endocrinology **3 credit hours**

- BIOL 4210 - Cell and Molecular Biology **4 credit hours** * AND
- BIOL 4211 - Cell and Molecular Biology Lab **0 credit hours** *

- BIOL 4300 - Immunology **4 credit hours** AND
- BIOL 4301 - Immunology Lab **0 credit hours**

- BIOL 4310 - Cardio-Renal Physiology **3 credit hours**
- BIOL 4440 - General Virology **4 credit hours**
- BIOL 4500 - Plant Physiology **4 credit hours** *

- BIOL 4560 - Neurobiology **4 credit hours** AND
- BIOL 4561 - Neurobiology Lab **0 credit hours**

- BIOL 4570 - Principles of Toxicology **3 credit hours** AND
- BIOL 4571 - Principles of Toxicology Lab **0 credit hours**

NOTE: **only if not used for core requirement*

BIOL UD elective (3 hours)

Supporting Courses (19-20 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours counted in True Blue Core, 1 credit hour remaining)**

- MATH 1920 - Calculus II **4 credit hours** OR
- MATH 2050 - Probability and Statistics **3 credit hours**
  OR
- BIOL 4350 - Biometry **4 credit hours** AND
- BIOL 4351 - Biometry Lab **0 credit hours** OR

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**
  OR
- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

Electives (17-29 hours)

Curriculum: Biology, Physiology

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Non-Written Communication **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- BIOL 1000 - Introduction to the Biology Major **1 credit hour**

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 30 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **6 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Electives **6 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**
  OR
- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**

Subtotal: 30 Hours

Junior

- BIOL 3060 - Diversity of Eukaryotic Life **2 credit hours** AND
- BIOL 3061 - Diversity of Eukaryotic Life Lab **1 credit hour**

- Human Society and Social Relationships **6 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- BIOL Physiology concentration (see above) **3-4 credit hours**
- Electives **6 credit hours**

- BIOL 3400 - General Ecology **4 credit hours** AND
- BIOL 3401 - General Ecology Lab **0 credit hours**

- BIOL 4110 - General Physiology **4 credit hours** AND
- BIOL 4111 - General Physiology Lab **0 credit hours**
  OR
- BIOL 4210 - Cell and Molecular Biology **4 credit hours** AND
- BIOL 4211 - Cell and Molecular Biology Lab **0 credit hours**
  OR
- BIOL 4500 - Plant Physiology **4 credit hours**

- BIOL 4350 - Biometry **4 credit hours** AND
- BIOL 4351 - Biometry Lab **0 credit hours**
  OR
- MATH 1920 - Calculus II **4 credit hours**
  OR
- MATH 2050 - Probability and Statistics **3 credit hours**

Subtotal: 32-34 Hours

Senior

- BIOL 4200 - Senior Seminar **1 credit hour**
- BIOL Physiology concentration (see above) **6-8 credit hours**
- BIOL upper-division course **3-4 credit hours**
- Electives* **15-16 credit hours**

Subtotal: 25-28 Hours

NOTE:

**Only if needed to meet 36 upper-division credit hours or 120 total credit hours.*

Biology, Teacher Licensure (MTeach), B.S.

Department of Biology

Students seeking a license to teach in secondary schools (grades 7-12) must complete (1) a major in the subject they intend to teach, (2) a minor in Secondary Education, and (3) additional teacher licensure requirements.
Students must contact their Secondary Education Minor advisors for approval of appropriate courses.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Biology, Teacher Licensure (MTeach), B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**42 hours***
Major Core	*29 hours*
Concentration	*11-12 hours*
Major UD Electives	*1-2 hours*
Supporting Courses	**27 hours***
Secondary Education Minor-MTeach	**30 hours**
TOTAL	**126-140 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 126 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)
- COMM 2200 (NWC)

Major Requirements (42 hours)

Biology Core (29 hours)

- BIOL 1000 - Introduction to the Biology Major **1 credit hour**

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3060 - Diversity of Eukaryotic Life **2 credit hours** AND
- BIOL 3061 - Diversity of Eukaryotic Life Lab **1 credit hour**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- BIOL 3400 - General Ecology **4 credit hours** AND
- BIOL 3401 - General Ecology Lab **0 credit hours**

- BIOL 4110 - General Physiology **4 credit hours** AND
- BIOL 4111 - General Physiology Lab **0 credit hours**
  OR
- BIOL 4210 - Cell and Molecular Biology **4 credit hours** AND
- BIOL 4211 - Cell and Molecular Biology Lab **0 credit hours**
  OR
- BIOL 4500 - Plant Physiology **4 credit hours**

- BIOL 4200 - Senior Seminar **1 credit hour**

General Biology Concentration (11-12 hours)

- BIOL 3020 - Comparative Anatomy of the Vertebrates **4 credit hours** AND
- BIOL 3021 - Comparative Anatomy of the Vertebrates Lab **0 credit hours**
  OR
- BIOL 4180 - Vertebrate Zoology **4 credit hours** AND
- BIOL 4181 - Vertebrate Zoology Lab **0 credit hours**

- BIOL 4080 - Mycology **4 credit hours** AND
- BIOL 4081 - Mycology Lab **0 credit hours**

- BIOL 3040 - Entomology **3 credit hours**
  OR
- BIOL 3050 - Parasitology **3 credit hours** AND
- BIOL 3051 - Parasitology Lab **0 credit hours**
  OR
- BIOL 4140 - Invertebrate Zoology **4 credit hours**

BIOL UD elective (1-2 hours)

Supporting Courses (27 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**
  OR
- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- MATH 1920 - Calculus II **4 credit hours** OR
- MATH 2050 - Probability and Statistics **3 credit hours** OR *
  **Must take a 1 hour elective if MATH 2050 is chose*n.

- BIOL 4350 - Biometry **4 credit hours** AND
- BIOL 4351 - Biometry Lab **0 credit hours**

- PSCI 1030 - Topics in Physical Science **4 credit hours** AND
- PSCI 1031 - Topics in Physical Science Lab **0 credit hours**

- COMM 2200 - Audience-Centered Communication **3 credit hours**

Secondary Education Minor-MTeach (30 hours)

See **Secondary Education Minor-MTeach** for further information.

Curriculum: Biology, Teacher Licensure (MTeach)

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MSE 1010 - Step 1: Inquiry Approaches to Teaching **1 credit hour**
- MSE 2010 - Step 2: Inquiry Lesson Design **1 credit hour**
- BIOL 1000 - Introduction to the Biology Major **1 credit hour**

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 32 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **6 credit hours**
- YOED 3520 - Knowing and Learning in Science and Mathematics **3 credit hours**
- YOED 3550 - Classroom Interactions in Mathematics and Science **3 credit hours**
- PHIL 3120 - Perspectives on Science and Math **3 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- CHEM 2030 - Elements of Organic Chemistry **4 credit hours** AND
- CHEM 2031 - Elements of Organic Chemistry Lab **0 credit hours**
  OR
- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

Subtotal: 33 Hours

Junior

- BIOL 3060 - Diversity of Eukaryotic Life **2 credit hours** AND
- BIOL 3061 - Diversity of Eukaryotic Life Lab **1 credit hour**

- BIOL 4200 - Senior Seminar **1 credit hour**
- COMM 2200 - Audience-Centered Communication **3 credit hours** (NWC)
- Human Society and Social Relationships **3 credit hours**
- Concentration courses, **7-8 credit hours**
- UD BIOL elective (BIOL 4740 rec.) **1-3 credit hours**

- BIOL 3400 - General Ecology **4 credit hours** AND
- BIOL 3401 - General Ecology Lab **0 credit hours**

- BIOL 4110 - General Physiology **4 credit hours** AND
- BIOL 4111 - General Physiology Lab **0 credit hours**

- BIOL 4350 - Biometry **4 credit hours** AND
- BIOL 4351 - Biometry Lab **0 credit hours**
  OR
- MATH 1920 - Calculus II **4 credit hours**
  OR
- MATH 2050 - Probability and Statistics **3 credit hours**

Subtotal: 29-33 Hours

Senior

- YOED 4040 - Residency I: MTeach **4 credit hours**
- YOED 4050 - Project-Based Instruction in Mathematics and Science **3 credit hours**
- YOED 4400 - Residency II **12 credit hours**
- Concentration course **4 credit hours**
- Human Society and Social Relationships **3 credit hours**

- PSCI 1030 - Topics in Physical Science **4 credit hours**
- PSCI 1031 - Topics in Physical Science Lab **0 credit hours**

Subtotal: 29-30 Hours

Biology

BIOL 1000 - Introduction to the Biology Major
1 credit hour Required for all Biology majors. Development of skill sets essential for success in the Biology major. Topics include the understanding of departmental and university resources and expectations, development of personalized academic plans, and development of skills for professional interactions.

BIOL 1030 - Exploring Life
4 credit hours
Corequisite: BIOL 1031. Designed for non-majors. Offers understanding, experiences, and skills related to common biological issues. Includes class discussions, small group activities, lectures, selected readings, and laboratory investigations. Students earning an A in BIOL 1030/1031 and wishing to declare a major or minor in Biology may substitute BIOL 1030/BIOL 1031 for BIOL 1110/BIOL 1111 toward meeting the requirement for the major or minor. Three hours lecture and one two-hour laboratory.
TBC: Scientific Literacy (Discovery)

BIOL 1031 - Exploring Life Lab
0 credit hours Corequisite: BIOL 1030.

BIOL 1110 - General Biology I
4 credit hours
Prerequisite: MATH 1710 with C- or better or MATH ACT of 19 or higher. Corequisite: BIOL 1111. Primarily for Biology majors and minors and other science-oriented students. Biological principles and processes, including introduction to the nature of science, cells (structure, function, metabolism, division), genetics, and evolution. Three hours lecture and one three-hour laboratory. While BIOL 1110 can be used to fulfill half the 8-hour True Blue Core requirement for Scientific Literacy, it is the first semester of a two-semester sequence primarily designed for science majors. TBR Common Course: BIOL 1110
TBC: Scientific Literacy (Discovery)

BIOL 1111 - General Biology I Lab
0 credit hours Corequisite: BIOL 1110. TBR Common Course: BIOL 1111

BIOL 1120 - General Biology II
4 credit hours Prerequisite: BIOL 1110/BIOL 1111. Corequisite: BIOL 1121. Primarily for Biology majors and minors and other science-oriented students. Survey of plants and animals emphasizing evolution, structure, function, reproduction, growth, and ecology. Three hours lecture and one three-hour laboratory. TBR Common Course: BIOL 1120

BIOL 1121 - General Biology II Lab
0 credit hours Corequisite: BIOL 1120. TBR Common Course: BIOL 1121

BIOL 2000 - Orientation to the Medical Lab
2 credit hours Corequisite: BIOL 2001. Open to anyone in medical and allied medical careers, but may not be taken as part of Biology major. Survey of medical lab careers, curricula, and affiliated laboratory programs; experience in medical laboratory testing procedures. One hour lecture and one two-hour laboratory.

BIOL 2001 - Orientation to the Medical Lab Field Experience Lab
0 credit hours Corequisite: BIOL 2000.

BIOL 2010 - Human Anatomy and Physiology I
4 credit hours
Completion of BIOL 1030 and BIOL 1031 or a grade of C or better in high school chemistry and biology within the last five years is strongly recommended. Corequisite: BIOL 2011 . Meets requirements for many pre-health professional programs including nursing. Structure and function of the cell, integumentary, skeletal, muscle, and nervous systems. Three hours lecture and one three-hour laboratory.
TBC: Scientific Literacy (Discovery)

BIOL 2011 - Human Anatomy and Physiology I Lab
0 credit hours Corequisite: BIOL 2010.

BIOL 2020 - Human Anatomy and Physiology II
4 credit hours
Prerequisite: C or better in BIOL 2010/BIOL 2011. Corequisite: BIOL 2021. Meets requirements for many pre-health professional programs including nursing. Structure and function of endocrine, circulatory, respiratory, urinary, digestive, and reproductive systems. Biology majors passing both BIOL 2010/BIOL 2111 and BIOL 2020/BIOL 2021 with a C or better may substitute both courses for BIOL 3020. However, the substitution is not recommended for pre-med students and does not count for upper-

division hours. Three hours lecture and one three-hour laboratory.
TBC: Scientific Literacy (Discovery)

BIOL 2021 - Human Anatomy and Physiology II Lab
0 credit hours Corequisite: BIOL 2020.

BIOL 2030 - Anatomy and Physiology
3 credit hours Prerequisite: BIOL 1030/BIOL 1031 or BIOL 1110/BIOL 1111. Corequisite: BIOL 2031. General structure and physiological activities of human systems. Two hours lecture and one two-hour laboratory.

BIOL 2031 - Anatomy and Physiology Lab
0 credit hours Corequisite: BIOL 2030.

BIOL 2100 - Microbiology in Disease
3 credit hours Prerequisites: BIOL 2010/BIOL 2011 and BIOL 2020/BIOL 2021 with grades of C (2.0) or better. Corequisite: BIOL 2101. Fundamentals of the role of microorganisms responsible for disease in humans. Does not apply toward a major or minor in Biology. Two hours lecture and one two-hour laboratory per week.

BIOL 2101 - Microbiology in Disease Lab
0 credit hours Corequisite: BIOL 2100.

BIOL 2230 - Microbiology
4 credit hours Prerequisites: BIOL 1110/BIOL 1111 and BIOL 1120/BIOL 1121 or BIOL 2010/BIOL 2011 and BIOL 2020/BIOL 2021. Concepts and techniques pertaining to the morphology, physiology, reproduction, isolation, cultivation and identification of microorganisms with particular emphasis on bacteria. Topics include the impact of microorganisms in our daily lives, both adverse and beneficial. Background in General Chemistry is strongly recommended. Three hours lecture and one three-hour laboratory.

BIOL 2231 - Microbiology Lab
0 credit hours Corequisite: BIOL 2230.

BIOL 3000 - Life Science for Elementary Teachers
4 credit hours Prerequisites: 8 hours of natural sciences from the following prefixes: ASTR, BIOL, CHEM, GEOL, PGEO, PHYS, and PSCI. A process-oriented approach to the study of life with emphasis on execution and analysis of activities and experiments suited to the elementary school classroom. Six hours lecture and laboratory. (May not be used for Biology majors or minors.). A process-oriented approach to the study of life with emphasis on execution and analysis of activities and experiments suited to the elementary school classroom. Six hours lecture and laboratory. (May not be used for Biology majors or minors.)

BIOL 3010 - Embryology
4 credit hours Prerequisite: BIOL 3250/BIOL 3251. Corequisite: BIOL 3011. Early development of the frog, chick, pig, and human. Living material, whole mounts, and serial sections are used for studying cleavage, germ layer formation, histogenesis, and organogenesis. Three hours lecture and one three-hour laboratory.

BIOL 3011 - Embryology Lab
0 credit hours Corequisite: BIOL 3010.

BIOL 3020 - Comparative Anatomy of the Vertebrates
4 credit hours Prerequisite: BIOL 3250/BIOL 3251. Corequisite: BIOL 3021. Vertebrate morphology and the development and function of systems and organs. Three hours lecture and one three-hour laboratory.

BIOL 3021 - Comparative Anatomy of the Vertebrates Lab
0 credit hours Corequisite: BIOL 3020.

BIOL 3040 - Entomology
3 credit hours Prerequisite: BIOL 3250/BIOL 3251. Morphology, classification, evolution, life histories, and economic importance of insects. Five hours of lecture and laboratory.

BIOL 3050 - Parasitology
3 credit hours Prerequisite: BIOL 3250/BIOL 3251. Corequisite: BIOL 3051. Life histories, host-parasite relationships, and control measures of the more common parasites of humans and domesticated animals. Two hours lecture and one three-hour laboratory.

BIOL 3051 - Parasitology Lab
0 credit hours Corequisite: BIOL 3050.

BIOL 3060 - Diversity of Eukaryotic Life
2 credit hours Prerequisites: BIOL 1110/BIOL 1111; corequisite: BIOL 3061. Survey of the major evolutionary lineages of eukaryotic organisms. Specifically, the evolution, diversity, ecological and societal roles of autotrophic protists, heterotrophic

protists, fungi, plants and animals discussed. Two hours lecture.

BIOL 3061 - Diversity of Eukaryotic Life Lab
1 credit hour Corequisite: BIOL 3060. Students study representative organisms from each lineage and sub-lineage and the key structures that are used to delineate the major lineages and sub-lineages.

BIOL 3150 - Radiation Biology
3 credit hours Prerequisites: PHYS 2010/PHYS 2011 and PHYS 2020/PHYS 2021. Types and properties of ionizing radiation, isotopes and tracer study techniques, and the biological effects of ionizing radiations on living things. Restricted to students in the Allied Health Technology program.

BIOL 3200 - Internship in Biology
2 to 4 credit hours Prerequisites: BIOL 3250/BIOL 3251; permission of department. Practical experience for students in a professional setting.

BIOL 3210 - Environmental Microbiology
3 credit hours Prerequisites: BIOL 2230/BIOL 2231 and BIOL 3250/BIOL 3251. Corequisite: BIOL 3211. Deals with microorganisms commonly found in air, water, and soil. Two hours lecture and one three-hour laboratory.

BIOL 3211 - Environmental Microbiology Lab
0 credit hours Corequisite: BIOL 3210.

BIOL 3250 - Genetics
4 credit hours Prerequisites: BIOL 1110/BIOL 1111 and BIOL 1120/BIOL 1121. Corequisite: BIOL 3251. An introductory course in genetics. Surveys and explores the sub-disciplines of genetics, including classical, molecular, and evolutionary genetics. Emphasis on the experiments, techniques, and theories forming the foundation of modern genetic research and its applications. Three hours lecture and one two-hour laboratory.

BIOL 3251 - Genetics Lab
0 credit hours Corequisite: BIOL 3250.

BIOL 3340 - Human Pathophysiology
3 credit hours Prerequisites: BIOL 2230/BIOL 2231 and (BIOL 2010/BIOL 2011, BIOL 2020/BIOL 2021) or BIOL 3250/BIOL 3251. Basic mechanisms of disease processes and their role in disrupting normal physiology. Three hours lecture.

BIOL 3350 - Principles of Radiation in Medicine
3 credit hours Prerequisites: BIOL 3150, PHYS 2010/PHYS 2011 and PHYS 2020/PHYS 2021. Basic concepts and theories of radiation physics. Detailed analysis of the structure of matter, properties of radiation, nuclear transformations, x-ray production, and interactions of ionizing radiation emphasized. Treatment units used in external radiation therapy, measurement and quality of ionizing radiation produced, absorbed dose measurement, dose distribution, and scatter analysis presented. Restricted to students in the Allied Health Technology Program.

BIOL 3400 - General Ecology
4 credit hours Prerequisites: BIOL 1110/BIOL 1111 and BIOL 1120/BIOL 1121. Corequisite: BIOL 3401. Basic concepts of the ecosystem and community aquatic and terrestrial habitats and population ecology; complemented by field and laboratory activities. Three hours lecture and one-three hour laboratory.

BIOL 3401 - General Ecology Lab
0 credit hours Corequisite: BIOL 3400.

BIOL 3500 - Evolution
3 credit hours Prerequisite: BIOL 3250/BIOL 3251. Evolutionary biology for majors. Topics include history of evolutionary thinking, mechanisms of evolution, basic quantitative and population genetics, life-history theory, evolution of sex, correlated responses to selection, speciation, macroevolution, molecular evolution, fossil record and geologic time scale, phylogenic inference, and the emergence of life. Three hours lecture.

BIOL 3890 - Biology Instruction Internship
1 credit hour Prerequisites: BIOL 3250/BIOL 3251, 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 a biology laboratory. Credits will not count toward a major or minor in Biology. May be repeated for up to three credits.

BIOL 4070 - Economic Botany
3 credit hours Prerequisite: BIOL 3250/BIOL 3251. Useful plants which have shaped civilization. Topics include origin of agriculture, fruits and nuts, grains and legumes, vegetables, spices and herbs, oils and

waxes, medicinal plants, psychoactive plants. Three hours lecture.

BIOL 4080 - Mycology
4 credit hours Prerequisite: BIOL 3250/BIOL 3251. Corequisite: BIOL 4081. Emphasizes taxonomy, morphology, and culture of fungi and their importance to humans. Three hours lecture and one three-hour laboratory.

BIOL 4081 - Mycology Lab
0 credit hours Corequisite: BIOL 4080.

BIOL 4090 - Forest Ecology
4 credit hours Prerequisites: A grade of C or better in BIOL 3250/BIOL 3251, BIOL 3400, and BIOL 3500 or permission of instructor. Ecological form and function of forested systems with a particular emphasis on communities of the southeastern U.S. and Tennessee. Topics include dendrology, community assembly and disassembly over time, abiotic and biotic drivers of forest community succession, phylogeography and biogeography, and threats and sustainable practices. Three hours lecture and one three-hour laboratory.

BIOL 4110 - General Physiology
4 credit hours Prerequisites: BIOL 2230/BIOL 2231 and BIOL 3250/BIOL 3251; CHEM 2030/CHEM 2031 or CHEM 3010 /CHEM 3011. Corequisite: BIOL 4111. Physiological and chemical properties of life processes in animals using an organ systems approach. Emphasis on mammalian physiology. Three hours lecture and one three-hour laboratory.

BIOL 4111 - General Physiology Lab
0 credit hours Corequisite: BIOL 4110.

BIOL 4130 - Histology
4 credit hours Prerequisites: BIOL 3250/BIOL 3251 and CHEM 2030/CHEM 2031 or CHEM 3010/CHEM 3011. Corequisite: BIOL 4131. Microscopic anatomy of vertebrate cells, tissues, and organs. Three hours lecture and one three-hour laboratory.

BIOL 4131 - Histology Lab
0 credit hours Corequisite: BIOL 4130.

BIOL 4140 - Invertebrate Zoology
4 credit hours Prerequisite: BIOL 3250/BIOL 3251. Corequisite: BIOL 4141. Morphology, classification, evolution, life histories, and economic importance of invertebrate phyla. Three hours lecture and one three-hour laboratory.

BIOL 4141 - Invertebrate Zoology Lab
0 credit hours Corequisite: BIOL 4140.

BIOL 4170 - Endocrinology
3 credit hours Prerequisites: BIOL 3250/BIOL 3251, BIOL 4110/BIOL 4111 or BIOL 2020/BIOL 2021; CHEM 2030/CHEM 2031 or CHEM 3010/CHEM 3011. Study of hormones and other chemical messengers including synthesis, secretion, transport, receptors, cellular, and physiological activity. Focus on humans and other vertebrates. Three hours lecture.

BIOL 4180 - Vertebrate Zoology
4 credit hours Prerequisite: BIOL 3250/BIOL 3251. Corequisite: BIOL 4181. Structure, life history, and classification of fish, amphibians, and mammals. Local representatives emphasized. Three hours lecture and one three-hour laboratory.

BIOL 4181 - Vertebrate Zoology Lab
0 credit hours Corequisite: BIOL 4180.

BIOL 4200 - Senior Seminar
1 credit hour Prerequisites: BIOL 2230/BIOL 2231, BIOL 3250/BIOL 3251, BIOL 3400/BIOL 3401, and BIOL 3500. Readings and discussions from scientific literature on a particular theme that will incorporate topics in cellular biology, energetics, genetics, molecular and organismal biology, evolution, and ecology., Majors advised to take this course during the semester of graduation.

BIOL 4210 - Cell and Molecular Biology
4 credit hours Prerequisites: BIOL 3250/BIOL 3251, BIOL 2230/BIOL 2231, and CHEM 2030/CHEM 2031 or CHEM 3010/CHEM 3011. Corequisite: BIOL 4211. Cellular morphology and function. Three hours lecture and one three-hour laboratory.

BIOL 4211 - Cell and Molecular Biology Lab
0 credit hours Corequisite: BIOL 4210.

BIOL 4220 - Ichthyology
4 credit hours Prerequisite: BIOL 3250 BIOL 3251. Corequisite: BIOL 4221. The morphology, physiology, taxonomy, and ecology of fishes. Three hours lecture and one three-hour laboratory.

BIOL 4221 - Ichthyology Lab
0 credit hours Corequisite: BIOL 4220.

BIOL 4270 - Transmitting Electron Microscopy
4 credit hours Prerequisite: Permission of department. Tissue fixation, dehydration, embedding, and thin sectioning for examination and development of micrographs using a Zeiss electron microscope. Seven hours lecture/laboratory.

BIOL 4280 - Undergraduate Research in Biology
1 to 4 credit hours Prerequisite: Permission of department. Selection, design, and conduction of projects typically allied with an instructor's research program. May be repeated for a total of twelve credits. Only four credits may count toward the Biology major.

BIOL 4290 - Scanning Electron Microscopy
4 credit hours Prerequisite: Permission of department. Preparation of biological and non-biological materials for examination and development of micrographs using an ISI electron microscope. Seven hours lecture/laboratory.

BIOL 4300 - Immunology
4 credit hours Prerequisites: BIOL 2230/BIOL 2231 and BIOL 3250/BIOL 3251. Corequisite: BIOL 4301. Humoral and cellular mechanisms of immunity. Three hours lecture and one three-hour laboratory.

BIOL 4301 - Immunology Lab
0 credit hours Corequisite: BIOL 4300.

BIOL 4310 - Cardio-Renal Physiology
3 credit hours Prerequisites: BIOL 4110/BIOL 4111 or BIOL 2020/BIOL 2021, BIOL 3250/BIOL 3251 and (CHEM 2030/CHEM 2031 or CHEM 3010/CHEM 3011). Interdependence of cardiac, hemodynamic, and renal mechanisms in regulating volume status, vascular tones, and cardiac output. Three hours lecture.

BIOL 4330 - Biome Analysis
1 to 4 credit hours Prerequisites: BIOL 1110/BIOL 1111 and BIOL 1120/BIOL 1121; permission of department; and junior or senior standing. An intensive classroom and on-site study of a specific biome. Special emphasis on data collection and analysis. Consult the department chair for specific credits and costs.

BIOL 4350 - Biometry
4 credit hours Prerequisites: BIOL 3250/BIOL 3251 and MATH 1910. Corequisite: BIOL 4351. Statistical methods utilized in biological research. Three hours lecture and one three-hour laboratory.

BIOL 4351 - Biometry Lab
0 credit hours Corequisite: BIOL 4350.

BIOL 4360 - Energy Dispersive X-Ray Analysis
1 credit hour Prerequisite: BIOL 4290. Elemental analysis of materials using an energy dispersive x-ray system with scanning electron microscopy. Three hours laboratory.

BIOL 4375 - Forensic Taphonomy
3 credit hours Prerequisites of BIOL 2230/BIOL 2231 and BIOL 3250/BIOL 3251 (or FSBI 3250/FSBI 3251). Taphonomic factors and events related to human decomposition and the role of forensic investigators/scientists in the forensic context.

BIOL 4390 - Ethology (Animal Behavior)
4 credit hours Prerequisite: BIOL 3250/BIOL 3251. Corequisite: BIOL 4391. Innate and learned animal behavior in primitive and advanced animals including behavior associated with space, reproduction, and food getting. Three hours lecture and one three-hour laboratory.

BIOL 4391 - Ethology (Animal Behavior) Lab
0 credit hours Corequisite: BIOL 4390.

BIOL 4420 - Plant Ecology and Evolution
4 credit hours Prerequisites: BIOL 1110/BIOL 1111, BIOL 1120/BIOL 1121, and BIOL 3250/BIOL 3251 (or permission of department). Major themes in the ecology and evolution of plants. Topics include how plants sense, respond, and adapt to their environment, life history, species, and patterns of diversity and abundance of plants. Three hours lecture and one three-hour laboratory.

BIOL 4430 - Diagnostic Microbiology
4 credit hours Prerequisites: BIOL 2230/BIOL 2231 and BIOL 3250/BIOL 3251. Microorganisms that cause disease in humans and other animals, their isolation and identification, mechanisms of disease causation, and methods of control. Six hours lecture/laboratory.

BIOL 4440 - General Virology
4 credit hours Prerequisites: BIOL 2230/BIOL 2231 and BIOL 3250/BIOL 3251; CHEM 1110/CHEM 1111 and CHEM 1120/CHEM 1121. Viruses, with emphasis on their clinical importance and impact on biotechnology. Six hours lecture/laboratory.

BIOL 4450 - Molecular Genetics
4 credit hours Prerequisites: BIOL 2230/BIOL 2231, BIOL 3250/BIOL 3251; CHEM 1110/CHEM 1111, CHEM 1120/CHEM 1121. Corequisite: BIOL 4451. Basic techniques of molecular genetics and gene manipulation with emphasis on the application of molecular genetics in basic and applied research. Three hours lecture and one separate three-hour laboratory.

BIOL 4451 - Molecular Genetics Lab
0 credit hours Corequisite: BIOL 4450. Three hour lab.

BIOL 4460 - Human Genetics
3 credit hours Prerequisite: BIOL 3250/BIOL 3251. Corequisite: BIOL 4461. Application of the fundamental laws of inheritance to humans. Two hours lecture and one two-hour laboratory.

BIOL 4461 - Human Genetics Lab
0 credit hours Corequisite: BIOL 4460.

BIOL 4500 - Plant Physiology
4 credit hours Prerequisites: BIOL 3250/BIOL 3251 and CHEM 2030/CHEM 2031 or CHEM 3010/CHEM 3011. Plant growth, development, and metabolism at the cellular and whole plant levels. Three hours lecture and three hours laboratory.

BIOL 4510 - Food and Industrial Microbiology
4 credit hours Prerequisite: BIOL 2230/BIOL 2231. Corequisite: BIOL 4511. Interaction between microorganisms and food; industrial processes of importance to humans. Six hours lecture/laboratory.

BIOL 4511 - Food and Industrial Microbiology Lab
0 credit hours Corequisite: BIOL 4510.

BIOL 4550 - Biotechnology
3 credit hours Prerequisites:BIOL 2230/BIOL 2231 and BIOL 3250/BIOL 3251. Instruction in both theory and application of current research methodologies in biology and molecular biology. Topics include immunochemistry, polymerase chain reaction, restriction enzyme analysis, and electrophoresis. Five hours lecture/laboratory.

BIOL 4560 - Neurobiology
4 credit hours Prerequisite: BIOL 3250/BIOL 3251. Corequisite: BIOL 4561. Introduces comparative neurobiology. Topics include the basic structure and function of the nerve cell and organization of nervous systems of representative species of invertebrate and vertebrate animals. Three hours lecture and one three-hour laboratory.

BIOL 4561 - Neurobiology Lab
0 credit hours Corequisite: BIOL 4560.

BIOL 4570 - Principles of Toxicology
3 credit hours Prerequisites: BIOL 1110/BIOL 1111, BIOL 1120/BIOL 1121, CHEM 1110/CHEM 1111, CHEM 1120/CHEM 1121, and CHEM 3010/CHEM 3011. Corequisite: BIOL 4571. Study of adverse effects of chemical agents on living organisms; current toxicological techniques used in the laboratory. Three hours lecture and three hours laboratory.

BIOL 4571 - Principles of Toxicology Lab
0 credit hours Corequisite: BIOL 4570.

BIOL 4580 - Marine Biology
4 credit hours Prerequisite: BIOL 3250 BIOL 3251, CHEM 1110/CHEM 1111, and CHEM 1120/CHEM 1121. Corequisite: BIOL 4581. Introduction to the biological, chemical, and physical characteristics of major marine environments and their associated flora and fauna. Three hours lecture and one three-hour laboratory.

BIOL 4581 - Marine Biology Lab
0 credit hours Corequisite: BIOL 4580.

BIOL 4590 - Principles of Environmental Toxicology
4 credit hours Prerequisites: BIOL 1110/BIOL 1111, BIOL 1120/BIOL 1121, CHEM 1110/CHEM 1111, CHEM 1120/CHEM 1121, and CHEM 3010/CHEM 3011. Ecological effects of chemicals in the environment and techniques currently utilized to assess these effects. Lab includes current environmental assessment techniques, including biomonitoring. Six hours lecture/laboratory.

BIOL 4720 - Animal Development
4 credit hours Prerequisite: BIOL 3250/BIOL 3251; BIOL 4210 recommended. Corequisite: BIOL 4721. Processes and underlying molecular mechanisms by which a single fertilized egg develops into an adult organism, focusing on vertebrate development, but including insights gained from other model organisms. Three hours lecture and two hours lab.

BIOL 4721 - Animal Development Lab
0 credit hours Corequisite: BIOL 4720.

BIOL 4730 - Microbial Physiology and Biochemistry
4 credit hours Prerequisites: BIOL 3250/BIOL 3251; CHEM 1110/CHEM 1111, CHEM 1120/CHEM 1121, and CHEM 2030/CHEM 2031 or CHEM 3010/CHEM 3011. Survey of the physiology and biochemistry of prokaryotic and eukaryotic microorganisms. Six hours lecture/laboratory.

BIOL 4740 - Research Methods
3 credit hours (Same as ABAS/CHEM/GEOL/PHYS/MATH 4740.) Prerequisites: YOED 3520 and BIOL 3250/BIOL 3251. Provides secondary science and mathematics teacher candidates with the tools that scientists use to solve scientific problems. Students will use these tools in a laboratory setting, communicate findings, and understand how scientists develop new knowledge.

BIOL 4750 - Plant Biotechnology
4 credit hours Prerequisite: BIOL 3250/BIOL 3251. Processes and reasoning behind the human manipulation of plant species for agricultural and technological purposes. Topics include traditional breeding techniques, tissue culture, plant cell transformation, and general plant molecular biology techniques as well as current debate over genetically modified organisms. Six hours lecture/laboratory.

BIOL 4770 - Biostatistical Programming
3 credit hours Prerequisite: BIOL 4350/BIOL 4351 or equivalent; access to Mac or PC laptop must be confirmed. Takes a ground-up approach to teaching the fundamentals of biostatistical analysis using R programming language and RStudio.

BIOL 4780 - Responsible Conduct of Research
1 credit hour Prerequisite: BIOL 1110 or CHEM 1110 or PSY 1410. Responsible conduct in scientific research. Topics include conflict of interest, plagiarism, reporting of scientific results, authorship, responsible use and care of animals, responsible use of human subjects.

Forensic Science

FRSC 1010 - Introduction to the Forensic Science Major
2 credit hours Required for all Forensic Science majors. Development of skill sets essential for success in the Forensic Science major and an introduction to the various fields of Forensic Science by expert guest lecturers. Topics include the understanding of program expectations, development of personalized academic plans, development of skills for professional interactions, as well as an introduction to the different fields of Forensic Science.

FRSC 4010 - Forensics Senior Seminar
2 credit hours Prerequisites: FRSC 1010, FSCJ 4340, and senior standing. Practical experiences in the treatment of evidence with a mock crime scene, collection and preservation of evidence, forensic analysis, record maintenance, professional practice, and courtroom testimony. Two hours lecture.

FRSC 4020 - Forensics Internship
4 credit hours Prerequisite: Permission of program director. A supervised laboratory experience for advanced students in an off-campus professional setting.

Forensic Science - Biology

FSBI 3250 - Genetics
4 credit hours Prerequisites: BIOL 1110/BIOL 1111 and BIOL 1120/BIOL 1121. Corequisite: FSBI 3251. An introductory course in genetics. Surveys and explores the sub-disciplines of genetics, including classical, molecular, and evolutionary genetics. Emphasis on the experiments, techniques, and theories forming the foundation of modern genetic research and its applications. Three hours lecture and one two-hour laboratory.

FSBI 3251 - Genetics Lab
0 credit hours
Corequisite: FSBI 3250.

FSBI 4300 - Immunology
4 credit hours Prerequisite: BIOL 2230/BIOL 2231; CHEM 1110/CHEM 1111, CHEM 1120/CHEM 1121.

Corequisite: FSBI 4301 . Instruction in theory and application of humoral and cellular mechanisms of immunity. Emphasis on understanding the mechanisms by which we respond to disease-causing organisms, allergens, self antigens, as well as the importance of immunology techniques in scientific research, clinical laboratory science, and forensic science. Three hours lecture and one three-hour laboratory.

FSBI 4301 - Immunology Lab
0 credit hours Corequisite: FSBI 4300.

FSBI 4550 - Biotechnology
3 credit hours Prerequisites: BIOL 1110/BIOL 1111, BIOL 1120/BIOL 1121, BIOL 2230/BIOL 2231; CHEM 1110/CHEM 1111, CHEM 1120/CHEM 1121 . Instruction in both the theory and application of current research methodologies in molecular biology including their forensic science application. Topics include DNA/RNA isolation, recombinant DNA methods, polymerase chain reaction, DNA sequencing, DNA fingerprinting, protein purification, and immunochemistry. Five hours lecture/laboratory.

Chemistry

Andrienne C. Friedli, Interim Chair

Banerjee, Bicker, Burden, Chong, Chusuei, Ding, DiVincenzo, Handy, Hietsoi, Hosbein, Ilsley, Iriarte-Gross, Kline, Kong, Lee, MacDougall, Melton, Miller, Ooi, D. Patterson, P. Patterson, Phelps, Sanger, Van Patten, Volkov, Wang, White, Zhang

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 in Biochemistry, Chemistry with a concentration in ACS and Teacher Licensure (MTeach) program, and Science with concentrations in Allied Health Science and Allied Health Technology. These Bachelor of Science degree programs are effective preparation for entry into health-related professional programs, including cytotechnology, dentistry, health information management, medicine, medical technology, nuclear medicine technology, occupational therapy, pharmacy, physical therapy, radiation therapy technology, chiropractic, and diagnostic medical sonography. Minors are also offered in Chemistry and Science.

The department participates in an interdisciplinary major in Forensic Science with Biology and Criminal Justice Administration.

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.

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/PSCI 1031) in addition to the True Blue Core requirements.

Students must contact their Secondary Education minor advisors for approval of appropriate courses. See MTeach for minor requirements and more information.

Teacher Licensure in Elementary Education (K-5)

Students may become licensed to teach in grades K-5 including science by following the Elementary Education major. The science and math courses required are PSCI 1030/PSCI 1031 and PSCI 4030; BIOL 1030/BIOL 1031 and BIOL 3000; and MATH (MATH 1010 or MATH 1710), MATH 1410, and MATH 1420. See other requirements for majors in the Elementary and Special Education Department section.

Three-and-One Programs

The following programs can lead to an MTSU degree: pre-chiropractic, pre-medical technology, pre-pharmacy, pre-nuclear medicine technology, pre-radiation therapy technology, and pre-diagnostic medical sonography.

Since acceptance into dental or pharmacy school after three years is highly competitive, most students complete a degree in a science-related discipline such as biology, chemistry, or biochemistry while completing prerequisites for professional school.

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.
6. Students seeking financial aid assistance for the final year of the Three-and-One Program should confer with the new institution regarding financial aid eligibility requirements. During the final year at another institution, the MTSU Financial Aid and Scholarships Office will **not** be awarding federal, state, or institutional financial aid.

Honors College

The Department of Chemistry offers the following courses in Honors: CHEM 1110/CHEM 1111, CHEM 1120/CHEM 1121,CHEM 3010/CHEM 3011,CHEM 3020/CHEM 3021 and PSCI 1030/PSCI 1031. See current online class schedule and Honors information in this catalog.

Graduate Study

The Department of Chemistry offers the Master of Science degree and a Chemical Analytics concentration in the Professional Science program. The Graduate Catalog has degree requirements and course listings.

Biochemistry, B.S.

Department of Chemistry
615-898-5466
Paul Kline, program coordinator
Paul.Kline@mtsu.edu

A Biochemistry degree can not only prepare students for professional careers as chemists; it may also serve as the basis for work in areas outside pure chemistry, such as materials science, medicine and other health-related fields, nutrition, pharmacology, patent law, business, and environmental science, to name a few.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Biochemistry, B.S., Academic Map

Degree Requirements

True Blue Core	**41 hours**
Major Requirements	**57 hours***
Supporting Courses	**12 hours***
Electives	**10-21 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit) *(See Note 1)*
- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1110/CHEM 1111 (Sci Lit) *(See Note 2)*

Major Requirements (57 hours)

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**
- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

- CHEM 4330 - Physical Chemistry Fundamentals I **4 credit hours** AND
- CHEM 4331 - Physical Chemistry Fundamentals I Lab **0 credit hours**

- CHEM 4500 - Biochemistry I **3 credit hours**
- CHEM 4510 - Biochemistry II **3 credit hours**

- CHEM 4530 - Biochemical Techniques **2 credit hours** OR
- CHEM 4570 - Biochemical Literature **2 credit hours**

- CHEM 4550 - Bioanalytical Chemistry **4 credit hours** AND
- CHEM 4551 - Bioanalytical Chemistry Lab **0 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- BIOL/CHEM upper-division electives **9 credit hours (minimum of 3 credit hours in each discipline)**

Supporting Courses (12 hours)

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**

Electives (10-21 hours)

- A minimum of 36 hours must be at the 3000/4000 level

Curriculum: Biochemistry

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- History and Civic Learning **6 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) *(See Note 1)* AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit) *(See Note 1)*

- CHEM 1120 - General Chemistry II **4 credit hours** *(See Note 2)* AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours** *(See Note 2)*

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

Subtotal: 28 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- Non-Written Communication **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Elective **1 credit hour**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)

Subtotal: 30 Hours

Junior

- CHEM 4500 - Biochemistry I **3 credit hours**
- CHEM 4510 - Biochemistry II **3 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

- CHEM 4550 - Bioanalytical Chemistry **4 credit hours** AND
- CHEM 4551 - Bioanalytical Chemistry Lab **0 credit hours**

- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Electives **5 credit hours**
- BIOL elective (upper-division) **3 credit hours**

Subtotal: 32 Hours

Senior

- CHEM 4330 - Physical Chemistry Fundamentals I **4 credit hours** AND
- CHEM 4331 - Physical Chemistry Fundamentals I Lab **0 credit hours**

- CHEM 4530 - Biochemical Techniques **2 credit hours** OR
- CHEM 4570 - Biochemical Literature **2 credit hours**

- CHEM upper-division elective **3 credit hours**
- BIOL/CHEM upper-division elective **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Upper-division elective **1 credit hour**
- Electives **14 credit hours**

Subtotal: 30 Hours

NOTE:

Included in the electives will be the hours necessary for the completion of the required 36 upper-division hours for graduation requirements and the necessary hours to satisfy the 120-hour graduation requirement.
NOTE 1: A student who has a sufficiently high score on the ACT Mathematics test may begin with MATH 1910. If the background in math is weak, MATH 1710 should be taken before MATH 1730.
NOTE 2: A student who has had little or no high school chemistry or is not satisfied with his/her high school chemistry should first take CHEM 1010/CHEM 1011 before taking CHEM 1110/CHEM 1111.

Chemistry Minor

Chemistry
Andrienne Friedli
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The minor in Chemistry consists of at least 19 semester hours of chemistry. At least four upper-division hours must be taken at MTSU. Consult your advisor to determine which courses will satisfy minor requirements. A 2.00 GPA is required.

NOTE: 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.

Required (8 hours)

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Electives (11 hours)

- 11 hours of chemistry, all at the 2000 level or above. At least 4 hours must be upper-division.

NOTE: *The following courses* **cannot** *be used to satisfy a Chemistry minor: CHEM 2880, CHEM 3000, CHEM 3880, CHEM 3890, CHEM 3980, CHEM 4580, CHEM 4740, and CHEM 4880.*

Chemistry, ACS Certified Concentration, B.S.

Department of Chemistry
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Keying Ding, program coordinator
Keying.Ding@mtsu.edu

This curriculum is approved by the American Chemical Society. With this degree students are more likely to be hired as practicing chemists or gain admission to professional programs or graduate schools.
NOTE: 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.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Chemistry, ACS Certified Concentration, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**48 hours***
Supporting Courses	**20 hours***
Electives	**11-21 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.
The following courses required by the major meet True Blue Core requirements:

- MATH 1730 (Quant Lit) *(See Note 1)*
- CHEM 1110/CHEM 1111 (Sci Lit) *(See Note 2)*
- PHYS 2110/PHYS 2111 (Sci Lit)

Major Requirements (48 hours)

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CHEM 2230 - Quantitative Analysis **3 credit hours** AND
- CHEM 2231 - Quantitative Analysis Lab **2 credit hours**

- CHEM 3000 - Careers in Chemistry and Biochemistry **1 credit hour**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

- CHEM 3530 - Principles of Biochemistry **4 credit hours** AND
- CHEM 3531 - Principles of Biochemistry Lab **0 credit hours**

- CHEM 4350 - Physical Chemistry I **4 credit hours** AND
- CHEM 4351 - Physical Chemistry I Lab **0 credit hours**

- CHEM 4360 - In-depth Physical Chemistry **4 credit hours** AND
- CHEM 4361 - Physical Chemistry II Lab **0 credit hours**

- CHEM 4400 - Inorganic Chemistry I **3 credit hours**

Choose 4 hours from the following:

- CHEM 3890 - Chemistry Instruction Internship **1 to 3 credit hours**
- CHEM 3980 - Cooperative Education **1 to 4 credit hours**
- CHEM 4880 - Research **4 credit hours**

Upper-division Chemistry Electives (7 hours)

At least 6 hours from:

- CHEM 4000 - Medicinal Chemistry **3 credit hours**
- CHEM 4100 - Organic Spectroscopy **3 credit hours**
- CHEM 4105 - Advanced Organic Chemistry **3 credit hours**
- CHEM 4150 - Bioorganic Chemistry **3 credit hours**
- CHEM 4310 - Modeling Organic and Biological Molecules **3 credit hours**
- CHEM 4410 - Inorganic Chemistry II **3 credit hours**
- CHEM 4520 - Topics in Biochemistry **3 credit hours**
- CHEM 4540 - Foundations of Enzymology **3 credit hours**
- CHEM 4610 - Environmental Chemistry **3 credit hours**
- CHEM 4700 - Polymers, an Introduction **3 credit hours**
- CHEM 4990 - Chemometrics and Statistics for Analytical Chemistry **3 credit hours**

At least 1 hour from:

- CHEM 3080 - Liquid Chromatography Techniques **1 credit hour**
- CHEM 3090 - Techniques of Gas Chromatography **1 credit hour**
- CHEM 4190 - Mass Spectrometry **1 credit hour**
- CHEM 4230 - Instrumental Analysis **4 credit hours**
- CHEM 4231 - Instrumental Analysis Lab **0 credit hours**

- CHEM 4380 - Nuclear Magnetic Resonance Experimental Methods **1 credit hour**
- CHEM 4530 - Biochemical Techniques **2 credit hours**
- CHEM 4430 - Advanced Synthetic Laboratory Techniques **3 credit hours**
- CHEM 4431 - Advanced Synthetic Laboratory Techniques Lab **0 credit hours**
- CHEM 4780 - Polymer and Materials Chemistry Laboratory **2 credit hours**

Supporting Courses (20 hours)

- MATH 1730 - Pre-Calculus **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1910 - Calculus I **4 credit hours**
- MATH 1920 - Calculus II **4 credit hours**

- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours (may be counted in the True Blue Core**)

- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Electives (11-21 hours)

- Sufficient upper-division credit must be taken to equal 36 credit hours

Recommended Curriculum: Chemistry, ACS Certified

Freshman

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- MATH 1730 - Pre-Calculus **4 credit hours** (Quant Lit)
- MATH 1910 - Calculus I **4 credit hours**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- History and Civic Learning **6 credit hours**

Subtotal: 28 Hours

Sophomore

- CHEM 2230 - Quantitative Analysis **3 credit hours** AND
- CHEM 2231 - Quantitative Analysis Lab **2 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours**

- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

- MATH 1920 - Calculus II **4 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Elective **3 credit hours**

Subtotal: 31 Hours

Junior

- Non-Written Communication **3 credit hours**
- Human Society and Social Relationships **6 credit hours**
- Elective **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**

- CHEM 3000 - Careers in Chemistry and Biochemistry **1 credit hour**
- CHEM 4400 - Inorganic Chemistry I **3 credit hours**

- CHEM 3530 - Principles of Biochemistry **4 credit hours** AND
- CHEM 3531 - Principles of Biochemistry Lab **0 credit hours**

- CHEM 4350 - Physical Chemistry I **4 credit hours** AND
- CHEM 4351 - Physical Chemistry I Lab **0 credit hours**

- CHEM 4360 - In-depth Physical Chemistry **4 credit hours** AND
- CHEM 4361 - Physical Chemistry II Lab **0 credit hours**

Subtotal: 31 Hours

Senior

Choose 4 hours from:

- CHEM 3880 - Undergraduate Research II **1 to 4 credit hours** OR
- CHEM 3980 - Cooperative Education **1 to 4 credit hours** OR
- CHEM 4880 - Research **4 credit hours**

- Creativity and Cultural Expression **3 credit hours**
- Electives **15 credit hours**
- Upper-division, in-depth CHEM lab elective **7 credit hours**
- CHEM lab elective **1 credit hour**

Subtotal: 30 Hours

NOTE:

Included in the electives will be the hours necessary for the completion of the required 36 upper-division hours for graduation requirements and the necessary hours to satisfy the 120-hour graduation requirement.
NOTE 1: A student who has a sufficiently high score on the ACT Mathematics test may begin with MATH 1910. If the background in math is weak, MATH 1710 should be taken before MATH 1730.
NOTE 2: A student who has had little or no high school chemistry or is not satisfied with his/her high school chemistry should first take CHEM 1010/CHEM 1011 before taking CHEM 1110/CHEM 1111.

Chemistry, B.S.

Department of Chemistry
615-904-8114
Scott Handy, program coordinator
Scott.Handy@mtsu.edu

The Chemistry program includes traditional areas-analytical, biochemistry, organic, inorganic, and physical-as well as computational, polymer, medicinal, and environmental chemistry.

NOTE: 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.

NOTE2: Students who wish to get jobs as chemists are strongly encouraged to take additional upper-division courses (especially CHEM 4230/CHEM 4231), follow the plan for the ACS major, or take more advanced chemistry courses upon graduation.

Academic Map

Following is a printable, suggested four-year schedule of courses:

Chemistry, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**35-41 hours***
Supporting Courses	**20 hours***
Electives	**18-26 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1730 (Quant Lit) *(See Note 1)*
- CHEM 1110/CHEM 1111 (Sci Lit) *(See Note 2)*
- PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111 (Sci Lit)

Major Requirements (35-41 hours)

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CHEM 2230 - Quantitative Analysis **3 credit hours** AND
- CHEM 2231 - Quantitative Analysis Lab **2 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

- CHEM 4330 - Physical Chemistry Fundamentals I **4 credit hours** AND
- CHEM 4331 - Physical Chemistry Fundamentals I Lab **0 credit hours**
  OR
- CHEM 4350 - Physical Chemistry I **4 credit hours** AND
- CHEM 4351 - Physical Chemistry I Lab **0 credit hours**
  AND
- CHEM 4360 - In-depth Physical Chemistry **4 credit hours** AND
- CHEM 4361 - Physical Chemistry II Lab **0 credit hours**

- CHEM 4400 - Inorganic Chemistry I **3 credit hours**

- CHEM 3530 - Principles of Biochemistry **4 credit hours** AND
- CHEM 3531 - Principles of Biochemistry Lab **0 credit hours**
  OR
- CHEM 4500 - Biochemistry I **3 credit hours** AND
- CHEM 4510 - Biochemistry II **3 credit hours**

Upper-Division Chemistry Electives (7 hours)

NOTE: *MTeach minor students may use CHEM 3890, CHEM 4740, and YOED 4050 to fulfill the 7 hours of upper-division electives.*

At least five hours from:

- CHEM 3000 - Careers in Chemistry and Biochemistry **1 credit hour**
- CHEM 3890 - Chemistry Instruction Internship **1 to 3 credit hours**
- CHEM 4000 - Medicinal Chemistry **3 credit hours**
- CHEM 4100 - Organic Spectroscopy **3 credit hours**
- CHEM 4105 - Advanced Organic Chemistry **3 credit hours**
- CHEM 4150 - Bioorganic Chemistry **3 credit hours**
- CHEM 4310 - Modeling Organic and Biological Molecules **3 credit hours**
- CHEM 4410 - Inorganic Chemistry II **3 credit hours**
- CHEM 4520 - Topics in Biochemistry **3 credit hours**
- CHEM 4540 - Foundations of Enzymology **3 credit hours**
- CHEM 4600 - Introduction to Environmental Chemistry **3 credit hours**
- CHEM 4610 - Environmental Chemistry **3 credit hours**
- CHEM 4700 - Polymers, an Introduction **3 credit hours**
- CHEM 4990 - Chemometrics and Statistics for Analytical Chemistry **3 credit hours**

At least two hours from:

- CHEM 3080 - Liquid Chromatography Techniques **1 credit hour**
- CHEM 3090 - Techniques of Gas Chromatography **1 credit hour**
- CHEM 3880 - Undergraduate Research II **1 to 4 credit hours**
- CHEM 4190 - Mass Spectrometry **1 credit hour**
- CHEM 4230 - Instrumental Analysis **4 credit hours**
- CHEM 4231 - Instrumental Analysis Lab **0 credit hours**
- CHEM 4380 - Nuclear Magnetic Resonance Experimental Methods **1 credit hour**
- CHEM 4430 - Advanced Synthetic Laboratory Techniques **3 credit hours**
- CHEM 4431 - Advanced Synthetic Laboratory Techniques Lab **0 credit hours**
- CHEM 4530 - Biochemical Techniques **2 credit hours**
- CHEM 4780 - Polymer and Materials Chemistry Laboratory **2 credit hours**

Supporting Courses (20 hours)

- MATH 1730 - Pre-Calculus **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1910 - Calculus I **4 credit hours**
- MATH 1920 - Calculus II **4 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours**
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours (may be counted in the True Blue Core)**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Electives (18-26 hours)

- Sufficient upper-division credit must be taken to equal 36 credit hours

Curriculum: Chemistry

Freshman Fall

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- MATH 1730 - Pre-Calculus **4 credit hours** (Quant Lit)
- Written Communication **3 credit hours**
- History and Civic Learning **3 credit hours**

Subtotal: 14 Hours

Freshman Spring

- Information Literacy **3 credit hours**
- History and Civic Learning **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 14 Hours

Sophomore Fall

- MATH 1920 - Calculus II **4 credit hours**
- Elective **3 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours** (Sci Lit)

Subtotal: 15 Hours

Sophomore Spring

- Creativity and Cultural Expression Literature **3 credit hours**

- CHEM 2230 - Quantitative Analysis **3 credit hours** AND
- CHEM 2231 - Quantitative Analysis Lab **2 credit hours**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Subtotal: 16 Hours

Junior Fall

- Non-Written Communication **3 credit hours**
- Elective **3 credit hours**
- Human Society and Social Relationships **3 credit hours**

- CHEM 4330 - Physical Chemistry Fundamentals I **4 credit hours** AND
- CHEM 4331 - Physical Chemistry Fundamentals I Lab **0 credit hours**
  OR
- CHEM 4350 - Physical Chemistry I **4 credit hours** AND
- CHEM 4351 - Physical Chemistry I Lab **0 credit hours**
  AND
- CHEM 4360 - In-depth Physical Chemistry **4 credit hours** AND
- CHEM 4361 - Physical Chemistry II Lab **0 credit hours**

- CHEM 3530 - Principles of Biochemistry **4 credit hours** AND
- CHEM 3531 - Principles of Biochemistry Lab **0 credit hours**
  OR
- CHEM 4500 - Biochemistry I **3 credit hours** AND
- CHEM 4510 - Biochemistry II **3 credit hours**

Subtotal: 17 Hours

Junior Spring

- CHEM 4400 - Inorganic Chemistry I **3 credit hours**
- CHEM upper-division elective **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Elective **3 credit hours**

Subtotal: 15 Hours

Senior Fall

- CHEM upper-division elective **2 credit hours**
- Elective **9 credit hours**
- Creativity and Cultural Expression **3 credit hours**

Subtotal: 14 Hours

Senior Spring

- CHEM upper-division elective **2 credit hours**
- Chemistry lab elective **2 credit hours**
- Upper-division electives **8 credit hours**
- Elective **3 credit hours**

Subtotal: 15 Hours

NOTE:

Included in the electives will be the hours necessary for the completion of the required 36 upper-division hours for graduation requirements and the necessary hours to satisfy the 120-hour graduation requirement.
NOTE 1: A student who has a sufficiently high score on the ACT Mathematics test may begin with MATH 1910. If the background in math is weak, MATH 1710 should be taken before MATH 1730.
NOTE 2: A student who has had little or no high school chemistry or is not satisfied with his/her high school chemistry should first take CHEM 1010/CHEM 1011 before taking CHEM 1110/CHEM 1111.

Chemistry, Teacher Licensure (MTeach), B.S.

Department of Chemistry
615-898-2077
Amy Phelps, program coordinator
Amy.Phelps@mtsu.edu

Students seeking a license to teach chemistry in secondary schools (grades 7-12) must complete (1) a major in Chemistry, (2) an MTeach minor, and (3) PSCI 1030/PSCI 1031 in addition to the True Blue Core requirements. Students must contact their Secondary Education Minor-MTeach advisors for approval of appropriate courses and more information.

NOTE: 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.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Chemistry, Teacher Licensure (MTeach), B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**36-42 hours***
Supporting Courses	**24-28 hours***
Secondary Education Minor (MTeach)	**30 hours**
TOTAL	**124-135 hours**

***This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 124 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1730 or MATH 1910 (Quant Lit) *(See Note 1)*
- CHEM 1110/CHEM 1111 (Sci Lit) *(See Note 2)*
- PHYS 2010/PHYS 2011 (Sci Lit)

Major Requirements (36-42 hours)

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**
- CHEM 2230 - Quantitative Analysis **3 credit hours** AND
- CHEM 2231 - Quantitative Analysis Lab **2 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

- CHEM 3530 - Principles of Biochemistry **4 credit hours** AND
- CHEM 3531 - Principles of Biochemistry Lab **0 credit hours**
  OR
- CHEM 4500 - Biochemistry I **3 credit hours** AND
- CHEM 4510 - Biochemistry II **3 credit hours**

- CHEM 4330 - Physical Chemistry Fundamentals I **4 credit hours** AND
- CHEM 4331 - Physical Chemistry Fundamentals I Lab **0 credit hours**
  OR
- CHEM 4350 - Physical Chemistry I **4 credit hours** AND
- CHEM 4351 - Physical Chemistry I Lab **0 credit hours** AND
  AND
- CHEM 4360 - In-depth Physical Chemistry **4 credit hours** AND
- CHEM 4361 - Physical Chemistry II Lab **0 credit hours**

- CHEM 3890 - Chemistry Instruction Internship **1 to 3 credit hours (1 credit hour required)**
- CHEM 4400 - Inorganic Chemistry I **3 credit hours**
- CHEM 4740 - Research Methods **3 credit hours**

Supporting Courses (24-28 hours)

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours**

- PSCI 1030 - Topics in Physical Science **4 credit hours** AND
- PSCI 1031 - Topics in Physical Science Lab **0 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours (may be counted in the True Blue Core)**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

- MATH 1730 - Pre-Calculus **4 credit hours (not required if MATH 1910 completed)**
- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**

Secondary Minor-MTeach (30 hours)

See **Secondary Education Minor-MT** for further information.

Curriculum: Chemistry Teacher Licensure (MTeach)

Freshman

- MSE 1010 - Step 1: Inquiry Approaches to Teaching **1 credit hour**
- MSE 2010 - Step 2: Inquiry Lesson Design **1 credit hour**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Non-Written Communication **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

Subtotal: 31 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **3 credit hours**
- MATH 1920 - Calculus II **4 credit hours**
- YOED 3520 - Knowing and Learning in Science and Mathematics **3 credit hours**
- YOED 3550 - Classroom Interactions in Mathematics and Science **3 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours**

- CHEM 2230 - Quantitative Analysis **3 credit hours** AND
- CHEM 2231 - Quantitative Analysis Lab **2 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

Subtotal: 33 Hours

Junior

- CHEM 3890 - Chemistry Instruction Internship **1 to 3 credit hours** (1 credit hour)
- CHEM 4400 - Inorganic Chemistry I **3 credit hours**
- CHEM 4740 - Research Methods **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression **6 credit hours**
- History and Civic Learning **3 credit hours**
- PHIL 3120 - Perspectives on Science and Math **3 credit hours**

- CHEM 4330 - Physical Chemistry Fundamentals I **4 credit hours** AND
- CHEM 4331 - Physical Chemistry Fundamentals I Lab **0 credit hours**
  OR
- CHEM 4350 - Physical Chemistry I **4 credit hours** AND
- CHEM 4351 - Physical Chemistry I Lab **0 credit hours**
  AND
- CHEM 4360 - In-depth Physical Chemistry **4 credit hours** AND
- CHEM 4361 - Physical Chemistry II Lab **0 credit hours**

- CHEM 3530 - Principles of Biochemistry **4 credit hours** AND
- CHEM 3531 - Principles of Biochemistry Lab **0 credit hours**
  OR
- CHEM 4500 - Biochemistry I **3 credit hours** AND
- CHEM 4510 - Biochemistry II **3 credit hours**

Subtotal: 30 Hours

Senior

- YOED 4040 - Residency I: MTeach **4 credit hours**
- YOED 4050 - Project-Based Instruction in Mathematics and Science **3 credit hours**
- YOED 4400 - Residency II **12 credit hours**
- Elective **0-4 credit hours**
- Human Society and Social Relationships **3 credit hours**

- PSCI 1030 - Topics in Physical Science **4 credit hours** AND
- PSCI 1031 - Topics in Physical Science Lab **0 credit hours**

Subtotal: 30 Hours

NOTE:

Included in the electives will be the hours necessary for the completion of the required 36 upper-division hours for graduation requirements and the necessary hours to satisfy the 120-hour graduation requirement.
NOTE 1: A student who has a sufficiently high score on the ACT Mathematics test may begin with MATH 1910. If the background in math is weak, MATH 1710 should be taken before MATH 1730.
NOTE 2: A student who has had little or no high school chemistry or is not satisfied with his/her high school chemistry should first take CHEM 1010/CHEM 1011 before taking CHEM 1110/CHEM 1111.

Science Minor

Chemistry
Andrienne Friedli
Andrienne.Friedli@mtsu.edu

The minor in Science consists of 24 semester hours acceptable for a minor. Students must choose an area of emphasis (biology, chemistry, or physics) and complete 16 hours in that area and 8 hours in one of the other areas. Specific requirements for each type of emphasis are listed below. At least 4 upper-division hours in a science must be taken at MTSU. A 2.00 GPA is required.

NOTE: 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.

Biology Emphasis (24 hours)

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours**
- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**
- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

4 hour BIOL elective chosen from the following:

- BIOL 2010 - Human Anatomy and Physiology I **4 credit hours** AND
- BIOL 2011 - Human Anatomy and Physiology I Lab **0 credit hours**
  OR
- BIOL 2020 - Human Anatomy and Physiology II **4 credit hours** AND
- BIOL 2021 - Human Anatomy and Physiology II Lab **0 credit hours**
  OR
- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**
  OR
- Upper-division BIOL course **4 credit hours**
  NOTE: Cannot be from BIOL 3000, 3200, 3230, 3890, 4280, 4540, or 4740

Choose 8 hours from the following:

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours**
  AND
- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**
  OR
- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  AND
- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours**
  AND
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND

- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Chemistry Emphasis (24 hours)

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours**
- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Choose 8 hours:

- CHEM electives at the 2000-level or above; at least 4 hours must be chosen at upper-division level
  NOTE: Cannot come from CHEM 2880, 2930, 2940, 3000, 3880, 3890, 3970, 3980, 4740, 4880)

Choose 8 hours from the following:

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours**
  AND
- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**
  OR
- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  AND
- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours**
  AND
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Physics Emphasis (24 hours)

Choose 8 hours from the following:

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours**
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Choose 8 hours:

- PHYS upper-division electives; at least 4 hours must be chosen at upper-division level.
  NOTE: Cannot come from PHYS 3800, 3900, 3930, 4740, 4850, 4860, 4900

Choose 8 hours from the following:

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** AND
- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours** OR
- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours** AND
- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

Science, Allied Health Science Concentration, B.S.

Chemistry
Andrienne Friedli, program coordinator
Andrienne.Friedli@mtsu.edu
Eric Miller, advisor
615-494-8894
EricB.Miller@mtsu.edu

The Allied Health Science concentration is designed for students who expect to enter a professional school for cytotechnology, chiropractic medicine, pharmacy, or medical laboratory science. It may also be used for students interested in dentistry, medicine, occupational therapy, or physical therapy. However, students interested in these areas should speak to their advisors about other major options better suited to their needs.

For some programs, this concentration leads to an MTSU degree through completion of at least 90 credit hours at MTSU, acceptance into a professional school, and either successful completion of one year or completion of the professional program (3+1). A four-year option is available and encouraged for students considering certain programs. For students completing a 3+1 program, a minimum of 21 semester hours of junior and senior (3000- 4000 level) courses must be completed at MTSU. Students choosing a four-year option must complete at least 36 credit hours of junior and senior (3000-4000 level) courses with an average grade of C (2.00 GPA) or better. With approval of the dean of the college, a student may complete 12 of the last 30 hours at another college or university or by CLEP.

Admission to the MTSU pre-professional program does not assure admission to a professional program. Selection for admission is competitive and is made by the admissions committee of the respective program according to its selection standards.

NOTE: 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.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Science, Allied Health Science, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**44 hours***
Supporting Courses	**20-21 hours***
Electives	**14-25 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1730 (Quant Lit) *(See Note 1)*
- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1110/CHEM 1111 (Sci Lit) *(See Note 2)*

Major Requirements (44 hours)

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

- CHEM 3530 - Principles of Biochemistry **4 credit hours** AND
- CHEM 3531 - Principles of Biochemistry Lab **0 credit hours**
  OR
- CHEM 4500 - Biochemistry I **3 credit hours** AND
- CHEM 4510 - Biochemistry II **3 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- BIOL 4300 - Immunology **4 credit hours** AND
- BIOL 4301 - Immunology Lab **0 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

Supporting Courses (20-21 hours)

- MATH 1530 - Applied Statistics **3 credit hours**
- MATH 1730 - Pre-Calculus **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**

- BIOL 2010 - Human Anatomy and Physiology I **4 credit hours** AND
- BIOL 2011 - Human Anatomy and Physiology I Lab **0 credit hours**
OR
- BIOL 4110 - General Physiology **4 credit hours** AND
- BIOL 4111 - General Physiology Lab **0 credit hours**

- BIOL 2020 - Human Anatomy and Physiology II **4 credit hours** AND
- BIOL 2021 - Human Anatomy and Physiology II Lab **0 credit hours**
OR
- BIOL 3340 - Human Pathophysiology **3 credit hours**

- MATH 1910 - Calculus I **4 credit hours** OR
- Pre-professional-approved elective **3 credit hours**

- BIOL 2000 - Orientation to the Medical Lab **2 credit hours** AND
- BIOL 2001 - Orientation to the Medical Lab Field Experience Lab **0 credit hours**
OR
- Pre-professional-approved elective **3 credit hours**

General/Upper Division Electives (14-25 hours)

- See advisor for recommendations

Curriculum: Science, Allied Health Science

Freshman Fall

- Written Communication **3 credit hours**
- MATH 1730 - Pre-Calculus **4 credit hours** (Quant Lit)

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

Subtotal: 15 Hours

Freshman Spring

- Information Literacy **3 credit hours**
- Human Society and Social Relationships **3 credit hours**

- MATH 1910 - Calculus I **4 credit hours** OR
- Pre-professional-approved elective **3 credit hours**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 14-15 Hours

Sophomore Fall

- Creativity and Cultural Expression Literature **3 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- BIOL 2000 - Orientation to the Medical Lab **2 credit hours** AND
- BIOL 2001 - Orientation to the Medical Lab Field Experience Lab **0 credit hours** OR
- Pre-professional approved elective **3 credit hours**

Subtotal: 17-18 Hours

Sophomore Spring

- Non-Written Communication **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **3 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

Subtotal: 17 Hours

Junior Fall

- BIOL 4110 - General Physiology **4 credit hours** AND
- BIOL 4111 - General Physiology Lab **0 credit hours**
  OR
- BIOL 2010 - Human Anatomy and Physiology I **4 credit hours** AND
- BIOL 2011 - Human Anatomy and Physiology I Lab **0 credit hours**

- CHEM 3530 - Principles of Biochemistry **4 credit hours** AND
- CHEM 3531 - Principles of Biochemistry Lab **0 credit hours**
  OR
- CHEM 4500 - Biochemistry I **3 credit hours**

- MATH 1530 - Applied Statistics **3 credit hours**
- History and Civic Learning **3 credit hours**
- Human Society and Social Relationships or pre-professional elective **3 credit hours**

Subtotal: 16-17 Hours

Junior Spring

- BIOL 3340 - Human Pathophysiology **3 credit hours**
  OR
- BIOL 2020 - Human Anatomy and Physiology II **4 credit hours** AND
- BIOL 2021 - Human Anatomy and Physiology II Lab **0 credit hours**

- BIOL 4300 - Immunology **4 credit hours** AND
- BIOL 4301 - Immunology Lab **0 credit hours**

- CHEM 4510 - Biochemistry II **3 credit hours** OR
- Pre-professional approved elective **3 credit hours**

- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours (if needed)**

Subtotal: 16-17 Hours

Senior Fall and Spring

- 3+1 students will earn the B.S. degree after completion of their professional program. Four-year students will need to complete an appropriate number of upper-division and elective credit to earn degree. See advisor for details.

NOTE:

Included in the electives will be the hours necessary for the completion of the required 36 upper-division hours for graduation requirements and the necessary hours to satisfy the 120-hour graduation requirement.
NOTE 1: A student who has a sufficiently high score on the ACT Mathematics test may begin with MATH 1910. If the background in math is weak, MATH 1710 should be taken before MATH 1730.
NOTE 2: A student who has had little or no high school chemistry or is not satisfied with his/her high school chemistry should first take CHEM 1010/CHEM 1011 before taking CHEM 1110/CHEM 1111.

Science, Allied Health Technology Concentration, B.S.

Chemistry
Andrienne Friedli, program coordinator
Andrienne.Friedli@mtsu.edu
Eric Miller, advisor
615-494-8894
EricB.Miller@mtsu.edu

The Allied Health Technology concentration is designed for students who expect to enter a professional school for diagnostic medical sonography, nuclear medicine technology, or radiation therapy technology after completing an appropriate pre-professional curriculum.

This concentration leads to an MTSU degree through completion of 120 credit hours at MTSU, or completion of at least 90 course hours, acceptance into a professional school, and successful completion of the professional program (3+1). At least 36 credit hours of junior and senior (3000-4000 level) courses must be completed with an average grade of C (2.00 GPA) or better. With approval of the dean of the college, a student may complete 12 of the last 30 hours at another college or university or by CLEP. For students completing a 3+1 program, a minimum of 21 semester hours of junior and senior (3000-4000 level) courses must be completed at MTSU.

Admission to the MTSU pre-professional program does not assure admission to a professional program. Selection for admission is competitive and is made by the admissions committee of the respective program according to its selection standards.

NOTE: 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.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Science, Allied Health Technology, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**37 hours***
Supporting Courses	**24 hours***
Electives	**18-29 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1730 (Quant Lit)
- BIOL 2010/BIOL 2011 (Sci Lit)
- CHEM 1110/CHEM 1111(Sci Lit) *(See Note 2)*

Major Requirements (37 Hours)

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- PSCI 4080 - Problems in Physical Science **4 credit hours**

- BIOL 2010 - Human Anatomy and Physiology I **4 credit hours** AND
- BIOL 2011 - Human Anatomy and Physiology I Lab **0 credit hours (may be counted in the True Blue Core)**

- BIOL 2020 - Human Anatomy and Physiology II **4 credit hours** AND
- BIOL 2021 - Human Anatomy and Physiology II Lab **0 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3150 - Radiation Biology **3 credit hours**
- BIOL 3340 - Human Pathophysiology **3 credit hours**
- BIOL 3350 - Principles of Radiation in Medicine **3 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

Supporting Courses (24 hours)

- NFS 1240 - Introduction to Nutrition and Wellness **3 credit hours**
- MATH 1530 - Applied Statistics **3 credit hours**

- HUM 2130 - Medical Vocabulary **3 credit hours** OR
- HLTH 3020 - Terminology in Health and Human Performance **3 credit hours**

- HLTH 3300 - First Aid and Safety Education **3 credit hours**
- HLTH 4270 - Bioethical Issues in Public Health **3 credit hours**
- HLTH 4280 - Instructor's Course in First Aid and CPR **2 credit hours**
- COMM 2300 - Interpersonal Communication **3 credit hours**
- MATH 1730 - Pre-Calculus **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**

General/Upper Division Electives (18-29 hours)

See advisor for recommendations

Curriculum: Science, Allied Health Technology

Freshman Fall

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- BIOL 2010 - Human Anatomy and Physiology I **4 credit hours** AND
- BIOL 2011 - Human Anatomy and Physiology I Lab **0 credit hours** (Sci Lit)

- MATH 1730 - Pre-Calculus **4 credit hours** (Quant Lit)
- Written Communication **3 credit hours**

Subtotal: 15 Hours

Freshman Spring

- BIOL 2020 - Human Anatomy and Physiology II **4 credit hours** AND
- BIOL 2021 - Human Anatomy and Physiology II Lab **0 credit hours**

- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours (for pre-nuclear medicine students only)**

Subtotal: 13-17 Hours

Sophomore Fall

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- Creativity and Cultural Expression Literature **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Non-Written Communication **3 credit hours**

Subtotal: 17 Hours

Sophomore Spring

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

- HUM 2130 - Medical Vocabulary **3 credit hours** OR
- HLTH 3020 - Terminology in Health and Human Performance **3 credit hours**

- HLTH 3300 - First Aid and Safety Education **3 credit hours**
- History and Civic Learning **3 credit hours**
- Human Society and Social Relationships **3 credit hours**

Subtotal: 16 Hours

Junior Fall

- BIOL 3150 - Radiation Biology **3 credit hours**
- PSCI 4080 - Problems in Physical Science **4 credit hours**
- MATH 1530 - Applied Statistics **3 credit hours**
- NFS 1240 - Introduction to Nutrition and Wellness **3 credit hours**
- HLTH 4280 - Instructor's Course in First Aid and CPR **2 credit hours**

Subtotal: 15 Hours

Junior Spring

- BIOL 3350 - Principles of Radiation in Medicine **3 credit hours**
- BIOL 3340 - Human Pathophysiology **3 credit hours**
- HLTH 4270 - Bioethical Issues in Public Health **3 credit hours**
- COMM 2300 - Interpersonal Communication **3 credit hours (unless Nuclear Medicine)**
- History and Civic Learning **3 credit hours**

Subtotal: 15 Hours

Senior Fall

3+1 students will earn the B.S. degree after completion of their professional program. Four-year students will need to complete an appropriate number of upper-division and elective credit to earn degree. See advisor for details.

NOTE:

Included in the electives will be the hours necessary for the completion of the required 36 upper-division hours for graduation requirements and the necessary hours to satisfy the 120-hour graduation requirement.
NOTE 1: A student who has a sufficiently high score on the ACT Mathematics test may begin with MATH 1910. If the background in math is weak, MATH 1710 should be taken before MATH 1730.
NOTE 2: A student who has had little or no high school chemistry or is not satisfied with his/her high school chemistry should first take CHEM 1010/CHEM 1011 before taking CHEM 1110/CHEM 1111.

Science, General Science Concentration with Teacher Licensure, B.S.

Chemistry
Amy Phelps
615-898-2077
Amy.Phelps@mtsu.edu

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 19 hours of coursework has been taken in each of two of three areas of chemistry, biology, or physics; (2) courses in addition to the True Blue Core requirements (see advisor); and (3) a minor in Secondary Education through MTeach.

A minimum of 9 semester hours of upper-division courses in any discipline of the Science major (biology, chemistry, or physics) 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.

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).

NOTE: 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.

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**47-48 hours***
Supporting Courses	**8 hours***
Secondary Education Minor	**30 hours**
Electives	**2-5 hours**
TOTAL	**120-129 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1730 (Quant Lit) *(See Note 1)*
- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1110/CHEM 1111 (Sci Lit) *(See Note 2)*

Major Requirements (47-48 hours)

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

Emphasis Areas (23-24 hours)

- Selected from the designated areas of biology, chemistry, and physics

Supporting Courses (8 hours)

- MATH 1730 - Pre-Calculus **4 credit hours** OR
- MATH 1910 - Calculus I **4 credit hours** OR
- MATH 1920 - Calculus II **4 credit hours**
  OR
- MATH 1710 - College Algebra **3 credit hours** AND
- MATH 1720 - Plane Trigonometry **3 credit hours (may be counted in the True Blue Core)**

- PSCI 1030 - Topics in Physical Science **4 credit hours** AND
- PSCI 1031 - Topics in Physical Science Lab **0 credit hours**

Secondary Minor-MTeach (30 hours)

See **Secondary Education Minor-MTeach** for further information.

Electives (2-5 hours)

- Sufficient upper-division credit hours must be taken to equal 36 credit hours

Curriculum: Science, General Science with Teacher Licensure

Freshman

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- MATH 1730 - Pre-Calculus **4 credit hours** (Quant Lit) OR
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Elective/Sec. Ed. Minor **4 credit hours**

Subtotal: 30 Hours

Sophomore

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours**
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

- Science major electives **8 credit hours**
- Electives/Secondary Education Minor **11 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**

Subtotal: 30 Hours

Junior

- CHEM 3890 - Chemistry Instruction Internship **1 to 3 credit hours (1 credit hour required)**
- Science major electives **8 credit hours**
- Electives/Secondary Education Minor **9 credit hours**
- Non-Written Communication **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **6 credit hours**

Subtotal: 30 Hours

Senior

- Science major electives **6 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Electives/Secondary Education Minor **15 credit hours**
- Human Society and Social Relationships **6 credit hours**

Subtotal: 30 Hours

Total hours in program: 120

NOTE:

Please see Secondary Education Minor-MTeach for more information.

NOTE:

Included in the electives will be the hours necessary for the completion of the required 36 upper-division hours for graduation requirements and the necessary hours to satisfy the 120-hour graduation requirement.
NOTE 1: A student who has a sufficiently high score on the ACT Mathematics test may begin with MATH 1910. If the background in math is weak, MATH 1710 should be taken before MATH 1730.
NOTE 2: A student who has had little or no high school chemistry or is not satisfied with his/her high school chemistry should first take CHEM 1010/CHEM 1011 before taking CHEM 1110/CHEM 1111.

Science, General Science Concentration, B.S.

Department of Chemistry
615-898-5085
Patricia Patterson, program coordinator
Patricia.Patterson@mtsu.edu

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. A minimum of 12 semester hours of upper-division courses in 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.

NOTE: 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.

Academic Maps

Following are printable, suggested four-year schedules of courses:

Science, General Science (Biology Chemistry), B.S., Academic Map
Science, General Science (Biology Physics), B.S., Academic Map
Science, General Science (Chemistry Physics), B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**46 hours***
Supporting Course	**4 hours***
Minor	**15-18 hours**
Electives	**11-25 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1730 (Quant Lit) *(See Note 1)*
- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1110/CHEM 1111 (Sci Lit) *(See Note 2)*

Major Requirements (46 hours)

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

Emphasis Areas (22 hours)

- Selected from the designated areas of biology, chemistry, and physics; at least 9 credit hours must be 3000/4000 level courses.

Supporting Course (4 hours)

- MATH 1730 - Pre-Calculus **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**

Minor (15-18 hours)

Electives (11-25 hours)

- Sufficient upper-division credit hours must be taken to equal 36 credit hours

Curriculum: Science, General Science

Freshman

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- MATH 1730 - Pre-Calculus **4 credit hours** (Quant Lit)
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Elective **1 credit hour**
- Creativity and Cultural Expression **3 credit hours**

Subtotal: 30 Hours

Sophomore

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

- Science major electives **8 credit hours**
- Non-Written Communication **3 credit hours**
- Minor **6 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**

Subtotal: 28 Hours

Junior

- History and Civic Learning **6 credit hours**
- Science major electives **8 credit hours**
- Minor **6 credit hours**
- Human Society and Social Relationships **6 credit hours**
- Electives (upper division) **6 credit hours**

Subtotal: 32 Hours

Senior

- Science major electives **6 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Minor **3 credit hours**
- Minor or elective (upper division) **3 credit hours**
- Electives (upper division) **12 credit hours**
- Elective **3 credit hours**

Subtotal: 30 Hours

NOTE:

Included in the electives will be the hours necessary for the completion of the required 36 upper-division hours for graduation requirements and the necessary hours to satisfy the 120-hour graduation requirement.
NOTE 1: A student who has a sufficiently high score on the ACT Mathematics test may begin with MATH 1910. If the background in math is weak, MATH 1710 should be taken before MATH 1730.
NOTE 2: A student who has had little or no high school chemistry or is not satisfied with his/her high school chemistry should first take CHEM 1010/CHEM 1011 before taking CHEM 1110/CHEM 1111.

Science, Medical School Early Acceptance Program, B.S.

Chemistry
Andrienne Friedli, program coordinator
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Eric Miller, advisor
615-494-8894
EricB.Miller@mtsu.edu

The Medical School Early Acceptance Program (MSEAP) is a unique collaboration between MTSU and Meharry Medical College. The purpose of the program is to address the shortage of primary care physicians in the United States and especially the state of Tennessee by providing highly qualified students an enriched undergraduate experience in preparation for medical school. Admission into this program is highly competitive. Designed for individuals who have a clear career focus prior to entering college, the program allows students to complete both a Bachelor of Science degree and a Doctor of Medicine degree in seven years. This program is an accelerated program; the expectation is for students to spend three years as an undergraduate and an additional four years in medical school at Meharry. After successful completion of the prerequisite requirements, the program assures highly motivated undergraduates admission to Meharry Medical College.

NOTE: 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.

Application, Admissions, and Student Commitment and Responsibilities

See www.mtsu.edu/cbas/meharry-app.php for information regarding admission, application, and student commitment and responsibilities.

Summer Prior to First Year

Pre-Med Bridge Program is a two-week summer academic enrichment program which gives admitted MSEAP students a head start on their college education. This program supplies MSEAP students the best opportunity to succeed in this challenging joint program by combining an intensive personalized academic experience with structured one-on-one learning support to prepare students with the foundational tools necessary to achieve success in the MSEAP.

Academic Map

Science, Medical School Early Acceptance Program, Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**40 hours***
Supporting Courses	**19 hours***
Pre-Med Electives	**12 hours**
Electives	**8-19 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- BIOL 1110/BIOL 1111 (Sci Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)
- PSY 1410 (HSSR) and SOC 1010 (HSSR) recommended

Major Requirements (40 hours)

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours (may be counted in the True Blue Core)**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

Supporting Courses (19 hours)

- BIOL 3200 - Internship in Biology **2 to 4 credit hours**
- CHEM 3980 - Cooperative Education **1 to 4 credit hours**
- CHEM 4500 - Biochemistry I **3 credit hours**
- CHEM 4510 - Biochemistry II **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**

- HETH 4110 - Trends and Issues in Healthcare **3 credit hours** OR
- PHIL 3345 - Bioethics **3 credit hours** OR
- SOC 4040 - Health Care Delivery Issues **3 credit hours** OR
- SOC 4360 - Medical Sociology **3 credit hours**

Pre-Medical Electives (12 hours)

See advisor for recommendations.

Electives (8-19 hours)

Curriculum: Science, Medical School Early Acceptance Program

Freshman Fall

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- Written Communication **3 credit hours**
- Non-Written Communication **3 credit hours**
- Human Society and Social Relationships **3 credit hours**

Subtotal: 17 Hours

Freshman Spring

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- Information Literacy **3 credit hours**

Subtotal: 15 Hours

Sophomore Fall

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- BIOL 3250 - Genetics **4 credit hours** AND
- BIOL 3251 - Genetics Lab **0 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- Creativity and Cultural Expression Literature **3 credit hours**

Subtotal: 15 Hours

Sophomore Spring

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

- Creativity and Cultural Expression **3 credit hours**

Subtotal: 15 Hours

Junior Fall

- CHEM 4500 - Biochemistry I **3 credit hours**
- Pre-medical electives **8 credit hours**
- Human Society and Social Relationships **3 credit hours**
- History and Civic Learning **3 credit hours**

Subtotal: 17 Hours

Junior Spring

- CHEM 4510 - Biochemistry II **3 credit hours**
- Pre-medical elective **4 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **3 credit hours**
- PHIL 3345 - Bioethics **3 credit hours**

Subtotal: 16 Hours

Chemistry

CHEM 1000 - Freshman Seminar in Chemical Sciences
1 credit hour Introduces the fields of chemistry and biochemistry, including an overview of career paths, strategies for success in the major, and current areas of active research. Also covers introduction to scientific literature, institutional resources, and enrichment opportunities such as undergraduate research.

CHEM 1010 - Introductory General Chemistry I
4 credit hours
Corequisite: CHEM 1011. For students with no prior courses in chemistry; to be taken before CHEM 1110/CHEM 1111. 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. TBR Common Course: CHEM 1010
TBC: Scientific Literacy (Discovery)

CHEM 1011 - Intro to General Chemistry I Lab
0 credit hours Corequisite: CHEM 1010. TBR Common Course: CHEM 1011

CHEM 1020 - Introductory General Chemistry II
4 credit hours Prerequisite: CHEM 1010/CHEM 1011. Corequisite: CHEM 1021 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. TBR Common Course: CHEM 1020

CHEM 1021 - Intro to General Chemistry II Lab
0 credit hours Corequisite: CHEM 1020. TBR Common Course: CHEM 1021

CHEM 1030 - Chemistry for Consumers
4 credit hours
Corequisite: CHEM 1031. 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 nonscience majors. Three hours lecture and one two-hour laboratory. (Does not count toward any major or minor.)
TBC: Scientific Literacy (Discovery)

CHEM 1031 - Chemistry for Consumers Lab
0 credit hours Corequisite: CHEM 1030.

CHEM 1110 - General Chemistry I
4 credit hours
Prerequisites: High school chemistry and MATH 1710 with grade of C (2.0) or better or MATH ACT score of 19 or higher or CHEM 1010 with grade of C (2.0) or better. Corequisite: CHEM 1111. 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. TBR Common Course: CHEM 1110.
TBC: Scientific Literacy (Discovery)

CHEM 1111 - General Chemistry I Lab
0 credit hours Corequisite: CHEM 1110. TBR Common Course: CHEM 1111

CHEM 1120 - General Chemistry II
4 credit hours Prerequisite: C- or better in CHEM 1110/CHEM 1111. Corequisite: CHEM 1121. 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. TBR Common Course: CHEM 1120

CHEM 1121 - General Chemistry II Lab
0 credit hours Corequisite: CHEM 1120.TBR Common Course: CHEM 1121

CHEM 2030 - Elements of Organic Chemistry
4 credit hours Prerequisite: CHEM 1020/CHEM 1021 or CHEM 1120/CHEM 1121. Corequisite: CHEM 2031. Aspects of organic chemistry fundamental to an understanding of reactions in living organisms. Three hours lecture and one three-hour laboratory.

CHEM 2031 - Elements of Organic Chemistry Lab
0 credit hours Corequisite: CHEM 2030.

CHEM 2230 - Quantitative Analysis
3 credit hours Prerequisites: CHEM 1120/CHEM 1121 with minimum grade of C- (or equivalent course). Corequisite: CHEM 2231 recommended but not required. Gravimetric, volumetric, optical, and electrochemical analysis with examples from clinical chemistry, water pollution chemistry, occupational health and safety, and industrial chemistry. Three hours lecture.

CHEM 2231 - Quantitative Analysis Lab
2 credit hours Prerequisite: Minimum grade of C- in CHEM 1120 or equivalent course. Corequisite: CHEM 2230 recommended, but not required. Laboratory course in classical wet chemical analysis; two three-hour laboratory periods per week.

CHEM 2880 - Undergraduate Research I
1 to 4 credit hours 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.

CHEM 3000 - Careers in Chemistry and Biochemistry
1 credit hour Prerequisite: CHEM 2030 or CHEM 3010. Communicating science, taking standardized tests, applying for graduate/professional school or a job, using library and online resources, and other professional skills. Capstone course. One-hour lecture. *Offered each spring.*

CHEM 3010 - Organic Chemistry I
3 credit hours Prerequisite: CHEM 1120/CHEM 1121 or equivalent with grade of C- or better. Corequisite: CHEM 3011. Types of carbon compounds, their nomenclature, reactions, and physical properties. Three hours lecture per week.

CHEM 3011 - Organic Chemistry I Lab
1 credit hour Corequisite: CHEM 3010. Laboratory course introducing techniques in organic chemistry, including spectroscopy. One three hour laboratory.

CHEM 3020 - Organic Chemistry II
3 credit hours Prerequisite: CHEM 3010/CHEM 3011 with grade of C- or better. Corequisite: CHEM 3021. A continuation of CHEM 3010. Three hours lecture per week.

CHEM 3021 - Organic Chemistry II Lab
1 credit hour Corequisite: CHEM 3020. Laboratory course focusing more on reactions and synthesis in organic chemistry. One three-hour laboratory.

CHEM 3080 - Liquid Chromatography Techniques
1 credit hour Prerequisite: CHEM 2230 / CHEM 2231 or consent of instructor. Techniques involving the use of liquid, column, paper, thin-layer, and ion-exchange chromatography for the purpose of purifying and/or separating compounds.

CHEM 3090 - Techniques of Gas Chromatography
1 credit hour Principles, techniques, and applications of gas chromatography. Selection of column materials, packing of columns, and types of detectors. Separation of mixtures of hydrocarbons, drugs, and pesticides.

CHEM 3530 - Principles of Biochemistry
4 credit hours Prerequisite: CHEM 2030/CHEM 2031 or CHEM 3010/CHEM 3011. Corequisite: CHEM 3531. Structure, properties, and functions of carbohydrates, lipids, proteins, and nucleic acids and their reactions in living organisms. Three-hour lecture and one three-hour lab. Does not count toward Biochemistry major.

CHEM 3531 - Principles of Biochemistry Lab
0 credit hours Corequisite: CHEM 3530. Lab to accompany CHEM 3530. One three-hour laboratory per week.

CHEM 3570 - Nutritional Biochemistry
3 credit hours Prerequisite: CHEM 2030/CHEM 2031 or CHEM 3010/CHEM 3011. Biochemistry of carbohydrates, lipids, proteins, nucleic acids, vitamins, and minerals with an emphasis on metabolism and human nutrition. Three-hour lecture.

CHEM 3850 - Environmental Field and Laboratory Methods
3 credit hours Prerequisite: CHEM 1120/CHEM 1121; sophomore or higher level. Provides students with the practical tools necessary to evaluate an environmental question, develop an investigative plan, carry out the sampling and analysis from environmental matrices, and evaluate and present the results. A hands-on laboratory and field-based course. Students will learn how to collect, preserve, and analyze samples commonly measured for environmental assessment.

CHEM 3880 - Undergraduate Research II
1 to 4 credit hours Prerequisite: Permission of instructor; CHEM 2230 recommended. 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 12 credits.

CHEM 3890 - Chemistry Instruction Internship
1 to 3 credit hours 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 and one hour will count toward a major in Chemistry. May be repeated for a total of three credits.

CHEM 3980 - Cooperative Education
1 to 4 credit hours Provides students with opportunities for on-the-job training or other off-campus research experiences in conjunction with on-campus academic experiences. A final presentation or manuscript is expected. Department chair should be consulted. Pass/Fail.

CHEM 4000 - Medicinal Chemistry
3 credit hours Prerequisites: CHEM 3010/CHEM 3011 and CHEM 3020/CHEM 3021 or CHEM 2030/CHEM 2031 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.

CHEM 4100 - Organic Spectroscopy
3 credit hours Prerequisite: CHEM 3020/CHEM 3021. Theory of and practice in the interpretation of mass, infrared, Raman, ultraviolet-visible, and nuclear magnetic resonance spectra. Lecture with accompanying lab exercises.

CHEM 4105 - Advanced Organic Chemistry
3 credit hours Prerequisite: CHEM 3020 with a grade of C (2.0) or better. A more in-depth survey of organic chemistry with an emphasis on modern reagents for oxidation and reduction, transition-metal catalysis, protecting group chemistry, and asymmetric synthesis. Application to synthesis will be central.

CHEM 4110 - Topics in Organic Chemistry
3 credit hours Prerequisite: Permission of instructor. Lectures, readings, and discussions of topics of current interest in chemistry. Lecture only. May be repeated for credit with a different topic (maximum of 6 hours).

CHEM 4125 - Forensic Chemistry
4 credit hours Prerequisites: CHEM 2230/CHEM 2231 and either CHEM 2030/CHEM 2031 or CHEM 3010 CHEM 3011 all with a grade of C- (1.67) or better. Corequisite: CHEM 4126. It is assumed that students have a solid grasp of college-level math including algebra. Chemistry of forensic substances such as paint, combustion and arson, color and colorants, glass, controlled drug substances, and fibers. Three hours lecture and one three-hour lab per week.

CHEM 4126 - Forensic Chemistry Laboratory
0 credit hours Prerequisite: CHEM 2030/CHEM 2031, CHEM 2230/CHEM 2231, and CHEM 3020 CHEM 3021 all with a grade of C- (1.67) or better. It is assumed that students have a solid grasp of college-level math including algebra. Corequisite: CHEM 4125. Experiments about the chemistry of forensic substances such as paint, combustion and arson, color and colorants, glass, controlled drug substances, and fibers.

CHEM 4150 - Bioorganic Chemistry
3 credit hours Prerequisites: CHEM 3010/ CHEM 3011 and CHEM 3020/ CHEM 3021 or CHEM 2030/ CHEM 2031 with permission of the instructor. Focuses on the structure and function of bioorganic molecules (i.e., peptides, proteins, nucleic acids, carbohydrates, and peptidomimetics), similarities between enzymatic reactions and bench-top organic reactions, and the techniques and instrumentation used to study bioorganic molecules.

CHEM 4190 - Mass Spectrometry
1 credit hour Prerequisite: CHEM 2230/CHEM 2231, CHEM 4550/CHEM 4551, 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.

CHEM 4230 - Instrumental Analysis
4 credit hours (Same as FSCH 4230.) Prerequisite: CHEM 2230/CHEM 2231, or CHEM 4550/CHEM 4551 with instructor permission. Corequisite: CHEM 4231. 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.

CHEM 4231 - Instrumental Analysis Lab
0 credit hours (Same as FSCH 4231.) Corequisite: CHEM 4230.

CHEM 4310 - Modeling Organic and Biological Molecules
3 credit hours Prerequisites: CHEM 3010/CHEM 3011 and CHEM 3020/CHEM 3021 or permission of instructor. Basic concepts of molecular modeling and utilization of corresponding visualization and computation software tools with applications to organic and biological molecules.

CHEM 4330 - Physical Chemistry Fundamentals I
4 credit hours Prerequisites: MATH 1910 and PHYS 2020/PHYS 2021. Corequisite: CHEM 4331. 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.

CHEM 4331 - Physical Chemistry Fundamentals I Lab
0 credit hours Corequisite: CHEM 4330.

CHEM 4340 - Physical Chemistry Fundamentals II
4 credit hours Prerequisite: CHEM 4330/CHEM 4331. A continuation of CHEM 4330/CHEM 4331. Corequisite: CHEM 4341. Three hours lecture and one three-hour laboratory.

CHEM 4341 - Physical Chemistry Fundamentals II Lab
0 credit hours Corequisite: CHEM 4340.

CHEM 4350 - Physical Chemistry I
4 credit hours Prerequisites: CHEM 2230/CHEM 2231; MATH 1920; PHYS 2020/PHYS 2021 or PHYS 2120/PHYS 2121. Corequisite: CHEM 4351. 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.

CHEM 4351 - Physical Chemistry I Lab
0 credit hours Corequisite: CHEM 4350.

CHEM 4360 - In-depth Physical Chemistry
4 credit hours Prerequisite: CHEM 4350/CHEM 4351. Corequisite: CHEM 4361. A molecular approach to traditional physical chemistry. Concepts and theorems of classical thermodynamics revisited on the basis of quantum and statistical mechanics applied to simple molecular models. Necessary mathematical apparatus discussed in sufficient detail, but only at applied level. Laboratory session provides hands-on experience with quantum-chemistry computational software to predict thermochemical and spectroscopic properties of molecules. Three hours lecture and one three-hour laboratories. Offered every spring.

CHEM 4361 - Physical Chemistry II Lab
0 credit hours Corequisite: CHEM 4360.

CHEM 4380 - Nuclear Magnetic Resonance Experimental Methods
1 credit hour Prerequisite: CHEM 3020/CHEM 3021 or CHEM 2030/CHEM 2031. NMR measurements, operation of the spectrometer, and evaluation of the quality of spectra produced.

CHEM 4400 - Inorganic Chemistry I
3 credit hours Prerequisites: CHEM 1120 or equivalent; CHEM 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. Chemistry of ions of the elements as it takes place in water, in solid-state salts, and in complexes, along with the chemistry of a selection of representative inorganic and organometallic molecules.

CHEM 4410 - Inorganic Chemistry II
3 credit hours Prerequisites: CHEM 3010 and CHEM 4400; corequisite: CHEM 4360/CHEM 4361 recommended. Atomic theory for chemical periodicity; symmetry and group theory; molecular orbital theory; coordination, organometallics.

CHEM 4430 - Advanced Synthetic Laboratory Techniques
3 credit hours Prerequisite: CHEM 3020/CHEM 3021. Corequisite: CHEM 4431. Techniques for synthesis and purification of organic and organometallic compounds. Practice compound characterization (NMR, IR, MS, XRD). Develop skills in database searches, data analysis, and scientific writing. Six hours laboratory and one-hour lecture.

CHEM 4431 - Advanced Synthetic Laboratory Techniques Lab
0 credit hours Corequisite: CHEM 4430.

CHEM 4500 - Biochemistry I
3 credit hours Prerequisite/corequisite: CHEM 3020/CHEM 3021; not open to those who have had CHEM 3530/CHEM 3531. Chemical properties of biological molecules such as amino acids, proteins, enzymes, and carbohydrates. Chemical basis of enzyme catalysis and reactions of carbohydrate metabolism. Three hours lecture per week.

CHEM 4510 - Biochemistry II
3 credit hours Prerequisite: CHEM 4500. Structure and metabolism of lipids, amino acids, nucleotides, and nucleic acids at the molecular level. Emphasis on chemistry of metabolic reactions. Three hours lecture per week.

CHEM 4520 - Topics in Biochemistry
3 credit hours Prerequisite: CHEM 3530 or CHEM 4500 or permission of instructor. Lectures, readings, and discussions of topics of current interest in biochemistry. Three hours lecture.

CHEM 4530 - Biochemical Techniques
2 credit hours Prerequisite/corequisite: CHEM 4500 or consent of instructor. Theoretical principles and laboratory experience underlying common biochemical analytical techniques including spectrophotometry, column chromatography, electrophoresis, enzyme kinetics, gas chromatography/mass spectrometry, structural analysis of carbohydrates and lipids, and manipulation of DNA. One hour lecture and three hours of laboratory per week.

CHEM 4540 - Foundations of Enzymology
3 credit hours Prerequisites: CHEM 3530/CHEM 3531 or CHEM 4500 with a grade of C- or better. Structure, function, and properties of protein- and ribonucleic acid-based enzymes. Chemical basis for catalysis and the methods used to study enzymes. Examples drawn from the literature to illustrate application of course material to disease.

CHEM 4550 - Bioanalytical Chemistry
4 credit hours Prerequisite: CHEM 2030 /CHEM 2031 or CHEM 3020/ CHEM 3021; corequisite: CHEM 4551 . Survey of basic quantitative, qualitative, and purification methods with specific emphasis on molecules of interest to biochemistry. Three hours lecture and one three-hour lab per week.

CHEM 4551 - Bioanalytical Chemistry Lab
0 credit hours Corequisite: CHEM 4550. Laboratory to accompany CHEM 4550. One three-hour laboratory per week.

CHEM 4560 - Nucleic Acids Chemistry
3 credit hours Prerequisite: CHEM 4500. Focuses on the structure and chemistry of nucleic acids as well as the application of genetic techniques in biotechnology. Addresses the basic concepts of nucleic acids and the transfer of genetic information in a living system at the molecular level. Types of mutations, effects of mutagens, and mutation repair mechanisms also covered along with the application of techniques related to nucleic acids in biotechnology.

CHEM 4565 - Food Biochemistry
3 credit hours Prerequisite: CHEM 4500, CHEM 4510, NFS 4270, or an equivalent course in biochemistry. Covers the chemistry of major food groups as well as the nutritional values of natural and functional foods in disease prevention and management of metabolic disorders. Structural, biochemical, and metabolic aspects of amino acids, carbohydrates, and lipids discussed in the context of food-related metabolic disorders.

CHEM 4570 - Biochemical Literature
2 credit hours Prerequisite: CHEM 4500 with a grade of C- or better. Survey of biochemical literature with an emphasis on database searches and communication of scientific results.

CHEM 4580 - Medical Technology Clinical Practicum
6 credit hours Intensive classroom and laboratory studies covering principles and techniques in the areas of clinical chemistry, microbiology, immunohematology, bloodbanking, and related areas. Pass/Fail.

CHEM 4600 - Introduction to Environmental Chemistry
3 credit hours Prerequisites: CHEM 1120/CHEM 1121 and 8 hours of BIOL and/or CHEM beyond the freshman level; junior or senior standing. Introduces major environmental issues including climate change, water quality, air pollution, landfills, hazardous wastes, fossil fuels, and alternative energy. The quality of environment and the changes in the environment due to contamination explored. Three hours lecture.

CHEM 4610 - Environmental Chemistry
3 credit hours Prerequisites: CHEM 1120/CHEM 1121, CHEM 2030/CHEM 2031 or CHEM 3010/CHEM 3011, 8 hours of upper-division biology or chemistry, and junior or senior standing. Fundamental chemical principles applied to the fate and behavior of environmental contaminants in soil-water environments. Important toxins explored and their movement and occurrence in ecosystems explained based on chemical and physical parameters. Topics will include pesticides, dioxin, mercury, and bioaccumulation. Three hours lecture.

CHEM 4700 - Polymers, an Introduction
3 credit hours Prerequisite: CHEM 3020/CHEM 3021; physical chemistry strongly recommended. Chemistry of polymers; their structure, properties, and applications. Three hours lecture.

CHEM 4730 - Advanced Physical Chemistry
4 credit hours Prerequisite: CHEM 4360/CHEM 4361 or permission of instructor. Corequisite: CHEM 4731. Modern chemical concepts as applied to the areas of thermodynamics, electrochemistry, and chemical kinetics. Three hours lecture and one three-hour calculation laboratory.

CHEM 4731 - Advanced Physical Chemistry Lab
0 credit hours Corequisite: CHEM 4730

CHEM 4740 - Research Methods
3 credit hours (Same as ABAS/BIOL/GEOL/PHYS/MATH 4740.) Prerequisite: YOED 3520. Provides secondary science and mathematics teacher candidates with the tools that scientists use to solve scientific problems. Students will use these tools in a laboratory setting, communicate findings, and understand how scientists develop new knowledge.

CHEM 4780 - Polymer and Materials Chemistry Laboratory
2 credit hours Prerequisite: CHEM 3020/CHEM 3021; CHEM 4330/CHEM 4331 strongly recommended. Laboratory introduction to synthesis, kinetics, characterization, engineering, and applications of polymers and other modern materials.

CHEM 4880 - Research
4 credit hours 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.

CHEM 4990 - Chemometrics and Statistics for Analytical Chemistry
3 credit hours Prerequisite: CHEM 2230/CHEM 2231 or CHEM 4330/CHEM 4331 or CHEM 4550/CHEM 4551 with C- or better. Elective course in chemometrics, statistics, and numerical methods of analysis for analytical chemistry. Propogation of error, linear regression, ANOVA, non-linear regression, and non-parametric techniques.

Forensic Science - Chemistry

FSCH 3530 - Principles of Biochemistry
4 credit hours Prerequisites: CHEM 2030/CHEM 2031 or CHEM 3010/CHEM 3011. Corequisite: FSCH 3531. Structure, properties, and functions of carbohydrates, lipids, proteins, and nuclei acids and their reactions in living organisms. For Forensic Science majors only. Three hours lecture and one three-hour lab.

FSCH 3531 - Principles of Biochemistry Lab
0 credit hours Corequisite: FSCH 3530.

FSCH 4230 - Instrumental Analysis in Forensic Science
4 credit hours Prerequisite: CHEM 2230/CHEM 2231 and CHEM 2030/CHEM 2031 or CHEM 3020/CHEM 3021. Corequisite: FSCH 4231 .

Potentiometric titration, polargraphic, 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. For Forensic Science majors only. Three hours lecture and one three-hour laboratory.

FSCH 4231 - Instrumental Analysis in Forensic Science Lab
0 credit hours Corequisite: FSCH 4230.

Interdisciplinary Microanalysis and Imaging Center

IMIC 4820 - Practical Training in Microanalysis Techniques
1 credit hour Introduces students to one microanalytical technique. Individual attention provided with the goal that the student will become an independent user with the technical skills to pursue research projects safely, properly, and independently. Emphasis on sample preparation, data collection, and data analysis. May be retaken with emphasis on a different instrument. Pass/Fail.

Physical Science

PSCI 1030 - Topics in Physical Science
4 credit hours
Corequisite: PSCI 1031. 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. (Does not count toward any major or minor.) TBR Common Course: PSCI 1030
TBC: Scientific Literacy (Discovery)

PSCI 1031 - Topics in Physical Science Lab
0 credit hours Corequisite: PSCI 1030. TBR Common Course: PSCI 1031

PSCI 1130 - Contemporary Issues in Science
0 credit hours Corequisite: PSCI 1131. Lecture emphasizing the application of basic concepts in science to topics of contemporary interest to the general citizenry. Covers basic science related to selected topics. Specific topics will vary. For nonscience majors. Does not count toward any major or minor.

PSCI 1131 - Activities for Contemporary Issues in Science
4 credit hours Corequisite: PSCI 1130. Laboratory and activity emphasizing the application of basic concepts in science to topics of contemporary interest to the general citizenry. Includes laboratory activities, group-oriented problem-solving using computers and class discussion of selected contemporary issues in science. Two two-hour laboratory sessions. For nonscience majors. Does not count toward any major or minor.

PSCI 3890 - Physical Science Instruction Internship
1 to 3 credit hours Prerequisite: Successful completion of the target course (PSCI 1030/PSCI 1031) 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.

PSCI 4030 - Experimental Physical Science
4 credit hours Prerequisite: PSCI 1030/PSCI 1031 or CHEM 1010/CHEM 1011 or CHEM 1020/CHEM 1021 or CHEM 1030/CHEM 1031 or CHEM 1110/CHEM 1111 or CHEM 1120/CHEM 1121 or GEOL 1030/GEOL 1031 or ASTR 1030/ASTR 1031. 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.

PSCI 4080 - Problems in Physical Science
4 credit hours 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.

Computer Science

Medha Sarkar, Chair

Al-Tobasei, Barbosa, Dong, Gu, Li, Phillips, Poudel, Ranganathan, Sainju, Seo, Smith, Upadhyay, Yang, Zhang

The Department of Computer Science offers a full range of courses designed to prepare students who plan to enter computing careers in business, government, education, and industry as well as those who plan to enter graduate school. The department emphasizes a blend of theory, abstraction, and design needed to prepare students to meet their future goals.

Programs in the department lead to the Bachelor of Science degree with a major in Computer Science. Students may select a concentration in Professional Computer Science accredited by the Computing Accreditation Commission of ABET, www.abet.org, or concentrations in Business Applications or Cybersecurity Systems. Only one minor is required for a Computer Science major with a concentration in Business Applications. The Professional Computer Science and Cybersecurity Systems concentrations do not require a minor. High achieving students majoring in Computer Science who intend to pursue a master's degree in Computer Science may apply to participate in the Accelerated Bachelors/Masters (ABM) pathway. In addition, a minor in Computer Science is offered.

NOTE: *TN eCampus courses will not count toward the major or minor without prior approval of the department.*

Class Attendance Policy

The instructor can at his/her own discretion drop a student after two class meetings if the student fails to attend the first two class meetings.

Transfer Credit Policy

A student may be able to apply up to 18 hours of Computer Science (CSCI) transfer credit from a non-ABET accredited computer science program toward the major if approved by the department transfer advisor. A student may be able to apply up to 35 hours of CSCI transfer credit from an ABET accredited computer science program toward the major if approved by the department transfer advisor. Transfer credit from the approved Tennessee Transfer Pathway Associates Degree in Computer Science will be accepted toward the major. A person seeking a second bachelor's degree must satisfy the COMM 2200 requirement as well as all the math, science, and computer science course requirements for the Professional Computer Science concentration. A person seeking a second bachelor's degree in the Business Applications concentration must satisfy all the math, business, and computer science course requirements. A minimum of 9 upper-division hours in CSCI must be completed at MTSU for the major, and a minimum of 3 upper-division hours in CSCI must be completed at MTSU for the minor.

Graduate Study

The Master of Science is offered in Computer Science as is a graduate minor on the master's and doctoral levels. Requirements and a list of courses offered for graduate credit may be found in the Graduate Catalog.

Computer Science Minor

Department of Computer Science

A minor in Computer Science consists of 17 semester hours. CSCI 1150 is considered a service course and does not count toward a major or minor. Credit in secondary computer languages toward a minor is limited to three hours. A GPA of 2.00 is required in the Computer Science minor.

Required (8 hours)

- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**

Electives (9 hours)

- 9 additional hours including 6 hours selected from upper-division computer science with approval of the minor advisor

Computer Science, Business Applications Concentration (Business Administration Minor), B.S.

Computer Science
615-898-2397, program
Medha Sarkar, program coordinator
Medha.Sarkar@mtsu.edu

The Computer Science major offers preparation for computing careers in business, government, education, and industry as well as for graduate school.

Accelerated Bachelors/Masters (ABM) Program

High achieving students majoring in Computer Science who intend to pursue a master's degree in Computer Science may apply to participate in the Accelerated Bachelors/Masters (ABM) pathway. The pathway allows undergraduate students an opportunity to complete select requirements for both the bachelor's and master's degrees simultaneously. Upon successful completion of the ABM pathway, students must submit an application (including application fee) to the graduate program. Additional application requirements will be waived, and the student will be admitted to the program automatically. For more information about the ABM pathway, see the Graduate Catalog.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Computer Science, Business Applications (Business Administration Minor), B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**44 hours**
Computer Science Core	*(26 hours)*
Business Applications Concentration	*(18 hours)*
Supporting Courses	**20 hours***
Business Administration Minor	**18 hours**
Elective	**0-3 hours**
TOTAL	**120-123 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- COMM 2200 (NWC)
- MATH 1910 (Quant Lit)

Major Requirements (44 hours)

Computer Science Core (26 hours)

- CSCI 1010 - Computer Science Colloquium **1 credit hour**
- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**
- CSCI 3080 - Discrete Structures **3 credit hours**
- CSCI 3110 - Algorithms and Data Structures **3 credit hours**
- CSCI 3130 - Assembly and Computer Organization **4 credit hours**
- CSCI 3240 - Introduction to Computer Systems **4 credit hours**
- CSCI 4700 - Software Engineering **3 credit hours**

Business Applications Concentration (18 hours)

- CSCI 4410 - Web Technologies **3 credit hours**
- CSCI 4560 - Database Management Systems **3 credit hours**
- CSCI elective **3 credit hours**
- CSCI upper-division electives **9 credit hours**

Supporting Courses (20 hours)

- COMM 2200 - Audience-Centered Communication **3 credit hours (may be counted in the True Blue Core)**
- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**
- MATH elective **3 credit hours (course for Math major)**
- PHIL 3170 - Ethics and Computing Technology **3 credit hours**

Business Administration Minor (18 hours)

See **Business Administration Minor** for further information.

Elective (0-3 hours)

Notes:

A maximum of 3 hours in the major may come from CSCI 4280, CSCI 4600, and CSCI 4910. Credit in secondary computer languages toward the major is limited to 3 hours. In order to take any computer science course having a prerequisite, the student must have earned a grade of C (2.00) or higher in the prerequisite. Each course counted toward the 44 credit hours of required Computer Science courses and MATH 1910 and COMM 2200 must be completed with a grade of C (2.00) or higher.

CSCI 1150 is considered a service course and does not count toward a major or minor.

Curriculum: Business Applications Concentration (Business Administration Minor)

Freshman

- CSCI 1010 - Computer Science Colloquium **1 credit hour**
- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- History and Civic Learning **6 credit hours**

Subtotal: 29 Hours

Sophomore

- COMM 2200 - Audience-Centered Communication **3 credit hours** (NWC)
- CSCI 3080 - Discrete Structures **3 credit hours**
- CSCI 3110 - Algorithms and Data Structures **3 credit hours**
- CSCI 3130 - Assembly and Computer Organization **4 credit hours**
- CSCI 3240 - Introduction to Computer Systems **4 credit hours**
- Scientific Literacy **8 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**

Subtotal: 31 Hours

Junior

- PHIL 3170 - Ethics and Computing Technology **3 credit hours**

- ACTG 3000 - Survey of Accounting for General Business **3 credit hours** OR
- ACTG 2110 - Principles of Accounting I **3 credit hours** AND
- ACTG 2120 - Principles of Accounting II **3 credit hours**

- INFS 2200 - Introduction to Microcomputing **3 credit hours** OR
- INFS 3100 - Principles of Management Information Systems **3 credit hours**

- MGMT 3610 - Principles of Management **3 credit hours**
- Math elective **3 credit hours**
- CSCI upper-division electives **6 credit hours**
- Elective **3 credit hours**
- CSCI elective **3 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**

Subtotal: 30 Hours

Senior

- CSCI 4410 - Web Technologies **3 credit hours**
- CSCI 4560 - Database Management Systems **3 credit hours**
- CSCI 4700 - Software Engineering **3 credit hours**
- CSCI upper-division elective **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression **6 credit hours**
- MKT 3820 - Principles of Marketing **3 credit hours**

- BLAW 3400 - Legal Environment of Business **3 credit hours** OR
- BLAW 3430 - Commercial Law **3 credit hours**

- FIN 3000 - Survey of Finance **3 credit hours** OR
- FIN 3010 - Principles of Corporate Finance **3 credit hours**

Subtotal: 30 Hours

Computer Science, Business Applications Concentration (Mathematics Minor), B.S.

Computer Science
615-898-2397, program
Medha Sarkar, program coordinator
Medha.Sarkar@mtsu.edu

The major in Computer Science offers preparation for computing careers in business, government, education, and industry as well as for graduate school.

Accelerated Bachelors/Masters (ABM) Program

High achieving students majoring in Computer Science who intend to pursue a master's degree in Computer Science may apply to participate in the Accelerated Bachelors/Masters (ABM) pathway. The pathway allows undergraduate students an opportunity to complete select requirements for both the bachelor's and master's degrees simultaneously. Upon successful completion of the ABM pathway, students must submit an application (including application fee) to the graduate program. Additional application requirements will be waived, and the student will be admitted to the program automatically. For more information about the ABM pathway, see the Graduate Catalog.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Computer Science, Business Applications (Mathematics Minor), B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**44 hours**
Computer Science Core	*(26 hours)*
Business Applications Concentration	*(18 hours)*
Supporting Courses	**35 hours***
Mathematics Minor (if taken)	**(18 hours)**
Electives	**2-5 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- COMM 2200 (NWC)
- MATH 1910 (Quant Lit)
- ECON 2420 (HSSR)

Major Requirements (44 hours)

Computer Science Core (26 hours)

- CSCI 1010 - Computer Science Colloquium **1 credit hour**
- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**
- CSCI 3080 - Discrete Structures **3 credit hours**
- CSCI 3110 - Algorithms and Data Structures **3 credit hours**
- CSCI 3130 - Assembly and Computer Organization **4 credit hours**
- CSCI 3240 - Introduction to Computer Systems **4 credit hours**
- CSCI 4700 - Software Engineering **3 credit hours**

Business Applications Concentration (18 hours)

- CSCI 4410 - Web Technologies **3 credit hours**
- CSCI 4560 - Database Management Systems **3 credit hours**
- CSCI elective **3 credit hours**
- CSCI upper-division electives **9 credit hours**

Supporting Courses (35 hours)

NOTE: Math courses may count in Mathematics Minor if chosen.

- COMM 2200 - Audience-Centered Communication **3 credit hours (may be counted in the True Blue Core)**
- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**
- Math elective **3 credit hours (course for Math majors)**
- PHIL 3170 - Ethics and Computing Technology **3 credit hours**

Business Courses

- ACTG 2110 - Principles of Accounting I **3 credit hours**
- ECON 2420 - Principles of Economics, Microeconomics **3 credit hours (may be counted in the True Blue Core)**
- FIN 3000 - Survey of Finance **3 credit hours**
- MGMT 3610 - Principles of Management **3 credit hours**

- ACTG 2120 - Principles of Accounting II **3 credit hours** OR
- ACSI 4230 - Mathematics of Compound Interest **3 credit hours** OR
- BLAW 3400 - Legal Environment of Business **3 credit hours** OR
- MGMT 3620 - Supply Chain Operations **3 credit hours** OR
- MKT 3820 - Principles of Marketing **3 credit hours**

Mathematics Minor (18 hours)
See Mathematics Minor for further information.

Electives (2-5 hours)

Notes:
A maximum of 3 hours in the major may come from CSCI 4280, CSCI 4600, and CSCI 4910. Credit in secondary computer languages toward the major is limited to 3 hours. In order to take any computer science course having a prerequisite, the student must have earned a grade of C (2.00) or higher in the prerequisite. Each course counted toward the 44 credit hours of required Computer Science courses and MATH 1910 and COMM 2200 must be completed with a grade of C (2.00) or higher.
CSCI 1150 is considered a service course and does not count toward a major or minor.

Curriculum: Business Applications Concentration (Mathematics Minor)

Freshman
- CSCI 1010 - Computer Science Colloquium **1 credit hour**
- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- History and Civic Learning **6 credit hours**

Subtotal: 29 Hours

Sophomore
- CSCI 3080 - Discrete Structures **3 credit hours**
- CSCI 3110 - Algorithms and Data Structures **3 credit hours**
- CSCI 3130 - Assembly and Computer Organization **4 credit hours**
- CSCI 3240 - Introduction to Computer Systems **4 credit hours**
- COMM 2200 - Audience-Centered Communication **3 credit hours** (NWC)
- Scientific Literacy **8 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**

Subtotal: 31 Hours

Junior

- ACTG 2110 - Principles of Accounting I **3 credit hours**
- FIN 3000 - Survey of Finance **3 credit hours**
- PHIL 3170 - Ethics and Computing Technology **3 credit hours**
- CSCI upper-division electives **6 credit hours**
- CSCI elective **3 credit hours**
- MATH electives **7 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**
- MGMT 3610 - Principles of Management **3 credit hours**

Subtotal: 31 Hours

Senior

- CSCI 4410 - Web Technologies **3 credit hours**
- CSCI 4560 - Database Management Systems **3 credit hours**
- CSCI 4700 - Software Engineering **3 credit hours**
- ECON 2420 - Principles of Economics, Microeconomics **3 credit hours** (HSSR)

- ACTG 2120 - Principles of Accounting II **3 credit hours** OR
- ACSI 4230 - Mathematics of Compound Interest **3 credit hours** OR
- BLAW 3400 - Legal Environment of Business **3 credit hours** OR
- MGMT 3620 - Supply Chain Operations **3 credit hours** OR
- MKT 3820 - Principles of Marketing **3 credit hours**

- Creativity and Cultural Expression **6 credit hours**
- CSCI upper-division elective **3 credit hours**
- Human Society and Social Relationships/Elective **3 credit hours**
- Elective **2 credit hours**

Subtotal: 29 Hours

Computer Science, Cybersecurity Systems Concentration, B.S.

Computer Science
615-898-2397, program
Medha Sarkar, program coordinator
Medha.Sarkar@mtsu.edu

The Computer Science major offers preparation for computing careers in business, government, education, and industry as well as for graduate school.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Computer Science, Cybersecurity Systems, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**38 hours**
Computer Science Core	*(26 hours)*
Cybersecurity Concentration	*(12 hours)*
Supporting Courses	**33 hours***
Electives	**8-22 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- COMM 2200 (NWC)
- MATH 1910 (Quant Lit)
- Scientific Literacy: BIOL 1110/BIOL 1111; CHEM 1010/CHEM 1011 or CHEM 1110/CHEM 1111; PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111 * **

Major Requirements (38 hours)

Computer Science Core (26 hours)

- CSCI 1010 - Computer Science Colloquium **1 credit hour**
- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**
- CSCI 3080 - Discrete Structures **3 credit hours**
- CSCI 3110 - Algorithms and Data Structures **3 credit hours**
- CSCI 3130 - Assembly and Computer Organization **4 credit hours**
- CSCI 3240 - Introduction to Computer Systems **4 credit hours**

- CSCI 4700 - Software Engineering **3 credit hours**

Cybersecurity Systems Concentration (12 hours)

- CSCI 4300 - Data Communication and Networks **3 credit hours**
- CSCI 4400 - Network Security **3 credit hours**
- CSCI 4410 - Web Technologies **3 credit hours**
- CSCI 4560 - Database Management Systems **3 credit hours**

Supporting Courses (33 hours)

- COMM 2200 - Audience-Centered Communication **3 credit hours (may be counted in the True Blue Core)**
- MATH 1910 - Calculus I **4 credit hours (may be counted in the True Blue Core)**
- MATH 1920 - Calculus II **4 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**
- Math elective **3 to 4 credit hours (course for Math majors)**
- Math elective **0 to 1 credit hours (not needed if math elective is 4 hours)**
- Science **8 credit hours (year-long sequence in the True Blue Core Scientific Literacy area; may be counted in the True Blue Core)**
- Science course **4 credit hours (different prefix from year-long sequence)**
- PHIL 3170 - Ethics and Computing Technology **3 credit hours**

Electives (8-22 hours)

Curriculum: Cybersecurity Systems Concentration

Freshman Fall

- CSCI 1010 - Computer Science Colloquium **1 credit hour**
- CSCI 1170 - Computer Science I **4 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- Written Communication **3 credit hours**
- History and Civic Learning **3 credit hours**

Subtotal: 15 Hours

Freshman Spring

- CSCI 2170 - Computer Science II **4 credit hours**
- MATH 1920 - Calculus II **4 credit hours**
- Information Literacy **3 credit hours**
- History and Civic Learning **3 credit hours**

Subtotal: 14 Hours

Sophomore Fall

- COMM 2200 - Audience-Centered Communication **3 credit hours** (NWC)
- CSCI 3080 - Discrete Structures **3 credit hours**
- CSCI 3130 - Assembly and Computer Organization **4 credit hours**
- Scientific Literacy **4 credit hours ***
- Creativity and Cultural Expression Literature **3 credit hours**

Subtotal: 17 Hours

Sophomore Spring

- CSCI 3110 - Algorithms and Data Structures **3 credit hours**
- CSCI 3240 - Introduction to Computer Systems **4 credit hours**
- Scientific Literacy (same rubric, second semester) **4 credit hours ***
- Human Society and Social Relationships **3 credit hours**

Subtotal: 14 Hours

Junior Fall

- CSCI 4300 - Data Communication and Networks **3 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**
- Science course **4 credit hours ****
- Electives **6 credit hours**

Subtotal: 16 Hours

Junior Spring

- CSCI 4410 - Web Technologies **3 credit hours**
- CSCI 4400 - Network Security **3 credit hours**
- PHIL 3170 - Ethics and Computing Technology **3 credit hours**
- Math elective **4 credit hours**
- Elective **3 credit hours**

Subtotal: 16 Hours

Senior Fall

- CSCI 4560 - Database Management Systems **3 credit hours**
- Electives **6 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**

Subtotal: 15 hours

Senior Spring

- CSCI 4700 - Software Engineering **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Electives **7 credit hours**

Subtotal: 13 Hours

NOTE:

**Cybersecurity Systems concentration students choose one year-long sequence from BIOL 1110/BIOL 1111, BIOL 1120/BIOL 1121, CHEM 1010/CHEM 1011, CHEM 1020/CHEM 1021, CHEM 1110/CHEM 1111, CHEM 1120/CHEM 1121, PHYS 2010/PHYS 2011, PHYS 2020/PHYS 2121, PHYS 2110 /PHYS 2111, PHYS 2120/PHYS 2121.*

***Students choose one course with different prefix from that chosen in sophomore year from BIOL 1110/BIOL 1111, CHEM 1010/CHEM 1011, CHEM 1110/CHEM 1111, PHYS 2010/PHYS 2011, PHYS 2110/PHYS 2111.*

Computer Science, Professional Computer Science Concentration, B.S.

Computer Science
615-898-2397, program
Medha Sarkar, program coordinator
Medha.Sarkar@mtsu.edu

The Computer Science major offers preparation for computing careers in business, government, education, and industry as well as for graduate school.

Accelerated Bachelors/Masters (ABM) Program

High achieving students majoring in Management who intend to pursue a master's degree in Computer Science (non-thesis option) may apply to participate in the Accelerated Bachelors/Masters (ABM) pathway. The pathway allows undergraduate students an opportunity to complete select requirements for both the bachelor's and master's degrees simultaneously. Upon successful completion of the ABM pathway, students must submit an application (including application fee) to the graduate program. Additional application requirements will be waived, and the student will be admitted to the program automatically. For more information about the ABM pathway, see the Graduate Catalog.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Computer Science, Professional Computer Science, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**44 hours**
Computer Science Core	*(26 hours)*
Professional Computer Science Concentration	*(18 hours)*
Supporting Courses	**33 hours***
Electives	**2-16 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- COMM 2200 (NWC)
- MATH 1910 (Quant Lit)
- Scientific Literacy: BIOL 1110/BIOL 1111; CHEM 1010/CHEM 1011 or CHEM 1110/CHEM 1111; PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111* **

Major Requirements (44 hours)

Computer Science Core (26 hours)

- CSCI 1010 - Computer Science Colloquium **1 credit hour**
- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**
- CSCI 3080 - Discrete Structures **3 credit hours**
- CSCI 3110 - Algorithms and Data Structures **3 credit hours**
- CSCI 3130 - Assembly and Computer Organization **4 credit hours**
- CSCI 3240 - Introduction to Computer Systems **4 credit hours**
- CSCI 4700 - Software Engineering **3 credit hours**

Professional Computer Science Concentration (18 hours)

The Professional Computer Science concentration which is accredited by the Computing Accreditation Commission of ABET, www.abet.org, requires the following in addition to the core requirements:

- CSCI 3210 - Theory of Programming Languages **3 credit hours**
- CSCI 4160 - Compiler Design and Software Development **3 credit hours**
- CSCI high-level language **3 credit hours**
- CSCI upper-division electives **9 credit hours**

Supporting Courses (33 hours)

- COMM 2200 - Audience-Centered Communication **3 credit hours (may be counted in the True Blue Core)**
- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**
- Math elective **3 to 4 credit hours (course for Math majors)**
- Math elective **0 to 1 credit hours (not needed if math elective is 4 hours)**
- Science **8 credit hours (year-long sequence in the True Blue Core Scientific Literacy area; 8 credit hours may be counted in the True Blue Core)**
- Science **4 credit hours (Different prefix from year-long sequence)**
- PHIL 3170 - Ethics and Computing Technology **3 credit hours**

Electives (2-16 hours)

- At least 4 credits must be upper division

Notes:

A maximum of 3 hours in the major may come from CSCI 4280, CSCI 4600, and CSCI 4910. Credit in secondary computer languages toward the major is limited to 3 hours. In order to take any computer science course having a prerequisite, the student must have earned a grade of C (2.00) or better in the prerequisite. Each course counted toward the 44 credit hours of required Computer Science courses and MATH 1910 and COMM 2200 must be completed with a grade of C (2.00) or higher.
CSCI 1150 is considered a service course and does not count toward a major or minor.

Curriculum: Professional Computer Science

Freshman

- CSCI 1010 - Computer Science Colloquium **1 credit hour**
- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- History and Civic Learning **6 credit hours**

Subtotal: 29 hours

Sophomore

- COMM 2200 - Audience-Centered Communication **3 credit hours** (NWC)
- CSCI 3080 - Discrete Structures **3 credit hours**
- CSCI 3110 - Algorithms and Data Structures **3 credit hours**
- CSCI 3130 - Assembly and Computer Organization **4 credit hours**
- CSCI 3240 - Introduction to Computer Systems **4 credit hours**
- Scientific Literacy **4 credit hours ***
- Scientific Literacy (same rubric, second semester) **4 credit hours ***
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**

Subtotal: 31 Hours

Junior

- CSCI 3210 - Theory of Programming Languages **3 credit hours**
- Math elective **4 credit hours**
- CSCI upper-division elective **3 credit hours**
- CSCI 303_ **3 credit hours**
- Electives **9 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**
- PHIL 3170 - Ethics and Computing Technology **3 credit hours**
- Science course (different prefix from year-long lab sequence) **4 credit hours** **

Subtotal: 32 Hours

Senior

- CSCI 4160 - Compiler Design and Software Development **3 credit hours**
- CSCI 4700 - Software Engineering **3 credit hours**
- CSCI upper-division elective **6 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression **6 credit hours**
- Electives **7 credit hours**

Subtotal: 28 Hours

NOTE:

**Professional Computer Science concentration students choose one year-long sequence from BIOL 1110/BIOL 1111, BIOL 1120/BIOL 1121, CHEM 1010/CHEM 1011, CHEM 1020/CHEM 1021, CHEM 1110/CHEM 1111, CHEM 1120/CHEM 1121, PHYS 2010/PHYS 2011, PHYS 2020/PHYS 2121, PHYS 2110 /PHYS 2111, PHYS 2120/PHYS 2121.*

***Professional Computer Science concentration students choose one course with different prefix from that chosen in sophomore year from BIOL 1110 /BIOL 1111, CHEM 1010 /CHEM 1011, CHEM 1110/CHEM 1111, PHYS 2010/PHYS 2011, PHYS 2110/PHYS 2111.*

Computer Science

CSCI 1010 - Computer Science Colloquium
1 credit hour Introduces new computer science students to the computer science major. Topics include degree requirements, faculty resources, research opportunities, and career options.

CSCI 1150 - Computer Orientation
3 credit hours A general introduction to computers with an emphasis on personal computing, database, word processing, presentation graphics, spreadsheets, and Internet tools. Does not count for Computer Science major or minor.

CSCI 1170 - Computer Science I
4 credit hours Prerequisite: MATH 1730 or MATH 1810 with a grade of C or better or Math ACT of 26 or better or Calculus placement test score of 73 or better. The first of a two-semester sequence using a high-level language; language constructs and simple data structures such as arrays and strings. Emphasis on problem solving using the language and principles of structured software development. Three lecture hours and two laboratory hour.

CSCI 2170 - Computer Science II
4 credit hours Prerequisites: CSCI 1170 (or equivalent) with a grade of C or better and MATH 1730 or MATH 1810 with a grade of C or better or Math ACT of 26 or better or Calculus placement test score of 73 or better. A continuation of CSCI 1170. Topics include introductory object-oriented programming techniques, software engineering principles, records, recursion, pointers, stacks and queues, linked lists, trees, and sorting and searching. Three lecture hours and two laboratory hours.

CSCI 3033 - Computer Languages: Java
3 credit hours Prerequisite: CSCI 3110 or consent of instructor. An opportunity for a Computer Science major or minor to gain experience and training in a secondary language. Covers the syntax, advantages, disadvantages, limitations, and selected applications of a language. Credit will not be given toward a Computer Science major or minor if credit has been received for the same language in another course. Credit in secondary computer languages is limited to 3 hours for the major or minor.

CSCI 3037 - Computer Languages: Visual Programming
3 credit hours Prerequisite: CSCI 3110 or consent of instructor. An opportunity for a Computer Science major or minor to gain experience and training in a secondary language. Covers the syntax, advantages, disadvantages, limitations, and selected applications of a language. Credit will not be given toward a Computer Science major or minor if credit has been received for the same language in another course. Credit in secondary computer languages is limited to 3 hours for the major or minor.

CSCI 3038 - Computer Languages: Python
3 credit hours Prerequisite: CSCI 3110 or consent of instructor. An opportunity for a Computer Science major or minor to gain experience and training in a secondary language. Covers the syntax, advantages, disadvantages, limitations, and selected applications of a language. Credit will not be given toward a Computer Science major or minor if credit has been received for the same language in another course. Credit in secondary computer languages is limited to 3 hours for the major or minor.

CSCI 3080 - Discrete Structures
3 credit hours (Same as MATH 3080.) Prerequisites: CSCI 1170 and MATH 1910 or consent of instructor. Topics include formal logic, proof techniques, matrices, graphs, formal grammars, finite state machines, Turing machines, and binary coding schemes.

CSCI 3110 - Algorithms and Data Structures
3 credit hours Prerequisites: CSCI 2170 and CSCI 3080 with C or better. Topics include additional object-oriented programming techniques, algorithm design, analysis of algorithms, advanced tree structures, indexing techniques, internal and external sorting, graphs, and file organizations.

CSCI 3130 - Assembly and Computer Organization
4 credit hours Prerequisite: CSCI 2170 with a grade of C (2.0) or better and MATH 1730 or MATH 1810 with a grade of C (2.0) or better or ACT math score of 26 or better or calculus placement test score of 73 or better. Assembly language and the organization and basic architecture of computer systems. Topics include hardware components of digital computers, microprogramming, and memory management. Laboratory exercises involve logical, functional properties of components from gates to

microprocessors. Three lectures and one two-hour laboratory.

CSCI 3160 - Introduction to Assembly Language
3 credit hours Prerequisite: CSCI 2170 or equivalent. Computer architecture and assembly language. Major emphasis on addressing techniques, macros, and program segmentation and linkage.

CSCI 3180 - Introduction to Numerical Analysis
3 credit hours (Same as MATH 3180.) Prerequisites: MATH 1920 and CSCI 2170 or approval of instructor. Topics include series approximation, finite differences interpolation, summation, numerical differentiation and integration, iteration, curve fitting, systems of equations and matrices, and error analysis.

CSCI 3200 - Introduction to Analysis of Algorithms
3 credit hours Prerequisites: CSCI 2170 and CSCI 3080 with C or better in both. Introduction to analysis of computer algorithms: criteria for algorithm analysis; algorithm complexity and asymptotic functions; algorithm design techniques such as recursive, divide-and-conquer, dynamic programming, greedy, backtracking, and branch-and-bound; introduction to Class P, NP, and NP-complete problems.

CSCI 3210 - Theory of Programming Languages
3 credit hours Prerequisites: CSCI 3110 and COMM 2200; corequisite: CSCI 3080. Syntax and theory of multiple languages covered with emphasis on binding times, parsers, grammars, finite automata, regular expressions, type checking and equivalence, scope of variables, exception handling, parameter passing, and storage management.

CSCI 3240 - Introduction to Computer Systems
4 credit hours Prerequisites: CSCI 2170 and either CSCI 3130 or ET 3620. Provides a programmer's view of how computer systems execute programs, store information, and communicate. Topics include machine-level code and its generation by optimizing compilers, computer arithmetic, memory organization and management, networking technology and protocols, and supporting concurrent computation. Three lecture hours and one two-hour laboratory.

CSCI 3250 - Operating Systems
3 credit hours Prerequisite: CSCI 3240. Concepts and facilities of an operating system. Major concepts in memory, processor, device, and information management are covered as well as interrelationships between the operating system and the architecture of the computer system.

CSCI 4160 - Compiler Design and Software Development
3 credit hours Prerequisites: CSCI 3080, CSCI 3110, and either CSCI 3130 or CSCI 3160. The various phases of a compiler along with grammars, finite automata, regular expressions, LR parsing, error recovery, backward and forward flow analysis, and code optimization. A term project consisting of the design and construction of a functional complier required.

CSCI 4250 - Computer Graphics
3 credit hours Prerequisites: CSCI 3110 and CSCI 3080 or consent of instructor. Topics include vector drawing displays, raster scan displays, input devices and techniques, graphics software, transformations, projections, interpolation, and approximation.

CSCI 4280 - Undergraduate Research
1 to 4 credit hours Prerequisite: Permission of instructor and department. Independent investigation of a selected research problem under the guidance of a faculty member resulting in an oral and written report of results. Does not count toward a minor in Computer Science. May be repeated for a maximum of four credits. A maximum of three credits in the major may come from CSCI 3970, 4280, CSCI 4600, and CSCI 4910.

CSCI 4300 - Data Communication and Networks
3 credit hours Prerequisite: CSCI 3240 or CSCI 3250. Computer network architectures, protocol hierarchies, and the open systems interconnection model. Modeling, analysis, design, and management of hardware and software on a computer network.

CSCI 4330 - Parallel Processing Concepts
3 credit hours Prerequisites: CSCI 3130 and CSCI 3240 or CSCI 3250. Basic concepts in parallel processing and programming in a parallel environment. Topics include classification of parallel architectures, study of actual parallel architectures, design and implementation of parallel programs, parallel software engineering.

CSCI 4350 - Introduction to Artificial Intelligence
3 credit hours Prerequisites: CSCI 3110 and CSCI 3080 or equivalent. Principles include search strategies, knowledge representation, reasoning, and

machine learning. Applications include expert systems and natural language understanding.

CSCI 4360 - Intelligent Robot System
3 credit hours Prerequisites: CSCI 3110 and CSCI 3080. Principles and applications of intelligent mobile robotics. Various architectures used in the basic AI robotics development paradigms and basic techniques used for robot navigation. Strong emphasis on hands-on mobile robot design, construction, programming, and experimentation using a variety of robot building platforms.

CSCI 4400 - Network Security
3 credit hours Prerequisite: CSCI 4300 (with a grade of C or better) or consent of instructor. Introduces network security: fundamentals of network security; mathematical concepts and theoretical analysis in cryptography; examination of risks and threats in computer networks and security mechanisms in different network layers; hands-on experience in network security, including implementation of encryption/decryption methods.

CSCI 4410 - Web Technologies
3 credit hours Prerequisites: CSCI 3080, CSCI 3110, and CSCI 3240. An intensive introduction into current Web technologies including basic HTML, tools for Web page design, XML, client-side methods, and server-side methods. Students will be required to implement several Web-based projects.

CSCI 4450 - Blockchain and Smart Contracts
3 credit hours Prerequisite: CSCI 4300 with a C (2.0) or better. Comprehensive exploration of blockchain technology and smart contracts; focus on security and real-world applications; insights into computer security; vulnerability threat control paradigms; fundamental concepts, features, and characteristics of blockchain and smart contracts; Ethereum-specific concepts, tokenization, smart contract security risks, and vulnerabilities.

CSCI 4460 - Cryptography and Applications
3 credit hours Prerequisites: MATH 2050 and CSCI 4400 with a C (2.0) or better. Thorough introduction to the principles and applications of cryptography; focus on various cipher techniques, cryptographic algorithms, and their practical applications; emphasis on hands-on labs to reinforce theoretical concepts and develop practical skills in information security.

CSCI 4560 - Database Management Systems
3 credit hours Prerequisites: CSCI 3080 and CSCI 3110. The relational and object models of database design along with relational algebras, data independence, functional dependencies, inference rules, normal forms, schema design, modeling languages, query languages, and current literature.

CSCI 4600 - Independent Study in Computer Science
1 to 6 credit hours Prerequisites: Senior standing and consent of instructor. Students wishing to enroll must submit a written course/topic proposal to the department prior to the semester in which CSCI 4600 is taken. Proposal must be approved prior to taking the course. At the course conclusion, each enrollee must submit a written report to the department. May count up to 3 hours toward Computer Science major.

CSCI 4700 - Software Engineering
3 credit hours Prerequisites: CSCI 3080, CSCI 3110, CSCI 3240, and COMM 2200 with grades of C (2.0) or better. Consists of a theoretical component and a practical component. Topics include the history of software engineering, software development paradigms and life cycles, and computer-aided software engineering (CASE). Team project developed in parallel with the theory.

CSCI 4710 - Secure Software Systems
3 credit hours Prerequisite: CSCI 3110 with C (2.0) or better. Comprehensive study of principles and practices of developing secure software systems; exploration and identification of software flaws; utilization of source code analysis tools; implementation of software testing and conduct penetration testing to enhance the security of software applications.

CSCI 4800 - Software Testing
3 credit hours Prerequisites: CSCI 2170 and CSCI 3080. Integrates theory and applications of software testing techniques. Provides actual hands-on testing experience. Considers multiple testing paradigms.

CSCI 4820 - Natural Language Processing
3 credit hours Prerequisites: CSCI 3080 and CSCI 3110 with a grade of C (2.0) or better. Proficiency in the Python programming language strongly recommended. Introduces the theory and practice of natural language processing (NLP), focusing on processes that enable computers to understand, generate, and analyze natural language. Includes

fundamental algorithms for language modeling and syntactic analysis; core NLP applications areas such as classification, chatbots, and machine translation; and modern methodologies underpinning natural language processing, including machine learning and deep learning.

CSCI 4850 - Neural Nets
3 credit hours Prerequisite: CSCI 3080. Various neural net architectures, theory, and applications including models such as Perceptron, back propagation, Kohonen, ART, and associative memory. Learning and conditioning methods also studied.

CSCI 4860 - Computer Vision
3 credit hours Prerequisites: CSCI 3080 and CSCI 3110 with a grade of C or better. Proficiency in the Python programming language and linear algebra strongly recommended. Algorithms and principles of computer vision. Fundamentals of image processing, feature extraction and representation, and object detection and recognition; image classification, convolutional neural networks, camera Calibration, 3D vision and stereo imaging, and motion analysis and tracking.

CSCI 4900 - Selected Topics in Computer Science
3 credit hours Prerequisite: CSCI 2170. Advanced topics in computer science to be selected and announced at time of class scheduling. May be repeated for up to six credits total.

CSCI 4910 - Computer Science Internship
1 to 6 credit hours Prerequisite: CSCI 3110. Must have completed at least 30 semester hours with two semesters at MTSU; must have taken at least two computer science courses at MTSU; minimum overall average of 2.75 and 3.00 in computer science. Employment experience in a computer-related function in a firm, governmental agency, etc. Must be approved by the department.

Concrete and Construction Management

Tom Nicholas, Director

Avila, Gormley, Huddleston, Knight, Strong, Yang, Vanhook, Wang, Whitman

www.mtsuedu/ccm

Students in the School of Concrete and Construction Management are involved in much more at the university than just coursework. The School is proud to have a robust recruiting program to help students connect with internships and full-time careers. Student labs allow for a realistic educational environment focused on hands-on learning environments and opportunities to work with faculty on research projects. The strong ties to industry allow students unique opportunities including travel to conferences, field trips to job sites, guest lecturers, involvement in applied research, and a huge network of alumni to help mentor students in the industry.

The mission of the School of Concrete and Construction Management is to prepare students for lifelong success in a broad array of construction industry careers. As a result, the School offers a variety of programs tailored to meet student interest and industry needs. The programs are generally categorized into the general field of Construction Management and the more specialized and unique field of Concrete Industry Management.

The Construction Management program has two concentrations:

- Land Development/Residential Building Construction Management
- Commercial Construction Management

Examples of employment in Construction Management include project manager, field engineer, field superintendent, estimator, business development manager, safety officer, preconstruction manager, inspectors, or government contracting officer. Graduates work for land developers, residential builders, general contractors, specialty contractors, construction management firms, design-build firms, architectural/engineering firms, vendors/suppliers or government agencies.

The School also offers a minor in Construction Management.

The Concrete Industry Management program has two concentrations:

- Concrete Contracting
- Production, Sales, and Service

Examples of Production, Sales, and Service employment include technical sales, operations manager, sales and marketing professional, product distribution manager, quality control manager, environmental and safety officer, logistics manager, information technology support, trade association director, and technical magazine writer.

Examples of Concrete Contracting employment include project manager or engineering for a general contractor, specialty contractor or subcontractor, concrete technical specialist in an architectural/engineering firm or government entity, estimator, designer, surveyor and field installation supervisor, staff, and safety officer.

The Concrete Industry Management programs are affiliated with the National Concrete Industry Management consortium, a joint initiative of a growing number of universities supported by networks of local, state, and regional concrete industry producers, suppliers, and contractors that pledge their time, talent, and resources to support the development of each university's CIM program.

In addition to the CIM major, graduates acquire a minor in business administration, which includes the study of personnel management, systems integration, marketing, sales and promotion as they relate to concrete products and services. The CIM core curriculum includes typical college-level general study requirements, general business, and concrete-related introductory course work. Advanced level courses and internships broaden the students' understanding of the workings of the concrete industry.

The Jones College of Business also offers a concentration in Concrete Industry Management within the Master of Business Administration. For further information, see the Graduate Catalog.

Concrete Industry Management, Concrete Contracting Concentration, B.S.

Concrete and Construction Management
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The major in Concrete Industry Management is designed to produce broadly educated, articulate graduates, grounded in basic science and mathematics, who are knowledgeable about concrete technology and techniques and are able to manage people and systems and to promote products or services related to the concrete industry. Examples of opportunities in the field include technical sales of products used to manufacture concrete; operations management of a concrete production facility; sales and marketing of production, construction, and finishing equipment; product distribution, supply chain management, and logistics; project management for a concrete or general contractor; work as a concrete specialist in an architectural/engineering firm or government entity; and support positions such as writer or editor for a technical magazine or professional/trade association management. The Concrete Contracting concentration offers preparation for entry-level positions with general and concrete contractors, project management firms, masonry contractors, precast erection firms, or government agencies responsible for construction projects. Position opportunities include project management, estimating, field supervision, planning and scheduling, and various other management positions.

Grading Policy

Students majoring in the Concrete Industry Management (CIM) program must receive grades of C (2.00) or better in all CIM courses in order for the courses to count toward graduation. A minimum grade of C (2.00) is required in all CIM classes that are prerequisites to other CIM classes.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Concrete Industry Management, Concrete Contracting, B.S, Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**54 hours**
Concrete and Construction Core	*6 hours*
CIM Core	*24 hours*
Concrete Contracting Concentration	*24 hours*
Supporting Courses	**18-19 hours***
Business Administration Minor	**18 hours**
TOTAL	**120-132 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1720 or MATH 1730 (Quant Lit)
- CHEM 1010/CHEM 1011 or CHEM 1110/CHEM 1111 (Sci Lit)
- GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041 (Sci Lit)

Major Requirements (54 hours)

Concrete and Construction Core (6 hours)

- CCM 1010 - Introduction to the Concrete and Construction Industry **1 credit hour**
- CCM 2050 - Plan Reading **2 credit hours**
- CCM 4010 - Concrete and Construction Law **3 credit hours**

Concrete Industry Management Core (24 hours)

- CIM 3000 - Fundamentals of Concrete: Properties and Testing **4 credit hours**
- CIM 3050 - Concrete Construction Methods **3 credit hours**
- CIM 3060 - Understanding the Concrete Construction System **3 credit hours**
- CIM 3100 - Applications of Concrete Construction **3 credit hours**
- CIM 3300 - Concrete Industry Internship **1 to 9 credit hours (3 credit hours required)**
- CIM 4150 - Concrete Problems: Diagnosis, Prevention, and Dispute Resolution **3 credit hours**
- CIM 4200 - Senior Concrete Lab **2 credit hours**
- CIM 4910 - Capstone **3 credit hours**

Concrete Contracting Concentration (24 hours)

- CIM 3080 - Formwork Design and Computerized Drafting **3 credit hours**
- CCM 3200 - Project Estimating **3 credit hours**
- CMT 3320 - Architectural Computer-Aided Drafting and Design **3 credit hours**
- CCM 3500 - Land Surveying **3 credit hours**
- CIM 4010 - Design and Construction Issues **3 credit hours**
- CIM 4100 - Field Management and Supervision **3 credit hours**
- CMT 4160 - Construction Safety and Health Management **3 credit hours**
- CMT 4320 - Software Applications for Virtual Design and Construction **3 credit hours**

Supporting and Elective Courses (18-19 hours)

- MATH 1720 - Plane Trigonometry **3 credit hours (may be counted in the True Blue Core)** OR
- MATH 1730 - Pre-Calculus **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**

- GEOL 1030 - Introduction to Earth Science **3 credit hours** AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour (may be counted in the True Blue Core)**
  OR
- GEOL 1040 - Physical Geology **4 credit hours** AND
- GEOL 1041 - Physical Geology Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours**
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- PSY 3020 - Basic Statistics for Behavioral Science **3 credit hours** OR
- BIA 2610 - Statistical Methods **3 credit hours** OR
- MATH 1530 - Applied Statistics **3 credit hours**

- Electives **4 credit hours**

Business Administration Minor (18 hours)

See **Business Administration Minor** for further information.

Curriculum: Concrete Industry Management, Concrete Contracting

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Non-Written Communication **3 credit hours**
- History and Civic Learning **3 credit hours**

- GEOL 1030 - Introduction to Earth Science **3 credit hours** (Sci Lit) AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour** (Sci Lit)
  OR
- GEOL 1040 - Physical Geology **4 credit hours** (Sci Lit) AND
- GEOL 1041 - Physical Geology Lab **0 credit hours** (Sci Lit)

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours** (Sci Lit)
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CCM 1010 - Introduction to the Concrete and Construction Industry **1 credit hour**
- CCM 2050 - Plan Reading **2 credit hours**
- CSCI 1150 - Computer Orientation **3 credit hours**

- MATH 1720 - Plane Trigonometry **3 credit hours** (Quant Lit) OR
- MATH 1730 - Pre-Calculus **4 credit hours** (Quant Lit)

Subtotal: 29-30 Hours

Sophomore

- PSY 3020 - Basic Statistics for Behavioral Science **3 credit hours** OR
- BIA 2610 - Statistical Methods **3 credit hours** OR
- MATH 1530 - Applied Statistics **3 credit hours**

- Human Society and Social Relationships (ECON 2410 and/or PSY 1410 recommended) **6 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **3 credit hours**
- CIM 3000 - Fundamentals of Concrete: Properties and Testing **4 credit hours**
- CIM 3050 - Concrete Construction Methods **3 credit hours**
- CIM 3060 - Understanding the Concrete Construction System **3 credit hours**

Subtotal: 31 Hours

NOTE:

CIM 3300, Concrete Industry Internship, will be taken sometime after the sophomore year for three credit hours.

Junior

- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
- CCM 3500 - Land Surveying **3 credit hours**
- CCM 4010 - Concrete and Construction Law **3 credit hours**
- CIM 3080 - Formwork Design and Computerized Drafting **3 credit hours**
- CIM 3100 - Applications of Concrete Construction **3 credit hours**
- CMT 3320 - Architectural Computer-Aided Drafting and Design **3 credit hours**
- CMT 4160 - Construction Safety and Health Management **3 credit hours**
- MGMT 3610 - Principles of Management **3 credit hours**
- MKT 3820 - Principles of Marketing **3 credit hours**

- FIN 3000 - Survey of Finance **3 credit hours** OR
- FIN 3010 - Principles of Corporate Finance **3 credit hours**

Subtotal: 30 Hours

Senior

- BLAW 3400 - Legal Environment of Business **3 credit hours**
- CIM 4010 - Design and Construction Issues **3 credit hours**
- CIM 4100 - Field Management and Supervision **3 credit hours**
- CIM 4150 - Concrete Problems: Diagnosis, Prevention, and Dispute Resolution **3 credit hours**
- CIM 4200 - Senior Concrete Lab **2 credit hours**
- CIM 4910 - Capstone **3 credit hours**
- CCM 3200 - Project Estimating **3 credit hours**
- CMT 4320 - Software Applications for Virtual Design and Construction **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Elective(s) **4 credit hours**

Subtotal: 30 Hours

Concrete Industry Management, Production, Sales, and Service Concentration, B.S.

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The major in Concrete Industry Management is designed to produce broadly educated, articulate graduates, grounded in basic science and mathematics, who are knowledgeable about concrete technology and techniques and are able to manage people and systems and to promote products or services related to the concrete industry. Examples of opportunities in the field include technical sales of products used to manufacture concrete; operations management of a concrete production facility; sales and marketing of production, construction, and finishing equipment; product distribution, supply chain management, and logistics; project management for a concrete or general contractor; work as a concrete specialist in an architectural/engineering firm or government entity; and support positions such as writer or editor for a technical magazine or professional/trade association management.
The Production, Sales, and Service concentration is geared toward developing technical managers for ready mix, block, and precast concrete production facilities as well as their suppliers, such as admixture, aggregate, cement, and equipment companies. Position opportunities include operations management, sales and sales management, marketing management, human resource management, technical service and quality control, or environmental and safety management.
All students in the Production, Sales, and Service concentration are required to choose a Business Administration minor.

Grading Policy

Students majoring in the Concrete Industry Management (CIM) program must receive grades of C (2.00) or better in all CIM courses in order for the courses to count toward graduation. A minimum grade of C (2.00) is required in all CIM classes that are prerequisites to other CIM classes.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Concrete Industry Management, Production, Sales, and Service, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**47 hours**
Concrete and Construction Core	*6 hours*
CIM Core	*24 hours*
Production, Sales, and Service Concentration	*17 hours*
Supporting Courses	**25 hours***
Business Administration Minor	**18 hours**
TOTAL	**120-131 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1630, MATH 1720, MATH 1730, MATH 1810, or MATH 1910 (Quant Lit)
- CHEM 1010/CHEM 1011 or CHEM 1110/CHEM 1111 (Sci Lit)
- GEOL 1030/GEOL 1031 or GEOL 1040 GEOL 1041 (Sci Lit)

Major Requirements (47 hours)

Concrete and Construction Core (6 hours)

- CCM 1010 - Introduction to the Concrete and Construction Industry **1 credit hour**
- CCM 2050 - Plan Reading **2 credit hours**
- CCM 4010 - Concrete and Construction Law **3 credit hours**

Concrete Industry Management Core (24 hours)

- CIM 3000 - Fundamentals of Concrete: Properties and Testing **4 credit hours**
- CIM 3050 - Concrete Construction Methods **3 credit hours**
- CIM 3060 - Understanding the Concrete Construction System **3 credit hours**
- CIM 3100 - Applications of Concrete Construction **3 credit hours**
- CIM 3300 - Concrete Industry Internship **1 to 9 credit hours (3 credit hours required)**
- CIM 4150 - Concrete Problems: Diagnosis, Prevention, and Dispute Resolution **3 credit hours**
- CIM 4200 - Senior Concrete Lab **2 credit hours**
- CIM 4910 - Capstone **3 credit hours**

Production, Sales, and Service Concentration (17 hours)

- CIM 4050 - Management of Concrete Products: Ordering and Delivering **3 credit hours**
- CIM 4060 - Management of Concrete Products: Production Facilities **3 credit hours**
- CIM 4300 - Concrete Mixture Design **2 credit hours**
- CMT 4160 - Construction Safety and Health Management **3 credit hours**

- ET 3910 - Introduction to Operations Management **3 credit hours** OR
- MGMT 3620 - Supply Chain Operations **3 credit hours**

- CMT 3320 - Architectural Computer-Aided Drafting and Design **3 credit hours** OR
- CIM 4400 - Decorative Concrete **3 credit hours** OR
- CIM 4500 - Masonry **3 credit hours** OR
- CIM 4600 - Design, Production, and Manufacture of Precast Concrete **3 credit hours** OR
- CIM 4800 - Special Problems in Concrete Industry Management **1 to 3 credit hours** OR
- SPAN 1015 - Spanish for Concrete and Construction Management **3 credit hours**

Supporting Courses (25 hours)

- MATH 1630 - College Mathematics for Managerial, Social, and Life Sciences **3 credit hours** OR
- MATH 1720 - Plane Trigonometry **3 credit hours** OR

- MATH 1730 - Pre-Calculus **4 credit hours** OR
- MATH 1810 - Applied Calculus I **3 credit hours** OR
- MATH 1910 - Calculus I **4 credit hours (may be counted in the True Blue Core)**

- GEOL 1030 - Introduction to Earth Science **3 credit hours** AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour**
  OR
- GEOL 1040 - Physical Geology **4 credit hours** AND
- GEOL 1041 - Physical Geology Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours**
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- PSY 3020 - Basic Statistics for Behavioral Science **3 credit hours** OR
- BIA 2610 - Statistical Methods **3 credit hours** OR
- MATH 1530 - Applied Statistics **3 credit hours**

- Electives **11 credit hours**

Business Administration Minor (18 hours)

See **Business Administration Minor** for further information.

Curriculum: Concrete Industry Management, Production, Sales, and Service

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- History and Civic Learning **3 credit hours**

- MATH 1630 - College Mathematics for Managerial, Social, and Life Sciences **3 credit hours** (Quant Lit) OR
- MATH 1720 - Plane Trigonometry **3 credit hours** (Quant Lit) OR
- MATH 1730 - Pre-Calculus **4 credit hours** (Quant Lit) OR
- MATH 1810 - Applied Calculus I **3 credit hours** (Quant Lit) OR
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)

- GEOL 1030 - Introduction to Earth Science **3 credit hours** (Sci Lit) AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour** (Sci Lit)
  OR
- GEOL 1040 - Physical Geology **4 credit hours** (Sci Lit) AND
- GEOL 1041 - Physical Geology Lab **0 credit hours** (Sci Lit)

- CCM 1010 - Introduction to the Concrete and Construction Industry **1 credit hour**
- CCM 2050 - Plan Reading **2 credit hours**
- CSCI 1150 - Computer Orientation **3 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours** (Sci Lit)
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

Subtotal: 29 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships (ECON 2410 and/or PSY 1410 recommended) **6 credit hours**
- History and Civic Learning **3 credit hours**
- CCM 4010 - Concrete and Construction Law **3 credit hours**
- CIM 3000 - Fundamentals of Concrete: Properties and Testing **4 credit hours**
- CIM 3050 - Concrete Construction Methods **3 credit hours**
- CIM 3060 - Understanding the Concrete Construction System **3 credit hours**

- PSY 3020 - Basic Statistics for Behavioral Science **3 credit hours** OR
- BIA 2610 - Statistical Methods **3 credit hours** OR
- MATH 1530 - Applied Statistics **3 credit hours**

Subtotal: 31 Hours

NOTE:

CIM 3300, Concrete Industry Internship, will be taken sometime after the sophomore year for six credits.

Junior

- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
- BLAW 3400 - Legal Environment of Business **3 credit hours**
- CIM 3100 - Applications of Concrete Construction **3 credit hours**
- CIM 3300 - Concrete Industry Internship **1 to 9 credit hours (3 credit hours required)**
- CIM 4050 - Management of Concrete Products: Ordering and Delivering **3 credit hours**
- CMT 4160 - Construction Safety and Health Management **3 credit hours**
- MGMT 3610 - Principles of Management **3 credit hours**
- Electives **6 credit hours**

- FIN 3000 - Survey of Finance **3 credit hours** OR
- FIN 3010 - Principles of Corporate Finance **3 credit hours**

Subtotal: 30 Hours

Senior

- Electives **5 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- CIM 4060 - Management of Concrete Products: Production Facilities **3 credit hours**
- CIM 4150 - Concrete Problems: Diagnosis, Prevention, and Dispute Resolution **3 credit hours**

- CIM 4300 - Concrete Mixture Design **2 credit hours**
- CIM 4910 - Capstone **3 credit hours**
- CIM 4200 - Senior Concrete Lab **2 credit hours**
- CMT 3320 - Architectural Computer-Aided Drafting and Design **3 credit hours**
- MKT 3820 - Principles of Marketing **3 credit hours**

- ET 3910 - Introduction to Operations Management **3 credit hours** OR
- MGMT 3620 - Supply Chain Operations **3 credit hours**

Subtotal: 30 Hours

NOTE:

Students should consult their advisors each semester to plan their schedules. The advisor listing can be found at www.mtsu.edu/ccm/.

Construction Management Minor

Concrete and Construction Management

The minor in Construction Management consists of 18 semester hours.

Required Courses (6 hours)

- CCM 1010 - Introduction to the Concrete and Construction Industry **1 credit hour**
- CCM 2050 - Plan Reading **2 credit hours**
- CCM 3200 - Project Estimating **3 credit hours**

Electives (12 hours)

- 12 hours of Construction Management courses as approved by the minor advisor

NOTE: *No more than 3 credit hours of CMT 3300 may be used.*

Construction Management, Commercial Construction Management Concentration, B.S.

Concrete and Construction Management
615-494-8687
Tom Gormley
Thomas.Gormley@mtsu.edu
www.mtsu.edu/ccm

The Construction Management major is a broad-based program designed to prepare students for positions in the construction industry. Corporate and private construction companies seek graduates to fill job positions in the field and in management. Students may select from concentrations in Land Development/Residential Building Construction Management and Commercial Construction Management. The merging of a strong technical background with the ability to lead personnel and manage systems produces a graduate who is invaluable to the construction industry.

The Commercial Construction Management concentration is designed to prepare students to assume positions of responsibility within the commercial construction industry worldwide. Students who graduate are able to secure positions as project estimators, codes inspectors, assistant project engineers, assistant superintendents or superintendents, assistant or project managers, and/or ultimately owners of construction-related companies. Students will get many hands-on opportunities for learning with the project-based program and will also be able to obtain practical experience in the industry through the internship/cooperative education requirements with companies that construct a variety of commercial structures.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Construction Management, Commercial Construction Management, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**48 hours**
Concrete and Construction Core	*6 hours*
Major Courses	*42 hours*
Supporting Courses	**22 hours***
Electives	**9-16 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1710 (Quant Lit)
- PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111 or PHYS 1110 (Sci Lit)

Major Requirements (48 hours)

Concrete and Construction Core (6 hours)

- CCM 1010 - Introduction to the Concrete and Construction Industry **1 credit hour**
- CCM 2050 - Plan Reading **2 credit hours**
- CCM 4010 - Concrete and Construction Law **3 credit hours**

Major Courses (42 hours)

- CCM 3200 - Project Estimating **3 credit hours**
- CMT 3000 - Commercial Construction and Materials **3 credit hours**
- CMT 3300 - Construction Management Internship **1 to 9 credit hours (3 hours required)**
- CMT 3320 - Architectural Computer-Aided Drafting and Design **3 credit hours**
- CCM 3500 - Land Surveying **3 credit hours**
- CMT 4000 - Soils, Foundations and Earth Moving Equipment **3 credit hours**
- CMT 4100 - Mechanical and Electrical Systems **3 credit hours**
- CMT 4120 - Scheduling **3 credit hours**
- CMT 4140 - Construction Management Principles **3 credit hours**
- CMT 4160 - Construction Safety and Health Management **3 credit hours**
- CMT 4200 - Commercial Cost Estimating and Bidding **3 credit hours**
- CMT 4280 - Commercial Construction Capstone **3 credit hours**
- CMT 4320 - Software Applications for Virtual Design and Construction **3 credit hours**
- CIM 4010 - Design and Construction Issues **3 credit hours**

Supporting Courses (22 hours)

- MATH 1710 - College Algebra **3 credit hours (may be counted in the True Blue Core)**
- MATH 1810 - Applied Calculus I **3 credit hours**
- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
- FIN 3000 - Survey of Finance **3 credit hours**
- BLAW 3400 - Legal Environment of Business **3 credit hours**
- MKT 3820 - Principles of Marketing **3 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours**
  OR
- PHYS 1110 - Discovering Physics **4 credit hours (may be counted in the True Blue Core)**

Electives (9-16 hours)

Curriculum: Construction Management, Commercial Construction Management

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **6 credit hours**
- Human Society and Social Relationships **6 credit hours**
- MATH 1710 - College Algebra **3 credit hours** (Quant Lit)
- MATH 1810 - Applied Calculus I **3 credit hours**
- CCM 1010 - Introduction to the Concrete and Construction Industry **1 credit hour**
- CCM 2050 - Plan Reading **2 credit hours**

Subtotal: 27 Hours

Sophomore

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours** (Sci Lit)
  OR
- PHYS 1110 - Discovering Physics **4 credit hours** (Sci Lit)

- Creativity and Cultural Expression Literature **3 credit hours**
- Scientific Literacy **4 credit hours**
- History and Civic Learning **6 credit hours**
- Non-Written Communication **3 credit hours**
- Elective **3 credit hours**
- CCM 3200 - Project Estimating **3 credit hours**
- CCM 3500 - Land Surveying **3 credit hours**
- CMT 3000 - Commercial Construction and Materials **3 credit hours**

Subtotal: 32 Hours

Junior

- CIM 4010 - Design and Construction Issues **3 credit hours**
- CMT 3300 - Construction Management Internship **1 to 9 credit hours (3 hours required)**
- CMT 3320 - Architectural Computer-Aided Drafting and Design **3 credit hours**
- CMT 4100 - Mechanical and Electrical Systems **3 credit hours**
- CMT 4120 - Scheduling **3 credit hours**
- CMT 4160 - Construction Safety and Health Management **3 credit hours**
- CMT 4320 - Software Applications for Virtual Design and Construction **3 credit hours**
- MKT 3820 - Principles of Marketing **3 credit hours**
- BLAW 3400 - Legal Environment of Business **3 credit hours**
- Elective **5 credit hours**

Subtotal: 32 Hours

Senior

- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
- CMT 4000 - Soils, Foundations and Earth Moving Equipment **3 credit hours**
- CCM 4010 - Concrete and Construction Law **3 credit hours**
- CMT 4140 - Construction Management Principles **3 credit hours**
- CMT 4200 - Commercial Cost Estimating and Bidding **3 credit hours**
- CMT 4280 - Commercial Construction Capstone **3 credit hours**
- FIN 3000 - Survey of Finance **3 credit hours**
- Electives **8 credit hours**

Subtotal: 29 Hours

Construction Management, Land Development/Residential Building Construction Management, B.S.

Concrete and Construction Management
615-494-8737
Duane Vanhook
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www.mtsu.edu/ccm

The Construction Management major is a broad-based program designed to prepare students for positions in the construction industry. Corporate and private construction companies seek graduates to fill job positions in the field and in management. Students may select from two concentrations: Land Development/Residential Building Construction Management and Commercial Construction Management. The merging of a strong technical background with the ability to lead personnel and manage systems produces a graduate who is invaluable to the construction industry.

The Land Development/Residential Building Construction Management concentration offers preparation for a variety of construction-related positions. The concentration is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE). As students progress, they are expected to develop creativity and the communication skills necessary to meet the challenges of industry. Students engage in a variety of activities to build a strong background in the field, including lectures by industry members, field trips, and hands-on activities in the classroom and in the field. The program is designed to prepare graduates for supervisory or staff positions in a variety of construction-related businesses (land development, construction firms, wholesalers of construction materials, construction material manufacturing, lumberyards, etc.) Employment opportunities for graduates include general supervision, project management, human relations, sales and marketing, production and inventory control, quality control, estimating, scheduling, and land development.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Construction Management, Land Development/Residential Building Construction Management, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**54 hours**
Supporting Courses	**29 hours***
Electives	**0-7 hours**
TOTAL	**120-124 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1710, MATH 1720, MATH 1730, MATH 1810, or MATH 1910 (Quant Lit)
- GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041 (Sci Lit)
- PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111 or PHYS 1110 (Sci Lit)

Major Requirements (54 hours)

Concrete and Construction Core (6 hours)

- CCM 1010 - Introduction to the Concrete and Construction Industry **1 credit hour**
- CCM 2050 - Plan Reading **2 credit hours**
- CCM 4010 - Concrete and Construction Law **3 credit hours**

Major Courses (48 hours)

- CCM 3200 - Project Estimating **3 credit hours**
- CMT 3150 - Residential Building Construction and Materials I **3 credit hours**
- CMT 3180 - Construction and Materials II **3 credit hours**
- CMT 3190 - Construction Land Development Operations **3 credit hours**
- CMT 4000 - Soils, Foundations and Earth Moving Equipment **3 credit hours**
- CMT 3210 - Construction Codes and Regulation **3 credit hours**
- CMT 3300 - Construction Management Internship **1 to 9 credit hours (3 hours required)**
- CMT 3320 - Architectural Computer-Aided Drafting and Design **3 credit hours**
- CCM 3500 - Land Surveying **3 credit hours**
- CMT 4100 - Mechanical and Electrical Systems **3 credit hours**
- CMT 4110 - Cost Estimating II **3 credit hours**
- CMT 4120 - Scheduling **3 credit hours**
- CMT 4130 - Construction Administration **3 credit hours**
- CMT 4160 - Construction Safety and Health Management **3 credit hours**
- CMT 4170 - Capstone-LDRB Construction Management **3 credit hours**
- CMT 4320 - Software Applications for Virtual Design and Construction **3 credit hours**

Supporting Courses (29 hours)

- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
- FIN 3030 - Principles of Real Estate **3 credit hours**
- MKT 3820 - Principles of Marketing **3 credit hours**

- INFS 2200 - Introduction to Microcomputing **3 credit hours** OR
- CSCI 1150 - Computer Orientation **3 credit hours**

- SPAN 1010 - Elementary Spanish I **3 credit hours** OR
- SPAN 1015 - Spanish for Concrete and Construction Management **3 credit hours**

- GEOL 1030 - Introduction to Earth Science **3 credit hours** AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour (may be counted in the True Blue Core)** OR
- GEOL 1040 - Physical Geology **4 credit hours** AND
- GEOL 1041 - Physical Geology Lab **0 credit hours (may be counted in the True Blue Core)**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours (may be counted in the True Blue Core)**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours (may be counted in the True Blue Core)**
  OR
- PHYS 1110 - Discovering Physics **4 credit hours (may be counted in the True Blue Core)**

- MATH 1710 - College Algebra **3 credit hours (may be counted in the True Blue Core)** AND
- MATH 1720 - Plane Trigonometry **3 credit hours**
  OR
- MATH 1730 - Pre-Calculus **4 credit hours**
  OR
- MATH 1810 - Applied Calculus I **3 credit hours**
  OR
- MATH 1910 - Calculus I **4 credit hours**

Electives (0-7 hours)

Curriculum: Construction Management, Land Development/Residential Building Construction Management

Students should consult their advisors each semester to plan their schedules.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Non-Written Communication **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- CCM 1010 - Introduction to the Concrete and Construction Industry **1 credit hour**
- CCM 2050 - Plan Reading **2 credit hours**

- INFS 2200 - Introduction to Microcomputing **3 credit hours** OR
- CSCI 1150 - Computer Orientation **3 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours** (Sci Lit)
  OR
- PHYS 1110 - Discovering Physics **4 credit hours** (Sci Lit)

- MATH 1710 - College Algebra **3 credit hours** (Quant Lit) AND
- MATH 1720 - Plane Trigonometry **3 credit hours**
  OR
- MATH 1730 - Pre-Calculus **4 credit hours** (Quant Lit)
  OR
- MATH 1810 - Applied Calculus I **3 credit hours** (Quant Lit)
  OR
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)

Subtotal: 28 Hours

Sophomore

- GEOL 1030 - Introduction to Earth Science **3 credit hours** (Sci Lit) AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour** (Sci Lit)
  OR
- GEOL 1040 - Physical Geology **4 credit hours** (Sci Lit) AND
- GEOL 1041 - Physical Geology Lab **0 credit hours** (Sci Lit)

- SPAN 1010 - Elementary Spanish I **3 credit hours** OR (NWC)
- SPAN 1015 - Spanish for Concrete and Construction Management **3 credit hours**

- CMT 3150 - Residential Building Construction and Materials I **3 credit hours**
- CMT 3180 - Construction and Materials II **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **6 credit hours**
- History and Civic Learning **6 credit hours**

Subtotal: 31 Hours

Junior

- CCM 3200 - Project Estimating **3 credit hours**
- CCM 4010 - Concrete and Construction Law **3 credit hours**
- CMT 3190 - Construction Land Development Operations **3 credit hours**
- CMT 4000 - Soils, Foundations and Earth Moving Equipment **3 credit hours**
- CMT 3210 - Construction Codes and Regulation **3 credit hours**
- CMT 3320 - Architectural Computer-Aided Drafting and Design **3 credit hours**
- CMT 4160 - Construction Safety and Health Management **3 credit hours**
- FIN 3030 - Principles of Real Estate **3 credit hours**
- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
- Elective **3 credit hours**

Subtotal: 30 Hours

Senior

- MKT 3820 - Principles of Marketing **3 credit hours**
- CMT 3300 - Construction Management Internship **1 to 9 credit hours (3 hours required)**
- CCM 3500 - Land Surveying **3 credit hours**
- CMT 4100 - Mechanical and Electrical Systems **3 credit hours**
- CMT 4110 - Cost Estimating II **3 credit hours**
- CMT 4120 - Scheduling **3 credit hours**
- CMT 4130 - Construction Administration **3 credit hours**
- CMT 4170 - Capstone-LDRB Construction Management **3 credit hours**
- CMT 4320 - Software Applications for Virtual Design and Construction **3 credit hours**
- Electives **4 credit hours**

Subtotal: 31 Hours

Road Construction Technology Certificate

Concrete and Construction Management
615-898-2419
Tom Nicholas, director
Tom.Nicholas@mtsu.edu
www.mtsu.edu/ccm

The Road Construction Technology certificate offers students an opportunity to advance their knowledge in this specialized area of construction. This one-year program requires 15 hours.

Road Construction Technology Certificate (15 hours)

- CIM 1500 - Basic Road Construction Safety **2 credit hours**
- CIM 2500 - Road Construction Problem Solving and Decision Making **3 credit hours**
- CIM 2510 - Fundamentals of Road Construction **3 credit hours**
- CIM 2520 - Advanced Road Construction **3 credit hours**
- CIM 3310 - Road Construction Internship I **2 credit hours**
- CIM 3320 - Road Construction Internship II **2 credit hours**

Concrete and Construction Management

CCM 1010 - Introduction to the Concrete and Construction Industry
1 credit hour Overview of the history, career opportunities, job functions, and professional organizations in the concrete and construction industries. Serves as an introduction to the majors within the School of Concrete and Construction Management. Seminar style to include student research and internship presentations, guest lecturers, and potential site visits.

CCM 2050 - Plan Reading
2 credit hours Introduces students to the terminology, symbols, conventions, layout, scales, and general specifications used to develop construction plans. Students examine plans and develop skills in plan reading and interpretation. Topics also include utilizing plans for documentation purposes, creating as-built drawings, quantity take-offs, estimating, and project planning.

CCM 3200 - Project Estimating
3 credit hours Prerequisite: CCM 2050. Introduces students to the fundamentals of preparing detailed construction estimates. Plan reading skills and building systems knowledge applied to determine the scope of work and work sequencing for estimating construction projects. Students use software to perform take-offs and estimate the value of material, labor, equipment, overhead, profit, contingencies, and subcontractor costs.

CCM 3500 - Land Surveying
3 credit hours Prerequisites: MATH 1710 and either MATH 1730 or MATH 1810. Examines surveying operations such as horizontal measurements, differential leveling, transverse loop calculations, layout, topographic mapping, and slope staking for roads and utilities in subdivisions. Surveying instruments used include automatic level, one person laser, theodolite, EDM and drone technology. Two hours lecture and three hours laboratory.

CCM 4010 - Concrete and Construction Law
3 credit hours Provides an overview of the U.S. legal system as applicable to concrete and construction project delivery and contracts. Topics covered include legal theory, ethics, forms of firm ownership, licensing, contracts, project phases, delivery methods, change orders, claims, dispute resolution, and risk management.

CMT 4350 - Cost Estimating for Disaster Restoration and Reconstruction Projects
3 credit hours Prerequisites: CCM 2050 and CCM 3200. Introduces the fundamentals of project estimating for disaster restoration and reconstruction management. Focuses on how to conduct damage assessments, document site conditions, create scopes of work, estimate costs, and use technology in disaster situations. Examines projects requiring emergency services, demolition, restoration, and reconstruction work of varying magnitudes.

Concrete Industry Management

CIM 1050 - Blueprint Reading
1 credit hour Provides a broad-based background in interpreting blueprints. Typical plans for both residential and commercial building reviewed.

CIM 1500 - Basic Road Construction Safety
2 credit hours Prerequisite: Permission of department. The study of best-known safe work practices in the road construction industry. Upon successful completion of the course, student will have a working knowledge of how to be safe as well as maintain a safe work environment. Offers preparation for the MSHA and OSHA certification exams.

CIM 2500 - Road Construction Problem Solving and Decision Making
3 credit hours Prerequisite: Permission of department. Study of various problem solving and decision making methodologies as well as best-known customer service practices. Upon successful completion of this course, student will have a working knowledge of how to quickly analyze the situation and resolve it by using superior communication and negotiation skills.

CIM 2510 - Fundamentals of Road Construction
3 credit hours Prerequisite: Permission of department. Develops fundamental skills in the areas of construction science, building and construction design, material resources, technical writing, applied math, and basic computer skills.

CIM 2520 - Advanced Road Construction
3 credit hours Prerequisite: Permission of department. Further develops skills acquired from CIM 2510 in the areas of construction science,

building and construction design, material resources, technical writing, applied math, and computer skills.

CIM 3000 - Fundamentals of Concrete: Properties and Testing
4 credit hours Prerequisites: CHEM 1010/CHEM 1011 or CHEM 1110/CHEM 1111; CCM 1010. Concrete testing, admixtures, placing, and finishing. Effects of concrete-making materials on properties of fresh and hardened concrete materials. Three hours lecture and three hours laboratory.

CIM 3050 - Concrete Construction Methods
3 credit hours Prerequisite: CCM 1010, or CIM 3000 with grade of C (2.0) or better. Forming and shoring, placing and reinforcing; transporting, placing, consolidating, finishing, jointing, and curing concrete for cast-in-place foundations, pavements, slabs on ground, structural frames, and other structural members; erecting precast concrete members; waterproofing concrete foundations.

CIM 3060 - Understanding the Concrete Construction System
3 credit hours Prerequisite: CIM 3000. Detailed look at how the concrete construction industry works. Includes review of model building codes, building officials and their function, concrete industry codes and standards, concrete construction processes, quality assurance systems, contract documents, and concrete construction markets.

CIM 3070 - Site Planning, Layout, and Preparation
3 credit hours Prerequisites: CCM 1010 and completion of program math requirements. Activities required to successfully prepare a site for concrete work. Includes initial site investigation, surveying, groundwork, subbase preparation, and elevations. Exposes students to modern technological tools and methods such the use of GPS, EDM, and lasers. Two hours lecture and three hours laboratory.

CIM 3080 - Formwork Design and Computerized Drafting
3 credit hours Prerequisite: CIM 3050. Overview of costs and safety with regard to formwork selection, design, and construction. Reviews the various forming systems available and how they may be integrated for use in specific project circumstances. Includes a basic review of CAD drafting techniques and their applications.

CIM 3090 - Computer Applications in Concrete and Construction Industries
3 credit hours Studies most commonly used computer software applications being used by the concrete and construction industries. Upon completion students will have working knowledge of the software in the advanced CIM classes as well as the industry.

CIM 3100 - Applications of Concrete Construction
3 credit hours Prerequisite: CIM 3050. Details many uses of concrete in the construction of buildings, pavements, and other facilities. Emphasis on the advantages, disadvantages, and unique problems faced by materials suppliers, contractors, and design professionals when concrete is chosen for specific applications.

CIM 3300 - Concrete Industry Internship
1 to 9 credit hours Prerequisite: Permission of department. Opportunity for students to gain supervised, practical work experience in their particular field of interest within the concrete industry. The student will be evaluated by internship supervisor, and a final report will be submitted by the student detailing the internship experience.

CIM 3310 - Road Construction Internship I
2 credit hours Prerequisite: Permission of department. This 400-hour, hands-on training will consist of working with earth moving equipment, pavers, compaction equipment, milling and cutting equipment, crushing equipment, recycling/stabilizing equipment, below grade construction. Trained MTSU faculty and industry professionals will lead this effort and put the interns through highly structured training program.

CIM 3320 - Road Construction Internship II
2 credit hours Prerequisite: Permission of department. This 400-hour, hands-on training will further enhance the training received in CIM 3310. It will consist of working with earth moving equipment, pavers, compaction equipment, milling and cutting equipment, crushing equipment, recycling/stabilizing equipment, below grade construction. Trained industry professionals will lead this effort and put the interns through highly structured training program. This training will take place at the participant's dealer location.

CIM 3600 - Advanced Concrete Project Management
3 credit hours Prerequisite: CIM 3060. A continuation of the construction management concepts taught in CIM 3060. Emphasis on application of advanced project management concepts. A group activity involving management of a complex concrete construction project.

CIM 4010 - Design and Construction Issues
3 credit hours Prerequisite: CCM 3200. A review of concrete construction materials and their physical and mechanical properties. Special emphasis placed on the concepts of mechanics of materials and resolving design/construction mismatches.

CIM 4030 - Issues in the Concrete and Construction Industry: A Legal and Ethical Perspective
1 credit hour Prerequisite: CIM 3050. Involves a case study approach to critically analyzing historical and current events in the concrete and construction industry. Particular emphasis on developing a managerial decision-making process incorporating ethical, legal, financial, and other business perspectives.

CIM 4050 - Management of Concrete Products: Ordering and Delivering
3 credit hours Prerequisite: CIM 3100 with C (2.0) or better. Provides student with basic understanding on managing order and delivery processes common to all concrete products. Emphasis on planning, organizing, and controlling at both the first-line supervisory and managerial levels. Key differences in the order and delivery functions of ready mix concrete, concrete masonry, pre-cast concrete, pre-stress concrete, and concrete pipe supplemented by product-specific guest lectures and plant tours.

CIM 4060 - Management of Concrete Products: Production Facilities
3 credit hours Prerequisite: CIM 3100 with C (2.0) or better. Provides student with basic understanding of managing the manufacturing process common to all concrete products production facilities. Emphasis on planning, organizing, and controlling at both the first-line supervisory and managerial levels. Review of key differences in manufacturing process of ready mix concrete, concrete masonry, precast concrete, pre-stress concrete, and concrete pipe explained through product-specific guest lectures and plant tours.

CIM 4070 - Concrete Contracting Personnel Management
3 credit hours Prerequisites: CIM declared major and senior standing. Application of personnel management techniques in the contracting business. Emphasis on adapting management styles to various employee personality traits, training techniques, personal management, effective and efficient management of equipment and other resources, and leadership development.

CIM 4100 - Field Management and Supervision
3 credit hours Prerequisite: Senior standing; CCM 1010 with C (2.0) or better. Offers knowledge and skills to effectively manage concrete construction jobsite activities. Emphasis on safety, equipment identification and use, maintenance, contingency plans, and worksite productivity.

CIM 4150 - Concrete Problems: Diagnosis, Prevention, and Dispute Resolution
3 credit hours Prerequisite: CIM 3100 with C (2.0) or better. Diagnosing and preventing problems related to concrete production, testing, construction, and performance. Identifying causes of fresh and hardened concrete problems such as fast and slow setting, air content variations, low strength, cracking, and scaling. Pre-job conferences and dispute resolution methods.

CIM 4200 - Senior Concrete Lab
2 credit hours Prerequisites: CIM 3000 with C (2.0) or better; senior standing. Opportunity for students to gain in-depth knowledge of the technical aspects of concrete and cement chemistry in a laboratory environment. The student will be evaluated by his/her ability to investigate a concrete situation and resolve the issue with a laboratory project. Graded activities include in-class exercises, written reports, and oral presentations. One hour lecture and three hours laboratory.

CIM 4300 - Concrete Mixture Design
2 credit hours Prerequisite: CIM 3100. A detailed study on the standard practices of designing and proportioning various types of concrete mixtures. Addresses the basic principles that govern the use of different types of cements, aggregates, supplementary cementitious materials, and chemical admixtures in concrete mixture design.

CIM 4400 - Decorative Concrete
3 credit hours Prerequisite: CIM 3000. Understanding and utilizing decorative concrete design applications, production, stamping, staining, and sealing. Manufacturing of concrete countertops, as well as vertical, flooring, and ornamental applications.

CIM 4500 - Masonry
3 credit hours Prerequisite: CIM 3000. Use, types, and manufacture of concrete masonry units. Discusses common techniques and technical considerations relating to construction using concrete masonry. Reviews typical laboratory testing procedures used for very specific compliance of concrete masonry units for use in construction.

CIM 4600 - Design, Production, and Manufacture of Precast Concrete
3 credit hours Prerequisite: CIM 3050. Covers all relevant topics within the precast concrete industry including design, manufacture, handling, transportation, safety, quality, and erection of precast concrete productions. Helps minimize learning curve as a new professional in the precast industry.

CIM 4700 - Global Concrete Production and Construction Technologies
1 to 3 credit hours Prerequisite: Permission of department. EXL course that includes a detailed look and hands-on experience in the concrete and construction industries in another part of the world. Classroom lectures include theoretical concepts and cultural expectations during travel; training portion allows students to apply the knowledge while working in a different culture and part of the world.

CIM 4800 - Special Problems in Concrete Industry Management
1 to 3 credit hours Prerequisites: Permission of department and declared CIM major. Opportunity to pursue projects of individual interest in concrete industry management. Projects may be technical and/or managerial in nature and may require any combination of literature reviews, lab work, field studies, and other research methods. A faculty member will approve a formally submitted proposal for the study, supervise progress, and grade a report and a presentation which are required upon completion of the project. May be repeated for up to 6 hours of undergraduate credit.

CIM 4910 - Capstone
3 credit hours Prerequisite: Permission of department. Intensive study of a problem(s) appropriate to the major and the student's career interest. Solution(s) for problem(s) presented to a committee of concrete industry representatives. Presentation must emphasize depth of analysis, completeness and effectiveness of solution, and presentation skills.

Construction Management Technology

CMT 1100 - Introduction to Construction Systems
3 credit hours Introduces the major systems encountered when managing construction. Includes those operations of the residential and commercial construction industry, their similarities and how they differ in scope and daily practice. Basic entry-level plan reading skills, specifications, estimating and scheduling concepts incorporated as part of the business management functions pertaining to the construction industry. Seminar style to include student research, guest lecturers, and potential site visits. Required for graduation in Construction Management and should be taken prior to beginning CM upper-division coursework.

CMT 3000 - Commercial Construction and Materials
3 credit hours Blueprint reading, commercial construction materials and equipment, commercial construction systems, new materials and procedures, and fundamentals essential to knowledge of the commercial construction field. Lecture, field observations, and site/or plant visits required.

CMT 3150 - Residential Building Construction and Materials I
3 credit hours Provides an introduction to construction documents, building materials, components, systems, construction equipment, and methods of light-frame wood construction. Examines materials and methods with regard to design, specifications, assembly, quality assurance standards, and sustainable building practices.

CMT 3155 - Land Development and Residential Building
3 credit hours Provides an overview of planning, land development, and residential building. Students examine the real estate development process, materials and methods used in the construction of

residential buildings, and the broader economic context of land development and residential building.

CMT 3160 - Cost Estimating I
3 credit hours Prerequisite: CMT 1100 or CMT 3150. Principles and practices involved in the preparation of a cost estimate for a residential home. Topics include introduction to cost estimating, materials, and labor costs for residential building.

CMT 3180 - Construction and Materials II
3 credit hours Prerequisites: CCM 1010 and CCM 2050. Continues the study of building materials, systems, standards and inspections, and construction methods for materials placed after structural completion. Sustainable building practices, efficiency standards, and structural load calculations also examined.

CMT 3190 - Construction Land Development Operations
3 credit hours Introduces the business, process, and management functions of land development operations. Applies a systems approach to the organizational environment and operating functions in land development. Students examine ownership structures, planning, organizing, coordinating, and allocating resources for construction land development.

CMT 3195 - Sustainable Construction
3 credit hours Prerequisite: Junior or senior standing. Introduces current green building technologies and practices, LEED (Leadership in Energy Environmental Design), and NAHB (National Association of Home Builders) Green Building Guidelines. Examines the environmental impact of the building industry and strategies for mitigating environmental impacts by the use of green technologies.

CMT 3210 - Construction Codes and Regulation
3 credit hours Examines building codes and regulations in construction; the role of building and quality control standards; and the regulatory environment for designing, estimating, and building construction.

CMT 3300 - Construction Management Internship
1 to 9 credit hours Prerequisite: Permission of department. Opportunity for students to gain supervised, practical work experience in their particular field of interest within the construction industry. Student will be evaluated by internship supervisor, and a final report/presentation will be submitted by the student to the faculty member detailing the internship experience.

CMT 3320 - Architectural Computer-Aided Drafting and Design
3 credit hours Prerequisite: Junior or senior standing. Applies Building Information Modeling (BIM) to develop skills in intermediate drafting, model manipulation, 3D imaging, visualization, clash detection, constructability, and coordination.

CMT 4000 - Soils, Foundations and Earth Moving Equipment
3 credit hours Prerequisite: Junior or senior status. Properties and testing of soils on a job site, different kinds of foundations used, and an overview of the different kinds and costs of earth moving equipment used in the commercial construction industry.

CMT 4100 - Mechanical and Electrical Systems
3 credit hours Provides an overview of the design, cost, and installation of mechanical, electrical, and plumbing systems in commercial and residential construction. Topics covered include MEP plan reading, technical specifications, plan and specification development, codes, and cost estimating. Also examines procurement, contracting, commissioning, and management methods as performed by contractors and construction managers.

CMT 4110 - Cost Estimating II
3 credit hours Prerequisite: CCM 3200. Builds on the principles of prior courses in estimating, codes, scheduling and contract administration to provide a culmination project in which the total cost of a residential real estate development is explored.

CMT 4120 - Scheduling
3 credit hours Prerequisite: CCM 3200. Introduces students to the fundamentals of construction scheduling and the critical path method (CPM). Work breakdown structures, activity sequencing, durations, network diagrams, scheduling logic, and bar charts developed using software. Students apply scheduling techniques to create and update project schedules, measure progress against baselines, and manage the construction process.

CMT 4130 - Construction Administration
3 credit hours Prerequisites: Senior standing; ACTG 3000 or ACTG 2110 and ACTG 2120 and CMT 3190.

An interdisciplinary course that introduces students to the administrative aspects of project and organization management in construction. Students examine cases and practical scenarios to develop skills in managing the construction process, project accounting, leadership, team management, communication, negotiating, conflict resolution, and risk management.

CMT 4140 - Construction Management Principles
3 credit hours Prerequisite: Junior or senior standing. Detailed look at how the construction industry works. Includes review of model building codes, building officials and their functions, construction industry codes and standards, quality assurance systems, contract documents, and principles of managing construction contracts.

CMT 4160 - Construction Safety and Health Management
3 credit hours Prerequisites: CCM 1010 and CCM 2050. Covers various causes of construction accidents and adopted strategies to prevent worksite injuries and illnesses. Other topics include workers' compensation, economics of construction safety management, and development of a safety program.

CMT 4170 - Capstone-LDRB Construction Management
3 credit hours Prerequisites: CMT 3190, CMT 4120, and CMT 4130; permission of department. A capstone course for students preparing to enter the land development and residential building industry. Students plan a residential land development project from conceptualization to close-out. Students develop skills in land use planning, land development, feasibility studies, market analysis, site analysis, design, codes, estimating, scheduling, financing, marketing, and business planning. A final project portfolio is prepared and presented to a board of industry representatives. Pass/Fail.

CMT 4172 - Capstone for Electrical Construction Management
3 credit hours Prerequisite: Permission of department. A capstone course for students pursuing their degrees and careers in electrical construction management. Students develop an electrical project proposal and portfolio to present to a board of industry representatives. Pass/Fail.

CMT 4200 - Commercial Cost Estimating and Bidding
3 credit hours
Prerequisites: CCM 2050 and CCM 3200. Provides students an introduction to preconstruction and estimating on commercial building projects. Students complete quantity take-offs, evaluate and make recommendations on subcontractor bids, and utilize a web-based estimating program. Students will be required to develop a complete estimate for a small commercial building.

CMT 4280 - Commercial Construction Capstone
3 credit hours Prerequisite: Permission of department. Construction portfolio presented to subcommittee of advisory committee. Pictures and/or projects developed in junior- and senior-level commercial construction classes included; all facets of a commercial construction project from inception to completion. To be taken last semester. Pass/Fail.

CMT 4320 - Software Applications for Virtual Design and Construction
3 credit hours Prerequisite: CMT 3320 with C (2.0) or better. Introduces advanced virtual design and construction technologies with applications of current software, processes, and modeling platforms common in design and construction.

CMT 4360 - Emerging Technologies in Construction
3 credit hours Prerequisite: Junior or senior standing. Provides an overview of emerging technologies currently being tested and utilized in multiple sectors of the construction industry. Students will examine how new technologies are employed to improve project management, estimating, inspections, design, and safety. Advantages, implementation barriers, practical problem solving, and concepts related to change management analyzed in depth using cases and applied research methods.

CMT 4800 - Construction Management Special Problems

1 to 3 credit hours Prerequisite: Permission of department. Opportunity to pursue projects of individual interest in construction management. Projects may be technical and/or managerial in nature and may require any combination of literature reviews, lab work, field studies, and other research methods. A faculty member will approve a formally submitted proposal for the study, supervise progress, and grade a report and a presentation which are required upon completion of the project. May be repeated for up to 6 hours of undergraduate credit.

Engineering Technology

Kenneth Currie, Chair

Bedekar, Chen, Foroudastan, Hu, Khiabani, Ledoux, Miao, Mohebbi, Pham, Rowe, Saavedra, Salman, Sbenaty, Sridhara, Vargas

The purpose of the programs offered in this department is to prepare students for a broad range of engineering, technical, and industrial management positions. This is accomplished through nationally accredited programs, a project-based learning environment, and extensive collaboration with industry. The department faculty members have appropriate academic credentials in addition to significant industrial experience. Numerous opportunities are available for students to participate in nationally competitive projects related to topics as diverse as space robotics, solar-powered vehicles, etc. Several programs require heavy interaction with the industrial sector, which allows students to work on projects with potential employers. Experiential learning opportunities exist through cooperative and internship classes. Highly motivated students may wish to obtain important industry-recognized certifications that exceed accreditation requirements. Students may study an array of the latest breakthroughs in topic areas such as mechatronics engineering, engineering technology, engineering systems, rapid prototyping of electrical and mechanical systems, safety, and environmental sustainability. The combination of these programs and activities offers preparation for graduates entering the fast-paced technology sector.

The Robert E. and Georgianna West Russell Chair of Manufacturing Excellence is designed to promote quality interaction with local industry. Students are encouraged to benefit from the scheduled activities, seminars, and short courses sponsored by the Chair of Manufacturing Excellence.

The department offers Bachelor of Science degrees in Engineering Technology and Mechatronics Engineering.

The Engineering Technology major includes three concentrations: Computer Engineering Technology, Electromechanical Engineering Technology, and Mechanical Engineering Technology.

Mechatronics Engineering blends the disciplines of mechanical, electrical, and computer engineering using a systems integration and design approach. Demand for graduates is extremely high.

Minors are offered in Engineering Technology, Electronics, and Engineering Systems.

Courses are offered which apply toward Six Sigma certification, Lean Manufacturing certification, and Project Management Professional certification.

Cooperative Education work experiences are possible for most programs. Interested students should check with their advisors.

Graduate Study

The Engineering Technology Department offers the Master of Science with thesis and non-thesis options. Requirements and a list of graduate courses offered may be found in the Graduate Catalog.

Electrical Engineering Minor

Engineering Technology
Lei Miao
615-898-2256
Lei.Miao@mtsu.edu

The minor in Electrical Engineering requires 18 semester hours. Required prerequisites must be met for all courses. Students minoring in Electrical Engineering should work closely with their minor advisors to determine what additional prerequisites are needed. A GPA of 2.0 is required in the Electrical Engineering minor.

Required Courses (15 hours)

- ENGR 2130 - Electrical Circuit Analysis I **3 credit hours**
- ENGR 3510 - Electrical Circuit Analysis II **3 credit hours**
- ENGR 3520 - Digital Circuits Fundamentals **3 credit hours**
- ENGR 3530 - Electronics and Instrumentation **3 credit hours**
- ENGR 3540 - Introduction to Feedback Control **3 credit hours**

Guided Elective (3 hours)

Select one:

- ENGR 4520 - Electrical Power and Machinery **3 credit hours**
- ENGR 4530 - Controls and Optimization **3 credit hours**

Electronics Minor

Engineering Technology

The minor in Electronics consists of at least 16 semester hours. Only non-majors may minor in Electronics.

Required Courses (10 hours)

- ET 3610 - Introduction to Electricity and Electronics **4 credit hours**
- ET 3620 - Digital Circuits Fundamentals **3 credit hours**
- ET 3630 - Electronics **3 credit hours**

Electives (6 hours)

Choose two courses from the following:

- ET 3640 - Digital Circuits Design **3 credit hours**
- ET 3650 - Introduction to Microprocessors **3 credit hours**
- ET 3660 - Communication Electronics **3 credit hours**
- ET 3670 - Computer-Assisted Printed Circuit Board Design **2 credit hours**
- ET 4600 - Programmable Logic Controllers **3 credit hours**
- ET 4610 - Instrumentation and Controls **3 credit hours**
- ET 4640 - Industrial Electricity **3 credit hours**
- ET 4660 - Microprocessor Interfacing **3 credit hours**
- ET 4670 - Microprocessor Design **3 credit hours**
- ET 4790 - Advanced Problems in Technology **3 credit hours**

Engineering Systems Minor

Engineering Technology

The 15-hour minor in Engineering Systems is available to Engineering Technology majors as well as other MTSU majors and offers preparation for positions in both the industrial and service sectors. Industry sought-after certifications can be earned in Lean Manufacturing and/or Six Sigma (Greenbelt level) upon completion of an industry project during an industry internship. Core competitive attributes applicable to all enterprises are emphasized and include quality, cost, and delivery systems (QCD) through successful completion of the following 3-hour semester courses:

Required Courses (15 hours)

- ET 3910 - Introduction to Operations Management **3 credit hours** (online)
- ET 3920 - Industrial Internship I **3 credit hours**
- ET 3960 - Industrial Quality Technology **3 credit hours** (hybrid online)
- ET 4900 - Productivity Strategies **3 credit hours** (online)
- ENGR 3930 - Systems Engineering **3 credit hours**

Engineering Technology Minor

Engineering Technology

The minor in Engineering Technology consists of 18 semester hours of courses as approved by the minor advisor. A minimum of 9 hours must be upper-division courses. The minor must include 8 semester hours in one of the following areas: drafting, electronics, engineering, industrial facilities and management, metals, or safety.

Engineering Technology, Computer Engineering Technology Concentration, B.S.

Engineering Technology
615-898-2776
Saleh Sbenaty, program coordinator
Saleh.Sbenaty@mtsu.edu

Engineering Technology is a technologically advanced program at the Bachelor of Science level utilizing theoretical concepts and hands-on instruction. Program selection is from the following concentrations: Computer Engineering Technology, Electromechanical Engineering Technology, and Mechanical Engineering Technology.

The Computer Engineering Technology concentration is accredited by the Engineering Technology Accreditation Commission of ABET (www.abet.org) under the General Criteria and the Computer Engineering Technology Program Criteria. The Computer Engineering Technology concentration provides the student with a sound technical base in electric and electronic circuits, digital systems, and computer hardware, software, and networking. Microcontroller, microprocessor, FPGA, embedded system, and microcomputer applications in the area of control and automation as well as programming, data acquisition, transfer, and analysis are also emphasized.

Employment opportunities exist in various fields that require the design, development, analysis, implementation, operation, optimization, and maintenance of electronic circuits, computer hardware, software, networking systems, and/or embedded computer systems. Typical employers include manufacturing, medical, aerospace, instrumentation and control, electrical power management, networking, and customer service sectors.

NOTE: *A grade of C or better is required on transfer credits accepted as part of a major in Engineering Technology.*

Academic Map

Following is a printable, suggested four-year schedule of courses:

Engineering Technology, Computer Engineering Technology, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**53 hours**
Engineering Technology Core	*21 hours*
Computer Engineering Technology Concentration	*32 hours*
Supporting Courses	**44 hours***
TOTAL	**124-138 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 124 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1730 (Quant Lit)
- CHEM 1010/CHEM 1011 (Sci Lit)
- PHYS 2010/PHYS 2011 (Sci Lit)
- COMM 2200 (NWC)

Major Requirements (53 hours)

Engineering Technology Core (21 hours)

- ENGR 1100 - Engineering Fundamentals **3 credit hours**
- ENGR 3915 - Technical Project Management and Soft Skills **3 credit hours**
- ENGR 3920 - Engineering Safety **3 credit hours**
- ENGR 3970 - Engineering Economy **3 credit hours**
- ET 3601 - Electrical Circuit Analysis I **3 credit hours**
- ET 3602 - Electrical Circuit Analysis II **3 credit hours**

Computer Engineering Technology Capstone

- ET 4801 - Computer Engineering Technology **1 to 3 credit hours (3 credit hours required)**

Computer Engineering Technology Concentration (32 hours)

- ET 3620 - Digital Circuits Fundamentals **3 credit hours**
- ET 3630 - Electronics **3 credit hours**
- ET 3640 - Digital Circuits Design **3 credit hours**
- ET 3650 - Introduction to Microprocessors **3 credit hours**
- ET 3670 - Computer-Assisted Printed Circuit Board Design **2 credit hours**
- ET 4600 - Programmable Logic Controllers **3 credit hours**
- ET 4610 - Instrumentation and Controls **3 credit hours**
- ET 4630 - Local Area Networks **3 credit hours**
- ET 4640 - Industrial Electricity **3 credit hours**
- ET 4660 - Microprocessor Interfacing **3 credit hours**
- ET 4670 - Microprocessor Design **3 credit hours**

Supporting Courses (44 hours)

- COMM 2200 - Audience-Centered Communication **3 credit hours (may be counted in the True Blue Core)**
- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**
- CSCI 3160 - Introduction to Assembly Language **3 credit hours**
- CSCI 3180 - Introduction to Numerical Analysis **3 credit hours**
- ENGL 3620 - Professional Writing **3 credit hours**
- MATH 1730 - Pre-Calculus **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1910 - Calculus I **4 credit hours**
- MATH 1920 - Calculus II **4 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours (may be counted in the True Blue Core)**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

Optional Computer Science Minor

The minor will include CSCI 1170, CSCI 2170, CSCI 3160, CSCI 3180 (14 hours) and at least 3 additional hours in upper-division computer science courses as approved by the minor and major advisors.

Curriculum: Engineering Technology, Computer Engineering Technology

Students should consult their advisors each semester to plan their schedules.

Freshman

- COMM 2200 - Audience-Centered Communication **3 credit hours** (NWC)
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- MATH 1730 - Pre-Calculus **4 credit hours** (Quant Lit)
- MATH 1910 - Calculus I **4 credit hours**
- ENGR 1100 - Engineering Fundamentals **3 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

Subtotal: 30 Hours

Sophomore

- MATH 1920 - Calculus II **4 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- ENGL 3620 - Professional Writing **3 credit hours**
- ET 3601 - Electrical Circuit Analysis I **3 credit hours**
- ET 3602 - Electrical Circuit Analysis II **3 credit hours**
- ET 3620 - Digital Circuits Fundamentals **3 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**

Subtotal: 33 Hours

Junior

- History and Civic Learning **3 credit hours**
- ET 3630 - Electronics **3 credit hours**
- ET 3640 - Digital Circuits Design **3 credit hours**
- ET 3650 - Introduction to Microprocessors **3 credit hours**
- ET 4600 - Programmable Logic Controllers **3 credit hours**
- ET 4630 - Local Area Networks **3 credit hours**
- ET 4660 - Microprocessor Interfacing **3 credit hours**
- CSCI 3160 - Introduction to Assembly Language **3 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

Subtotal: 31 Hours

Senior

- History and Civic Learning **3 credit hours**
- CSCI 3180 - Introduction to Numerical Analysis **3 credit hours**
- ENGR 3915 - Technical Project Management and Soft Skills **3 credit hours**
- ET 3670 - Computer-Assisted Printed Circuit Board Design **2 credit hours**
- ET 4610 - Instrumentation and Controls **3 credit hours**
- ET 4670 - Microprocessor Design **3 credit hours**
- ENGR 3920 - Engineering Safety **3 credit hours**
- ET 4801 - Computer Engineering Technology **1 to 3 credit hours (3 credit hours required)**
- ENGR 3970 - Engineering Economy **3 credit hours**
- ET 4640 - Industrial Electricity **3 credit hours**

Subtotal: 30 Hours

Engineering Technology, Electromechanical Engineering Technology Concentration, B.S.

Engineering Technology
615-898-2776
Jorge Vargas, program coordinator
Jorge.Vargas@mtsu.edu

Engineering Technology is a technologically advanced program at the Bachelor of Science level utilizing theoretical concepts and hands-on instruction. Program selection is from the following concentrations: Computer Engineering Technology, Electromechanical Engineering Technology, and Mechanical Engineering Technology.

The Electromechanical Engineering Technology concentration is accredited by the Engineering Technology Accreditation Commission of ABET (www.abet.org) under the General Criteria and the Electromechanical Engineering Technology Program Criteria. The Electromechanical Engineering Technology concentration is structured to prepare the student for positions in industry requiring the integration of electricity (for power and control) and mechanical devices (for force and motion) to perform tasks associated with manufacturing and the performance of services.

Employment opportunities exist in fields such as robotics, fluid power, industrial electricity, heating and air conditioning, and industrial automation. This concentration is in high demand from technology-based companies such as automotive and high-tech manufacturing operations.

NOTE: *A grade of C or better is required on transfer credits accepted as part of a major in Engineering Technology.*

Academic Map

Following is a printable, suggested four-year schedule of courses:
Engineering Technology, Electromechanical Engineering Technology, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**66 hours**
Engineering Technology Core	*21 hours*
Electromechanical Engineering Technology Concentration	*45 hours*
Supporting Courses	**31 hours***
TOTAL	**124-138 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 124 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1730 (Quant Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)
- PHYS 2010/PHYS 2011 (Sci Lit)
- COMM 2200 (NWC)

Major Requirements (66 hours)

Engineering Technology Core (21 hours)

- ENGR 1100 - Engineering Fundamentals **3 credit hours**
- ENGR 3915 - Technical Project Management and Soft Skills **3 credit hours**
- ENGR 3920 - Engineering Safety **3 credit hours**
- ENGR 3970 - Engineering Economy **3 credit hours**
- ET 3601 - Electrical Circuit Analysis I **3 credit hours**
- ET 3602 - Electrical Circuit Analysis II **3 credit hours**

Electromechanical Engineering Technology Capstone

- ET 4802 - Electromechanical Engineering Technology **1 to 3 credit hours (3 credit hours required)**

Electromechanical Engineering Technology Concentration (45 hours)

- ENGR 2210 - Introduction to Materials Science and Engineering **3 credit hours**
- ENGR 2110 - Statics **3 credit hours**
- ET 2310 - Computer-Assisted Drafting and Design I **3 credit hours**
- ET 3210 - Machine Tool Technology **3 credit hours**
- ET 3360 - Computer-Assisted Drafting and Design II **3 credit hours**
- ET 3620 - Digital Circuits Fundamentals **3 credit hours**
- ET 3630 - Electronics **3 credit hours**
- ET 3650 - Introduction to Microprocessors **3 credit hours**
- ET 3810 - Engineering Thermodynamics **3 credit hours**
- ET 3860 - Strength of Materials **3 credit hours**
- ET 4600 - Programmable Logic Controllers **3 credit hours**
- ET 4610 - Instrumentation and Controls **3 credit hours**
- ET 4640 - Industrial Electricity **3 credit hours**
- ET 4850 - Fluid Power **3 credit hours**
- ET 4860 - Robotics **3 credit hours**

Supporting Courses (31 hours)

- COMM 2200 - Audience-Centered Communication **3 credit hours (may be counted in the True Blue Core)**
- CSCI 1170 - Computer Science I **4 credit hours**
- MATH 1730 - Pre-Calculus **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1910 - Calculus I **4 credit hours**
- MATH 2110 - Data Analysis **1 credit hour**

- MATH 1530 - Applied Statistics **3 credit hours** OR
- PSY 3020 - Basic Statistics for Behavioral Science **3 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours (may be counted in the True Blue Core)**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

Curriculum: Engineering Technology, Electromechanical Engineering Technology

Students should consult their advisors each semester to plan their schedules.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- MATH 1730 - Pre-Calculus **4 credit hours** (Quant Lit)
- MATH 1910 - Calculus I **4 credit hours**
- ENGR 1100 - Engineering Fundamentals **3 credit hours**
- ENGR 2210 - Introduction to Materials Science and Engineering **3 credit hours**
- ET 2310 - Computer-Assisted Drafting and Design I **3 credit hours**
- COMM 2200 - Audience-Centered Communication **3 credit hours** (NWC)

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

Subtotal: 33 Hours

Sophomore

- MATH 1530 - Applied Statistics **3 credit hours** OR
- PSY 3020 - Basic Statistics for Behavioral Science **3 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Nat Sci) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Nat Sci)

- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **6 credit hours**
- ET 3210 - Machine Tool Technology **3 credit hours**
- ET 3601 - Electrical Circuit Analysis I **3 credit hours**
- ET 3602 - Electrical Circuit Analysis II **3 credit hours**
- ET 3620 - Digital Circuits Fundamentals **3 credit hours**
- ET 3360 - Computer-Assisted Drafting and Design II **3 credit hours**

Subtotal: 31 Hours

Junior

- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- MATH 2110 - Data Analysis **1 credit hour**
- CSCI 1170 - Computer Science I **4 credit hours**
- ENGR 2110 - Statics **3 credit hours**
- ET 3630 - Electronics **3 credit hours**
- ET 3810 - Engineering Thermodynamics **3 credit hours**
- ET 3860 - Strength of Materials **3 credit hours**
- ENGR 3920 - Engineering Safety **3 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

Subtotal: 30 Hours

Senior

- Human Society and Social Relationships **3 credit hours**
- ENGR 3915 - Technical Project Management and Soft Skills **3 credit hours**
- ET 3650 - Introduction to Microprocessors **3 credit hours**
- ET 4600 - Programmable Logic Controllers **3 credit hours**
- ET 4610 - Instrumentation and Controls **3 credit hours**
- ET 4640 - Industrial Electricity **3 credit hours**
- ET 4802 - Electromechanical Engineering Technology **1 to 3 credit hours (3 credit hours required)**
- ET 4850 - Fluid Power **3 credit hours**
- ET 4860 - Robotics **3 credit hours**
- ENGR 3970 - Engineering Economy **3 credit hours**

Subtotal: 30 Hours

Engineering Technology, Mechanical Engineering Technology Concentration, B.S.

Engineering Technology
615-898-2776
TBD, program coordinator

Engineering Technology is a technologically advanced program at the Bachelor of Science level utilizing theoretical concepts and hands-on instruction. Program selection is from the following concentrations: Computer Engineering Technology, Electromechanical Engineering Technology, and Mechanical Engineering Technology.

The Mechanical Engineering Technology concentration is accredited by the Engineering Technology Accreditation Commission of ABET (www.abet.org) under the General Criteria and the Mechanical Engineering Technology Program Criteria. The Mechanical Engineering Technology concentration enables students to obtain the skills necessary for placement in highly competitive jobs in machine design, manufacturing, engineering, field service engineering, technical sales, thermal analysis, product design, utilities operations, air conditioning design, plant operations, and a variety of other professions. Through design projects and laboratory training, students examine how to relate such skills to a variety of fields in mechanical engineering technology including product and machine design, power generation, utilities, and manufacturing. The educational quality of this program is especially high in that it provides students with the opportunity to mesh their in-class experiences with project-oriented assignments and real-world experience in national competitions such as the Great Moonbuggy Race, SAE Formula One Collegiate Competition, and the Mini Baja Race.

The prospects for a graduate in mechanical engineering technology are as broad as the major concentration itself. Graduates can expect opportunities to work on a variety of projects from developing and producing engines and transportation equipment in the automobile, ship, rail, and aviation industries to working as a member of an engineering technologist design team to improve high-performance automobiles and air-conditioned environments. Students graduating from mechanical engineering technology programs often find themselves in highly responsible, challenging, and extremely rewarding positions.

NOTE: *A grade of C or better is required on transfer credits accepted as part of a major in Engineering Technology.*

Academic Map

Following is a printable, suggested four-year schedule of courses:
Engineering Technology, Mechanical Engineering Technology, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**67 hours**
Engineering Technology Core	*21 hours*
Mechanical Engineering Technology Concentration	*46 hours*
Supporting Courses	**30 hours***
TOTAL	**124-138 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 124 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1730 (Quant Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)
- PHYS 2010/PHYS 2011 (Sci Lit)
- COMM 2200 (NWC)

Major Requirements (67 hours)

Engineering Technology Core (21 hours)

- ENGR 1100 - Engineering Fundamentals **3 credit hours**
- ENGR 3915 - Technical Project Management and Soft Skills **3 credit hours**
- ENGR 3920 - Engineering Safety **3 credit hours**
- ENGR 3970 - Engineering Economy **3 credit hours**
- ET 3601 - Electrical Circuit Analysis I **3 credit hours**
- ET 3602 - Electrical Circuit Analysis II **3 credit hours**

Mechanical Engineering Technology Capstone

- ET 4803 - Mechanical Engineering Technology **1 to 3 credit hours (3 credit hours required)**

Mechanical Engineering Technology Concentration (46 hours)

- ENGR 2210 - Introduction to Materials Science and Engineering **3 credit hours**
- ENGR 2110 - Statics **3 credit hours**
- ENGR 2120 - Dynamics **3 credit hours**
- ET 2310 - Computer-Assisted Drafting and Design I **3 credit hours**
- ET 2920 - Industrial Orientation Internship **1 to 3 credit hours (1 credit hour required)**
- ET 3210 - Machine Tool Technology **3 credit hours**
- ET 3260 - Manufacturing Processes and Materials **3 credit hours**
- ET 3360 - Computer-Assisted Drafting and Design II **3 credit hours**
- ET 3810 - Engineering Thermodynamics **3 credit hours**
- ET 3860 - Strength of Materials **3 credit hours**
- ET 4330 - Advanced Computer-Aided Drafting **3 credit hours**
- ET 4340 - Design of Machine Elements **3 credit hours**
- ET 4815 - Heating, Ventilation, and Air Conditioning **3 credit hours**
- ET 4830 - Vibration **3 credit hours**
- ET 4850 - Fluid Power **3 credit hours**
- ET 4860 - Robotics **3 credit hours**

Supporting Courses (30 hours)

- COMM 2200 - Audience-Centered Communication **3 credit hours (may be counted in the True Blue Core)**
- CSCI 1170 - Computer Science I **4 credit hours**
- MATH 1730 - Pre-Calculus **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1910 - Calculus I **4 credit hours**
- MATH 1920 - Calculus II **4 credit hours**
- ENGL 3620 - Professional Writing **3 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours (may be counted in the True Blue Core)**

Curriculum: Engineering Technology, Mechanical Engineering Technology

Students should consult their advisors each semester to plan their schedules.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- MATH 1730 - Pre-Calculus **4 credit hours** (Quant Lit)
- MATH 1910 - Calculus I **4 credit hours**
- ENGR 1100 - Engineering Fundamentals **3 credit hours**
- ENGR 2210 - Introduction to Materials Science and Engineering **3 credit hours**
- ET 2310 - Computer-Assisted Drafting and Design I **3 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

Subtotal: 31 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **3 credit hours**
- Creativity and Cultural Expression **6 credit hours**
- MATH 1920 - Calculus II **4 credit hours**
- ENGR 2110 - Statics **3 credit hours**
- ET 3210 - Machine Tool Technology **3 credit hours**
- ET 3360 - Computer-Assisted Drafting and Design II **3 credit hours**
- ET 3601 - Electrical Circuit Analysis I **3 credit hours**
- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)

Subtotal: 32 Hours

Junior

- COMM 2200 - Audience-Centered Communication **3 credit hours** (NWC)
- Human Society and Social Relationships **3 credit hours**
- History and Civic Learning **3 credit hours**
- ENGL 3620 - Professional Writing **3 credit hours**
- ENGR 2120 - Dynamics **3 credit hours**
- ET 3260 - Manufacturing Processes and Materials **3 credit hours**
- ET 3602 - Electrical Circuit Analysis II **3 credit hours**
- ET 3810 - Engineering Thermodynamics **3 credit hours**
- ET 3860 - Strength of Materials **3 credit hours**
- ET 4330 - Advanced Computer-Aided Drafting **3 credit hours**

Subtotal: 30 Hours

Senior

- Human Society and Social Relationships **3 credit hours**
- ET 4340 - Design of Machine Elements **3 credit hours**
- ENGR 3920 - Engineering Safety **3 credit hours**
- ET 4850 - Fluid Power **3 credit hours**
- ENGR 3970 - Engineering Economy **3 credit hours**
- ET 4815 - Heating, Ventilation, and Air Conditioning **3 credit hours**
- ET 4860 - Robotics **3 credit hours**
- ET 4803 - Mechanical Engineering Technology **1 to 3 credit hours (3 credit hours required)**
- ET 4830 - Vibration **3 credit hours**
- ENGR 3915 - Technical Project Management and Soft Skills **3 credit hours**
- ET 2920 - Industrial Orientation Internship **1 to 3 credit hours (1 credit hour)**

Subtotal: 31 Hours

Mechatronics Engineering, B.S.

Engineering Technology
Ken Currie, department chair
Ken.Currie@mtsu.edu
615-898-2098

The Mechatronics Engineering degree encompasses knowledge and skills in mechanical engineering, electronics engineering, digital controls, computer programming, and project management to enable the students to analyze and design automation and robotics systems used in today's advanced manufacturing environment. This program offers preparation in diagnostics and design of integrated industrial automation systems as well as the various aspects of project and process management, systems engineering, and risk management. This program emphasizes the latest techniques in systems approach in design and problem solving which is highly supported by today's industry. The Mechatronics Engineering program is designed to prepare students for engineering positions as automation system designers and project managers in various industries such as automotive, aerospace, advanced manufacturing, green energy, biotechnology, healthcare, homeland security and defense, and transportation and logistics.
The Mechatronics Engineering program at MTSU is accredited by the Engineering Accreditation Commission of ABET, www.abet.org, under the General Criteria.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Mechatronics Engineering, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**64 hours**
Supporting Courses	**34 hours***
TOTAL	**128-139 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 128 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- PHYS 2110/PHYS 2111 (Sci Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)

Major Requirements (64 hours)

- ENGR 1100 - Engineering Fundamentals **3 credit hours**
- ENGR 2210 - Introduction to Materials Science and Engineering **3 credit hours**
- ENGR 2100 - Introduction to Engineering Design **3 credit hours**
- ENGR 2110 - Statics **3 credit hours**
- ENGR 2120 - Dynamics **3 credit hours**
- ENGR 2130 - Electrical Circuit Analysis I **3 credit hours**

- ENGR 3510 - Electrical Circuit Analysis II **3 credit hours**
- ENGR 3520 - Digital Circuits Fundamentals **3 credit hours**
- ENGR 3530 - Electronics and Instrumentation **3 credit hours**
- ENGR 3540 - Introduction to Feedback Control **3 credit hours**
- ENGR 3550 - Fluid Mechanics **3 credit hours**
- ENGR 3560 - Mechanics of Materials **3 credit hours**
- ENGR 3590 - Kinematics and Dynamics of Machinery **3 credit hours**
- ENGR 3915 - Technical Project Management and Soft Skills **3 credit hours**
- ENGR 3970 - Engineering Economy **3 credit hours**
- ENGR 4500 - FE Exam Preparation **1 credit hour**
- ENGR 4501 - Topics in Mechatronics Engineering **1 to 3 credit hours (3 credit hours required)**
- ENGR 4510 - Programmable Logic Controllers and Networks **3 credit hours**
- ENGR 4520 - Electrical Power and Machinery **3 credit hours**
- ENGR 4530 - Controls and Optimization **3 credit hours**
- ENGR 4580 - Mechatronic System Design **3 credit hours**
- ENGR 4590 - Automation System Design **3 credit hours**

Supporting Courses (34 hours)

- CSCI 1170 - Computer Science I **4 credit hours**
- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3120 - Differential Equations I **3 credit hours**

- MATH 2010 - Elements of Linear Algebra **3 credit hours** OR
- MATH 2050 - Probability and Statistics **3 credit hours** OR
- MATH 3180 - Introduction to Numerical Analysis **3 credit hours** OR
- MATH 3260 - Differential Equations II **3 credit hours** OR
- MATH 4200 - Introduction to Mathematics of Investment **3 credit hours** OR
- MATH 4230 - Vector Analysis **3 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours**
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours (may be counted in the True Blue Core)**

- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Curriculum: Mechatronics Engineering

Students should consult their advisors each semester to plan their schedules.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**
- ENGR 1100 - Engineering Fundamentals **3 credit hours**
- ENGR 2100 - Introduction to Engineering Design **3 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- PHYS 2110 - Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours** (Sci Lit)

Subtotal: 34 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **3 credit hours**
- ENGR 2110 - Statics **3 credit hours**
- ENGR 2120 - Dynamics **3 credit hours**
- ENGR 2130 - Electrical Circuit Analysis I **3 credit hours**
- ENGR 2210 - Introduction to Materials Science and Engineering **3 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3120 - Differential Equations I **3 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**

- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Subtotal: 33 Hours

Junior

- Non-Written Communication **3 credit hours**
- ENGR 3510 - Electrical Circuit Analysis II **3 credit hours**
- ENGR 3520 - Digital Circuits Fundamentals **3 credit hours**
- ENGR 3530 - Electronics and Instrumentation **3 credit hours**
- ENGR 3550 - Fluid Mechanics **3 credit hours**
- ENGR 3560 - Mechanics of Materials **3 credit hours**
- ENGR 3590 - Kinematics and Dynamics of Machinery **3 credit hours**
- ENGR 3915 - Technical Project Management and Soft Skills **3 credit hours**
- ENGR 3970 - Engineering Economy **3 credit hours**
- ENGR 4501 - Topics in Mechatronics Engineering **1 to 3 credit hours (3 credit hours required)**

- MATH 2010 - Elements of Linear Algebra **3 credit hours** OR
- MATH 2050 - Probability and Statistics **3 credit hours** OR
- MATH 3180 - Introduction to Numerical Analysis **3 credit hours** OR
- MATH 3260 - Differential Equations II **3 credit hours** OR
- MATH 4200 - Introduction to Mathematics of Investment **3 credit hours** OR
- MATH 4230 - Vector Analysis **3 credit hours**

Subtotal: 33 hours

Senior

- ENGR 3540 - Introduction to Feedback Control **3 credit hours**
- ENGR 4500 - FE Exam Preparation **1 credit hour**
- ENGR 4510 - Programmable Logic Controllers and Networks **3 credit hours**
- ENGR 4520 - Electrical Power and Machinery **3 credit hours**
- ENGR 4530 - Controls and Optimization **3 credit hours**
- ENGR 4580 - Mechatronic System Design **3 credit hours**
- ENGR 4590 - Automation System Design **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **3 credit hours**

Subtotal: 28 Hours

Engineering

ENGR 1100 - Engineering Fundamentals
3 credit hours Prerequisite: MATH 1630, MATH 1730, or MATH 1910. Introduces various engineering fields. Emphasis on problem-solving techniques and the use of mathematics in analyzing technical problems. Topics such as graphical representation of data, estimation, dimensions, units, error estimates, statistics, and team work addressed. Engineering ethics and impact of engineering solutions on society and the environment.

ENGR 2100 - Introduction to Engineering Design
3 credit hours Introduction to computer-aided design (CAD) for product design, modeling, and prototyping. Individual use and team-based environment to design and prototype a functional and manufacturable marketable product. Application to design, manufacturing, and analysis using geometric tolerancing and dimensioning. Two hours lecture and three hours laboratory.

ENGR 2110 - Statics
3 credit hours Prerequisites: ENGR 1100, MATH 1910, and PHYS 2011 or PHYS 2111. Mechatronics Engineering majors must complete PHYS 2111. Fundamental concepts and conditions of static equilibrium; their application to systems of forces and couples acting on rigid bodies; and the calculation of centers of gravity, centroids, and moments of inertia.

ENGR 2120 - Dynamics
3 credit hours Prerequisites: ENGR 2110 and MATH 1920. Kinematics of particles in rectilinear and curvilinear motions. Kinetics of particles, Newton's second law, energy and momentum methods. Systems of particles, Kinematics and plane motion of rigid bodies, forces and accelerations, energy and momentum methods. Introduction to mechanical vibrations.

ENGR 2130 - Electrical Circuit Analysis I
3 credit hours Prerequisites: ENGR 1100, MATH 1910, and PHYS 2121 or PHYS 2111. Mechatronics Engineering majors must complete PHYS 2121. Fundamentals of calculus-based electric circuit analysis. Topics include Ohm's law, resistors, Kirchhoff's current and voltage laws, Mesh and Nodal analysis, independent and dependent voltage and current sources, source transformations, Thevenin's and Norton's theorems, superposition, maximum power transfer theorem, capacitors, inductors, and steady-state and transient analysis for circuits with storage elements. Two hours of lecture and three hours of laboratory.

ENGR 2210 - Introduction to Materials Science and Engineering
3 credit hours Prerequisites: CHEM 1110/CHEM 1111. Origin and behavior of materials. Classifications of materials. Physical metallurgy-mechanical and physical properties, crystalline structure, imperfections in solids, phase diagrams, failure mechanisms in materials, hardening and tempering, isothermal diagrams. Involves hands-on experiences through lab sessions in the use of metallurgical and mechanical testing equipment. Lecture and laboratory.

ENGR 3510 - Electrical Circuit Analysis II
3 credit hours Prerequisites: ENGR 2130 and MATH 3120. Second course on circuit analysis. Topics covered include Sinusoidal Steady-State Analysis, Sinusoidal Steady-State Power Calculations, Balanced Three-Phase Circuits, Frequency Response and Filter Design, Magnetically Coupled Coils and Ideal Transformers. Two-hour lecture and three-hour lab.

ENGR 3520 - Digital Circuits Fundamentals
3 credit hours Prerequisites: ENGR 2130 and CSCI 1170. Introduces logic design with emphasis on practical design techniques and circuit implementation. Topics include Boolean algebra; theory of logic functions; mapping techniques and function minimization; logic equivalent circuits and symbol transformations; transistor-transistor-logic (TTL)/metal oxide semi-conductor (MOS) logic into gate implementations; electrical characteristics; propagation delays; signed number notations and arithmetic. Digital design using random logic and programmable logic devices (FPGAs and CPLDs). Two hours lecture and three hours laboratory.

ENGR 3530 - Electronics and Instrumentation
3 credit hours Prerequisite: ENGR 3510. Introduces use and analysis of electronic circuits and input mechanism of various sensors, design of analog signal conditioning systems based on the system requirement, as well as understanding the theory and the art of modern instrumentation and measurements (I&M) systems. Topics include BJT and MOSFET circuit model and analysis; operational amplifier; instrumentation amplifier; survey of sensor input mechanisms; analog signal conditioning and sensor

application; measurement system architecture; errors in measurement; standard used in measurement. Two hours lecture and three hours laboratory.

ENGR 3540 - Introduction to Feedback Control
3 credit hours Prerequisites: ENGR 3520, ENGR 3530, MATH 3120. ENGR 3530 may be taken concurrently. Introduces classical feedback control in electrical, mechanical, mechatronics, and other continuous-time dynamic systems. Discusses how to model, evaluate, and design SISO and linear control systems using differential equations, transfer function, root locus, and frequency response methods. Hands-on experiments involving Matlab, Labview, transducers (sensors), and actuators (motors) used to complement the theoretical aspects of the course. Embedded control also introduced. Two hours of lecture and three hours of laboratory.

ENGR 3550 - Fluid Mechanics
3 credit hours Prerequisites: ENGR 2120 and MATH 3110. Continuum, velocity field, fluid statics, manometers, basic conservation laws for systems and control volumes, dimensional analysis. Euler and Bernoulli equations, viscous flows, boundary layers, flow in channels and around submerged bodies, one-dimensional gas dynamics, turbo-machinery. Applications in hydraulic, pneumatic, and fluidics discussed. Two hours lecture and three hours laboratory.

ENGR 3560 - Mechanics of Materials
3 credit hours Prerequisites: ENGR 2210, ENGR 2110, and MATH 1920. Plane stress, plane strain, and stress-strain laws. Application of stress and deformation analysis to members subjected to centric, torsional, flexural, and combined loading. Introduces theories of failure, buckling, and energy methods.

ENGR 3570 - Machine Design
3 credit hours Prerequisites: ENGR 2100, ENGR 2120, and ENGR 3560. Analytical design methods. Stress analysis, working stress, combined stresses, failure theories, fatigue failure. Design techniques for shafts, fasteners, gears, bearings, and belt and chain drives. Includes a design project. Two hours lecture and three hours laboratory.

ENGR 3590 - Kinematics and Dynamics of Machinery
3 credit hours Prerequisites: ENGR 2120 and CSCI 1170. The kinematics and dynamics of machinery and its applications to mechatronic systems. Analysis of motion translation/rotation in machinery, energy of machine mechanisms. Involves projects, seminars, and workshops regarding graphical, analytical, and numerical techniques for dynamic analysis and synthesis of machines. Two hours lecture and three hours laboratory.

ENGR 3915 - Technical Project Management and Soft Skills
3 credit hours Prerequisite: Junior standing or permission of instructor. Project management as sanctioned by the International Project Management Institute and how to assess and boost emotional intelligence or soft skills. Student successfully completing course will earn 20 Professional Development Units (PDUs) issued by the International Project Management Institute.

ENGR 3920 - Engineering Safety
3 credit hours Safety and health in the manufacturing, construction, and utilities industries, including pertinent laws, codes, regulations, standards, and product liability considerations. Organizational and administrative principles and practices for safety management and safety engineering, accident investigation, safety education, and safety enforcement.

ENGR 3930 - Systems Engineering
3 credit hours Prerequisites: ENGR 2100, ENGR 3915, and ENGR 3970. An interdisciplinary course with both technical and management aspects of large, multifaceted engineering projects. Special emphasis placed on design, implementation, and improvement of mechatronic systems. Topics include systems engineering, engineering management, economics, quality control and engineering, project management, production systems planning and operations, and human factors.

ENGR 3970 - Engineering Economy
3 credit hours Prerequisite: Junior standing or permission of instructor. Development of capital budgets. Justification of capital projects using time value of money concepts. Replacement analysis. Review of justification of actual capital projects and computer applications. Introduces economic risk assessment and Lean Six Sigma from an economic viewpoint.

ENGR 4500 - FE Exam Preparation
1 credit hour Prerequisite: Senior standing or completion of all 3000-level courses. Review of topics

covered on the general session of the Fundamentals of Engineering exam. Covers all aspects of engineering curriculum including mathematics, engineering probability and statistics, chemistry, computers, ethics and business practices, engineering economics, engineering mechanics (statics and dynamics), strength of materials, material properties, fluid mechanics, electricity and magnetism, and thermodynamics.

ENGR 4501 - Topics in Mechatronics Engineering
1 to 3 credit hours Prerequisite: Permission of department. Introduces new topics in various areas of advancement in engineering as related to mechatronics, automation, and robotics. Content varies depending on topics addressed.

ENGR 4510 - Programmable Logic Controllers and Networks
3 credit hours Prerequisite: ENGR 3520. Introduces programmable logic controllers (PLCs). Emphasizes ladder diagrams and programming of PLC. Introduces network systems such as DeviceNet, ProfiNet, and ProfiBus. Emphasizes the integration of PLCs in automation systems. Two hours lecture and three hours laboratory.

ENGR 4520 - Electrical Power and Machinery
3 credit hours Prerequisite: ENGR 3510. Single- and three-phase power circuit calculations with phasor diagrams and electromagnetic laws. Magnetic field and circuit analysis. Variable frequency drives. Electromechanical energy conversion and rotating machinery modeling and analysis. Construction, equivalent circuit, and performance analysis of three-phase transformers and DC, induction, and synchronous motors. Two hours lecture and three hours laboratory.

ENGR 4530 - Controls and Optimization
3 credit hours Prerequisite: ENGR 3540. Introduces modern control theory to the students. Topics include state-space analysis and design, nonlinear and optimal control, controllability, observability, robust control, and digital control. Introduces basics of discrete event dynamic systems. Two hours lecture and three hours lab.

ENGR 4580 - Mechatronic System Design
3 credit hours Prerequisites: ENGR 3590 and ENGR 3915; prerequisite or corequisite: ENGR 3550. Presents specifics in the mechanical design of mechatronic systems. Includes problem analysis, conceptualization, design/material selection, and performance analysis. Addresses mechanical subsystems, bill of materials, and economic analysis of the system. Two hours lecture and three hours laboratory.

ENGR 4590 - Automation System Design
3 credit hours Prerequisites: ENGR 4580 and ENGR 4510. Capstone design project. Design and analysis of a complete mechatronic system using controllers, sensors, and actuators. Advance systems programming with current industrial network programs and GUIs. Implementation of project and process management principles as well as professional documentation and presentation. Two hours lecture and three hours laboratory.

Engineering Technology

ET 2310 - Computer-Assisted Drafting and Design I
3 credit hours Covers basic technical drawing/sketching and drafting concepts using personal computers, plotters, and appropriate CAD software. Two hours lecture and three hours laboratory.

ET 2920 - Industrial Orientation Internship
1 to 3 credit hours Prerequisite: Consent of the instructor. Provides industrial exposure for students with little or no industrial work experience. Students will be placed in an acceptable company for introductory industrial experiences. Arrangement for this course must be made in advance. Students may take from one to three credit hours; may be repeated for up to a maximum of three credit hours. Pass/Fail.

ET 2930 - Cooperative Education Experience I
3 credit hours Prerequisite: Permission of department. Provides students with opportunity for on-the-job training in conjunction with on-campus academic experiences. Students will participate in professional growth seminars. Pass/Fail.

ET 2940 - Cooperative Education Experience II
3 credit hours Prerequisite: ET 2930; permission of department. Continuation of ET 2930. Pass/Fail.

ET 3210 - Machine Tool Technology
3 credit hours Prerequisite: ENGR 2210 and ET 2310. Metals, their sources, manufacture, and properties; basic metalworking hand tools, measurements; layout; drawing and safety. Exercises

in the use of the basic machine tools in machine shop work. Lecture and laboratory. Two hours lecture and three hours laboratory.

ET 3260 - Manufacturing Processes and Materials
3 credit hours Prerequisite: ENGR 2210. An analysis of machines, tools, processes, and materials used in production.

ET 3360 - Computer-Assisted Drafting and Design II
3 credit hours Prerequisites: CMT 3320 or ET 2310. Utilizes PC and CAD software to develop skills in the creation and analysis of mechanical solid models for design and production purposes. Includes the use of shading and rendering to enhance three-dimensional model display and the extraction of two-dimensional engineering drawings. Two hours lecture and three hours laboratory.

ET 3601 - Electrical Circuit Analysis I
3 credit hours Prerequisites: ENGR 1100 and MATH 1910. Fundamentals of electrical circuits. Addresses basic circuit components and quantities. Emphasis on DC circuit calculations and theorems. Uses lab equipment to build and test DC circuits. Two hours lecture and three hours laboratory.

ET 3602 - Electrical Circuit Analysis II
3 credit hours Prerequisite: ET 3601 and MATH 1910. Addresses basic circuit components and quantities of AC circuits. Introduces three-phase circuits and transformers. Emphasis on AC circuit calculations and theorems. Uses lab equipment to build and test AC circuits. Two hours lecture and three hours laboratory.

ET 3610 - Introduction to Electricity and Electronics
4 credit hours Prerequisite: MATH 1710 or MATH 1730. Orientation to direct current, alternating current, magnetism, filters, and semiconductor devices. Rectifier-filters and basic transistor amplifiers are also examined as representative electronic circuits. Use of meters, oscilloscopes, and other test instruments are stressed in the laboratory. Three hours lecture and three hours laboratory.

ET 3615 - Principles of Electricity
3 credit hours Prerequisite: MATH 1710 or MATH 1730. An overview of basic electrical circuits and systems, direct current circuits, alternating current circuits, and electrical devices and control schemes. Electrical motors, relays, solenoids, transformers, and power supplies examined. National Electric Code also examined. For students enrolled in Construction Management or Concrete Industry Management. Laboratory exercises stress the use of test instruments and the construction of basic electrical circuits. Two hours lecture and three hours laboratory.

ET 3620 - Digital Circuits Fundamentals
3 credit hours Prerequisite: ET 3601 or permission of instructor. Provides thorough coverage of basic digital electronic circuits analysis and design. TTL and CMOS families examined. Number systems, mapping, and minimization techniques covered. Digital design using random logic and programmable logic devices (FPGAs and CPLDs). Two hours lecture and three hours laboratory.

ET 3630 - Electronics
3 credit hours Prerequisite: ET 3602 or permission of instructor. Introduction to analog electronics. Defines basic parameters and theory of operation of discrete semiconductor devices. Introduces fundamentals of electronic circuits analysis and design. Applications illustrate use and laboratory projects provide hands-on experience. Two hours lecture and three hours laboratory.

ET 3640 - Digital Circuits Design
3 credit hours Prerequisite: ET 3620; corequisite: ET 3630 or permission of instructor. In-depth study of sequential circuit analysis and design that includes sate machine design. Emphasis on the use of available development boards using both FPGAs and CPLDs and their respective CAD tools. PLDs programmed using latest relative CAD systems. Two hours lecture and three hours laboratory.

ET 3650 - Introduction to Microprocessors
3 credit hours Prerequisites: CSCI 1170 and ET 3620. Covers architecture of microcontrollers and microprocessor-based systems and their related components. Machine language programming extensively used to solve problems and demonstrate the relationship of the microprocessor and its supporting peripherals. Basic microcomputer architecture also emphasized. Two hours lecture and three hours laboratory.

ET 3660 - Communication Electronics
3 credit hours Prerequisite: ET 3630 or permission of instructor. Theory of electronic circuits as applied to communication; special electronics circuits required in communications systems. Testing theory and procedures. Various methods of electronic communications. Testing and evaluation of electronic circuits. Two hours lecture and three hours laboratory.

ET 3670 - Computer-Assisted Printed Circuit Board Design
2 credit hours Prerequisites: ET 3620 and ET 3630 or permission of instructor. Utilizes computer software to develop skills in creating schematic and printed circuit board artwork for use in printed circuit board production. Includes plotting, printing, and generating all necessary documents required for fabrication. One hour lecture and three hours laboratory.

ET 3810 - Engineering Thermodynamics
3 credit hours Prerequisites: ENGR 1100; PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111; MATH 1910. Basic concepts of engineering thermodynamics, properties and thermodynamic states, work, heat, first law, second law, entropy, ideal gases, and analysis of conventional power and refrigeration systems.

ET 3860 - Strength of Materials
3 credit hours Prerequisite: ENGR 2110. The mechanics of materials emphasizing the analysis and design of statically determinate beams, columns, and structural members in torsion and application of the three moment equations to statically indeterminate beams.

ET 3910 - Introduction to Operations Management
3 credit hours Prerequisite: Junior standing or permission of instructor. A foundation course in manufacturing and service operations management. Problem-solving applications emphasized.

ET 3920 - Industrial Internship I
3 credit hours Prerequisite: Consent of instructor. Student is employed by an acceptable industry for industrial experience. Credit given for actual work with employer. Arrangement for this course must be made in advance. Pass/Fail.

ET 3930 - Industrial Internship II
3 credit hours A continuation of Internship I. Same stipulations apply. Pass/Fail.

ET 3950 - Metrology
3 credit hours Overview of methods and procedures of precision measuring and gauging as used in inspection and quality control by industry. Two hours lecture and three hours laboratory.

ET 3960 - Industrial Quality Technology
3 credit hours Prerequisite: Junior standing or consent of instructor. Covers breadth and some depth in quality technology. Explores history of quality, present techniques, and future predictions. Covers six-sigma methodology at the "greenbelt" level. Certification after industry project. Lecture.

ET 3970 - Cooperative Education Experience III
3 credit hours Prerequisite: ET 2940; permission of department. Continuation of ET 2940. Pass/Fail.

ET 3980 - Cooperative Education Experience IV
3 credit hours Prerequisite: ET 3970; permission of department. Continuation of ET 3970. Pass/Fail.

ET 4230 - Advanced Machine Tool Technology
3 credit hours Prerequisite: ET 3210. Taper turning, boring and thread chasing, and calculations of screw threads and other operations. Gear terminology and calculations; practice gear cutting on the milling machine; use of index head. Two hours lecture and three hours laboratory.

ET 4280 - Computer-Aided Manufacturing: Numerical Control (NC)
3 credit hours Prerequisites: ET 2310 and ET 3210 or consent of instructor. The role of NC in today's manufacturing environment; machines and machine control systems of a typical installation. Justifying NC equipment. Emphasis on writing and debugging programs for a three-axis milling machine and a two-axis turning machine utilizing both computer numerical control and computer-aided part programming. For those with little experience or seeking to broaden their knowledge. Two hours lecture and three hours laboratory.

ET 4330 - Advanced Computer-Aided Drafting
3 credit hours Prerequisite: ET 3360 or permission of instructor. Topics include customizing menus, 3-D concepts and surface modeling, AutoLisp, rendering, and slide shows. Interactive computer drafting and design using advanced AutoCAD software and add-ons. Primarily for students who want to increase their capabilities using CAD. Two hours lecture and three hours laboratory.

ET 4340 - Design of Machine Elements
3 credit hours Prerequisite: ET 3860. Analytical design methods. Stress analysis, working stress, combined stresses, failure theories, fatigue failure. Design techniques for shafts, fasteners, gears, bearings, and belt and chain drives. Includes a design project.

ET 4440 - Fire Safety
3 credit hours Fundamental methods of fire protection, prevention, and suppression. Includes characteristics and behavior of fire, fire hazards of materials and buildings, codes and standards for fire prevention and protection, fire protection equipment and systems, and fire fighting forces and how they operate.

ET 4450 - Industrial Hygiene
3 credit hours An introduction to industrial or occupational hygiene--that science and art devoted to the anticipation, recognition, evaluation, and control of those environmental factors or stresses, arising in or from the workplace, which may cause sickness, impaired health and well-being, or significant discomfort and inefficiency among workers or citizens of the community.

ET 4490 - Topics in Industrial Technology
1 to 6 credit hours Subject topics offered as required to meet the needs of the class.

ET 4590 - Manufacturing Automation Systems
3 credit hours Technical, human, and business aspects of modern automation system. Includes automation controls, levels of control and major components/subsystems, object-based software components, intelligent actuators and sensors, emerging trends, flexible manufacturing systems (FMS), computer integrated manufacturing (CIM), industrial systems and supply chain applications, organizational approaches, and automation justification.

ET 4600 - Programmable Logic Controllers
3 credit hours Prerequisite: ET 3602 or permission of instructor. Introduction to programmable logic controllers (PLCs). Selection, operation, and troubleshooting. Ladder diagrams and programming of PLC emphasized. One hour lecture and three hours laboratory.

ET 4610 - Instrumentation and Controls
3 credit hours Prerequisites: ET 3620 and ET 3630. Devices and techniques used in the measurement of physical parameters. Consideration of accuracies and sources of error, identification of typical measurements, sensors and transducers, control stability and response. Two hours lecture and three hours laboratory.

ET 4630 - Local Area Networks
3 credit hours Provides the necessary foundation experience to understand the design, implementation, and management strategies of local and wide area networks (LAN/WAN). Data Communication Standards and protocol, fundamentals included. Will include lecture, laboratory activities, and a LAN design requirement. Two hours lecture and three hours laboratory.

ET 4640 - Industrial Electricity
3 credit hours Prerequisite: ET 3602 or permission of instructor. AC power theory and circuits for industrial applications, polyphase systems, power factor correction, and transformers. Theory, applications, and selection of motors and generators. Industrial motor control and power transmission. Two hours lecture and three hours laboratory.

ET 4660 - Microprocessor Interfacing
3 credit hours Prerequisites: ET 3640 and ET 3650 or permission of instructor. Emphasis on interfacing various analog and digital devices to a microcontroller/microprocessor-based system: memory expansion, A/D and D/A, display devices, keyboards and keypads, electromechanical devices, and sensors. PLDs (FPGAs/CPLDs) interfaced to facilitate rapid prototyping of digital system design. Two hours lecture and three hours laboratory.

ET 4670 - Microprocessor Design
3 credit hours Prerequisites: ET 3640 and ET 4660 or permission of instructor. Advanced microprocessor system design. Emphasis on the design of core CPUs and imbedded components using high-density FPGA/CPLD development boards. Industrial applications of microprocessor-based systems. Two hours lecture and three hours laboratory.

ET 4701 - Industrial Topics
1 to 6 credit hours Problems in any one of a variety of areas to meet the needs of the class.

ET 4790 - Advanced Problems in Technology
3 credit hours Prerequisite: Completion of all courses in a given area or approval of instructor. For the advanced student who wishes to work on a designated problem in a specific area. Works on an individual problem or project independently under the guidance of an instructor.

ET 4801 - Computer Engineering Technology
1 to 3 credit hours All required freshman-, sophomore-, and junior-level courses in all disciplines have to be completed before registering for this course. Engineering situations are solved by experimental means. Student must have experimental approach, gather data, interpret results, and prepare a formal technical written and oral report.

ET 4802 - Electromechanical Engineering Technology
1 to 3 credit hours All required freshman-, sophomore-, and junior-level courses in all disciplines have to be completed before registering for this course. Engineering situations are solved by experimental means. Student must have experimental approach, gather data, interpret results, and prepare a formal technical written and oral report.

ET 4803 - Mechanical Engineering Technology
1 to 3 credit hours Prerequisites: ET 3860, ET 4340, and ET 4815. All required freshman-, sophomore-, and junior-level courses in all disciplines have to be completed before registering for this course. Engineering situations are solved by experimental means. Student must have experimental approach, gather data, interpret results, and prepare a formal technical written and oral report.

ET 4815 - Heating, Ventilation, and Air Conditioning
3 credit hours Prerequisite: ET 3810 or permission of instructor. Design and operation of heat and mass transfer systems which produce the needed environments for manufacturing operations, industrial processes, and human comfort. Systems that use mechanical equipment such as pumps, blowers, fans, compressors, and heat exchanges found in fields such as air conditioning, low temperature metallurgy, food preservation, chemical processing, and industrial manufacturing covered. Three hours lecture.

ET 4830 - Vibration
3 credit hours Prerequisite: ENGR 2120. Provides a broad-based background in vibration analysis and introduces present practices. Topics include free, damped, and forced vibrations with one degree of freedom; vibration isolation; free vibration with two degrees of freedom; and introduction to matrix formulation. Three hours lecture.

ET 4850 - Fluid Power
3 credit hours Systems and the basic components that make up these systems, including hydraulic, pneumatic, and fluidic. Emphasis on understanding the language and graphic symbols associated with fluid power, the performance characteristics of system components, and problem solving. Two hours lecture and three hours laboratory.

ET 4860 - Robotics
3 credit hours Prerequisites: MATH 1910; CSCI (3 hours). Fundamentals of robots. Types of robots, types of controls, the prime movers, the application of robots in the industrial environment, and problem solving. Two hours lecture and three hours laboratory.

ET 4900 - Productivity Strategies
3 credit hours Prerequisite: Junior standing or permission of instructor. Analysis, design, and implementation of productivity strategies and productivity improvement programs for a wide variety of organizations. Touches a spectrum of disciplines such as work design, quality, design engineering, and employee involvement. Includes lean manufacturing with certification available after successful industry project.

ET 4920 - Plant Layout and Materials Handling
3 credit hours Prerequisite: ET 2310. An overview of facility planning including equipment selection, work flow analysis, activity relationship analysis, and plant layout for product, process, and JIT requirements. Teams assigned actual projects in industry. CAD layout presentations to industry management required.

ET 4990 - Industrial Engineering Systems
3 credit hours Prerequisite: Junior standing or permission of instructor. System design of work tasks including establishing time standards by time and motion study and work sampling; ergonomic design for integration of the human into the work task environment. Scientific methods supplemented by quality considerations with emphasis on statistical quality control (SQC). Computer software used for design and analysis.

Environmental Science and Technology

EST 4760 - Seminar in Environmental Science and Technology
1 credit hour Prerequisite: Permission of department. Student presentations on capstone projects. Incorporates guest speakers, readings, reflective thought, career and job search, and discussions on environmental issues.

EST 4770 - Pollution Control Technology
3 credit hours Prerequisites: 8 hours each in biology, chemistry, and physics, or consent of instructor. Solid waste and water pollution control technology. Legislative regulations and quality standards, pollution types and sources, detection and analysis instruments, and treatment or abatement principles and practices.

EST 4780 - Air, Solids, and Noise Pollution Technology
3 credit hours Prerequisites: 8 hours each chemistry, biology, and physics or permission of instructor. Air, noise, solid and hazardous waste pollution technology, including legislative regulations and quality standards: sources, detection, and analysis instrumentation and practices, and treatment and abatement principles, equipment, and practices.

EST 4810 - Energy and the Environment
3 credit hours Prerequisites: 4 hours chemistry and 3 hours mathematics or consent of instructor. Sources and methods of energy production and classifications of energy usages, with emphasis on usage trends, energy conservation strategies, and alternate energy utilization.

EST 4820 - Solar Building Design
3 credit hours Prerequisites: 4 hours science and 3 hours mathematics or consent of instructor. Broad introduction to the environmental and economic impact of solar energy for residential and light industrial construction including day lighting, passive solar design, and hot water heating.

EST 4840 - Energy Auditing
3 credit hours Prerequisites: 4 hours chemistry and 3 hours mathematics or consent of instructor. Types of energy consumption and classifications of energy usages, with emphasis on conservation strategies and total management for residential and industrial plants.

EST 4980 - Environmental Public Health
3 credit hours Prerequisites: 8 hours college biology and 8 hours college chemistry. Applying the sciences of biology, chemistry, statistics, and environmental engineering to the field of public health. Public health epidemiology and disease control concepts related to the anticipation, recognition, assessment, and control of common public health disease problems.

Geosciences

Melissa Lobegeier, Interim Chair

Aber, Abolins, Brown, J. Collins, L. Collins, Cribb, El Kadiri, Hass, Momm

Courses in the Department of Geosciences are designed to meet the True Blue Core needs of all students, to broaden their knowledge of the physical environment, to enhance their cultural development, and to provide a solid foundation for those planning to enter fields in which geoscience knowledge is essential.

The department offers programs leading to a Bachelor of Science degree with a major in Environmental Science and a major in Geosciences with concentrations in Physical Geography and Geology. To provide the student with maximum opportunities for career preparation, the two Geosciences concentrations are subdivided into five career paths: physical geography and geospatial analysis within the Physical Geography concentration; and geology, earth science, and earth science for teachers within the Geology concentration. Proper selection of courses will permit a student to work as a professional in a chosen area, pursue graduate studies, or be licensed to teach.

Minors include Environmental Science, Geology/Earth Science, Geospatial Analysis, and Physical Geography.

Graduate Study

The department offers a M.S. in Geosciences and minors in Physical Geography and Earth Science/Geology at the graduate level. The list of available courses offered can be found in the Graduate Catalog.

Environmental Science Minor

Geosciences

The minor in Environmental Science consists of 15 credit hours including ENVS 2810 with the remainder in courses with an ENVS, GEOL, or PGEO prefix and up to 6 credit hours with an EST or ET prefix, to be selected by the student and approved by a member of the Department of Geosciences faculty assigned as mentor. At least 9 hours must be at the upper-division level.

Required Course (3 hours)

- ENVS 2810 - Introduction to Environmental Science **3 credit hours**

Electives (12 hours)

- Courses with an ENVS, GEOL, or PGEO prefix and up to 6 credit hours with an EST or ET prefix **12 credit hours**

Environmental Science, B.S.

Geosciences
Racha El Kadiri, program coordinator
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The Environmental Science major is an interdisciplinary degree that integrates knowledge from various scientific fields. It features a strong foundation in the geosciences with support courses from chemistry, physics, biology, and math. Coursework includes such topics as environmental issues and impacts, energy resources and recovery, climate and climate change, and geographic information systems.

Students will find career opportunities within both the private and public sector. Typical employment opportunities exist in various local, regional, and national government agencies, and as environmental consultants in air and water quality oversight, pollution control and mitigation, environmental analysis and resource assessment, and hazardous and sanitary waste management.

The degree program includes a capstone experience with opportunities for academic research, study abroad, field courses to a variety of locations, or an internship in local government or industry. Students can choose the best fit for their career goals with the guidance of their faculty mentor.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Environmental Science, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**29-30 hours***
Math/Science Cognate	**24 hours***
Capstone Experience	**6-8 hours**
ES Major Supporting Coursework	**20-24 hours**
Electives	**0-8 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- GEOL 1040/GEOL 1041 (Sci Lit)
- MATH 1730 or MATH 1910 (Quant Lit) required in cognate; MATH 1710 is a prerequisite for MATH 1730.
- BIOL 1110/BIOL 1111 (Sci Lit) or CHEM 1110/CHEM 1111 (Sci Lit), or PHYS 2010/PHYS 2011 (Sci Lit) may be applied to cognate

Major Requirements (29-30 hours)

- ENVS 2810 - Introduction to Environmental Science **3 credit hours**
- GEOL 3030 - Geoscience of Energy Resources **3 credit hours**
- GEOL 3060 - Computer Methods in Geology **3 credit hours**
- PGEO 4000 - Climatology and Climate Change **3 credit hours**
- PGEO 4020 - Environmental Issues, Impacts, and Sustainability **3 credit hours**
- PGEO 4530 - Geographic Information Systems **3 credit hours**

- GEOL 1040 - Physical Geology **4 credit hours** AND
- GEOL 1041 - Physical Geology Lab **0 credit hours**

- GEOL 4120 - Environmental Geology **4 credit hours** OR
- GEOL 4130 - Hydrogeology **5 credit hours**

- GEOL 3010 - Oceanography **3 credit hours** OR
- PGEO 4010 - Biogeography **3 credit hours**

Math/Science Cognate (24 hours)

NOTE: BIOL/CHEM/MATH/PHYS may also count in the True Blue Core. Students must complete 16 hours in BIOL/CHEM/PHYS including a two-term sequence in one discipline.

- CSCI 1170 - Computer Science I **4 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- MATH 1730 - Pre-Calculus **4 credit hours** OR
- MATH 1910 - Calculus I **4 credit hours**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**
  OR
- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**
  OR
- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

Capstone Experience Courses (6-8 hours)

After earning 90 credit hours toward the Environmental Science program, students must complete a capstone experience including at least 6-8 upper-division credit hours from the courses below. The capstone experience must be approved by the Environmental Science faculty mentor.

Internship

- BIOL 3200 - Internship in Biology **2 to 4 credit hours**
- CSCI 4910 - Computer Science Internship **1 to 6 credit hours**
- CIM 3300 - Concrete Industry Internship **1 to 9 credit hours**
- GEOL 4571 - Internship in Geology **3 credit hours**
- GEOL 4572 - Internship in Geology **3 credit hours**
- PGEO 4571 - Internship in Physical Geography **3 credit hours**
- PLSO 4680 - Internship in Plant and Soil Science **3 to 6 credit hours**

Field Course

- GEOL 3401 - Field Course **4 credit hours**
- GEOL 3402 - Field Course **4 credit hours**
- PGEO 3401 - Field Studies in Physical Geography **4 credit hours**
- ANTH 4950 - Archaeological Field School **3 to 6 credit hours**

Undergraduate Research

- AGRI 4910 - Problems in Agriculture **1 to 6 credit hours**
- BIOL 4280 - Undergraduate Research in Biology **1 to 4 credit hours**
- CHEM 3880 - Undergraduate Research II **1 to 4 credit hours**
- CIM 4200 - Senior Concrete Lab **2 credit hours**
- CSCI 4280 - Undergraduate Research **1 to 4 credit hours**
- ET 4790 - Advanced Problems in Technology **3 credit hours**
- GEOL 4090 - Problems in Geology **1 to 6 credit hours**
- PGEO 4280 - Special Topics and Problems in Physical Geography **1 to 6 credit hours**

Environmental Science Major Supporting Coursework (20-24 hours)

A minimum of 8 hours at 3000 and/or 4000 level. NOTE: Major supporting coursework may not be PGEO or GEOL courses. Advisor and student will need to appropriately manage course selection from this list and verify that prerequisites are met.

- ANTH 3310 - Biological Anthropology **3 credit hours**
- BIOL 2230 - Microbiology **4 credit hours**
- BIOL 2231 - Microbiology Lab **0 credit hours**
- BIOL 3210 - Environmental Microbiology **3 credit hours**
- BIOL 3211 - Environmental Microbiology Lab **0 credit hours**
- BIOL 3250 - Genetics **4 credit hours**
- BIOL 3251 - Genetics Lab **0 credit hours**
- BIOL 3400 - General Ecology **4 credit hours**
- BIOL 3500 - Evolution **3 credit hours**
- BIOL 4090 - Forest Ecology **4 credit hours**
- BIOL 4140 - Invertebrate Zoology **4 credit hours**
- BIOL 4180 - Vertebrate Zoology **4 credit hours**
- BIOL 4181 - Vertebrate Zoology Lab **0 credit hours**
- BIOL 4220 - Ichthyology **4 credit hours**
- BIOL 4221 - Ichthyology Lab **0 credit hours**
- BIOL 4420 - Plant Ecology and Evolution **4 credit hours**
- BIOL 4500 - Plant Physiology **4 credit hours**
- BIOL 4570 - Principles of Toxicology **3 credit hours**

- BIOL 4571 - Principles of Toxicology Lab **0 credit hours**
- BIOL 4580 - Marine Biology **4 credit hours**
- BIOL 4581 - Marine Biology Lab **0 credit hours**
- BIOL 4590 - Principles of Environmental Toxicology **4 credit hours**
- CCM 3500 - Land Surveying **3 credit hours**
- CHEM 2230 - Quantitative Analysis **3 credit hours**
- CHEM 2231 - Quantitative Analysis Lab **2 credit hours**
- CHEM 3010 - Organic Chemistry I **3 credit hours**
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**
- CHEM 4400 - Inorganic Chemistry I **3 credit hours**
- CHEM 4600 - Introduction to Environmental Chemistry **3 credit hours**
- CHEM 4610 - Environmental Chemistry **3 credit hours**
- CMT 3000 - Commercial Construction and Materials **3 credit hours**
- CMT 3150 - Residential Building Construction and Materials I **3 credit hours**
- CMT 3180 - Construction and Materials II **3 credit hours**
- CMT 3195 - Sustainable Construction **3 credit hours**
- CMT 3210 - Construction Codes and Regulation **3 credit hours**
- ENGR 1100 - Engineering Fundamentals **3 credit hours**
- ENGR 2100 - Introduction to Engineering Design **3 credit hours**
- ENGR 2110 - Statics **3 credit hours**
- ENGR 2120 - Dynamics **3 credit hours**
- ENGR 2130 - Electrical Circuit Analysis I **3 credit hours**
- ENGR 2210 - Introduction to Materials Science and Engineering **3 credit hours**
- ENGR 3510 - Electrical Circuit Analysis II **3 credit hours**
- ENGR 3520 - Digital Circuits Fundamentals **3 credit hours**
- ENGR 3530 - Electronics and Instrumentation **3 credit hours**
- ENGR 3540 - Introduction to Feedback Control **3 credit hours**
- ENGR 3550 - Fluid Mechanics **3 credit hours**
- ENGR 3560 - Mechanics of Materials **3 credit hours**
- ENGR 3915 - Technical Project Management and Soft Skills **3 credit hours**
- ENGR 3920 - Engineering Safety **3 credit hours**
- ENGR 3970 - Engineering Economy **3 credit hours**
- ET 2310 - Computer-Assisted Drafting and Design I **3 credit hours**
- ET 3601 - Electrical Circuit Analysis I **3 credit hours**
- ET 3602 - Electrical Circuit Analysis II **3 credit hours**
- ET 3610 - Introduction to Electricity and Electronics **4 credit hours**
- ET 3630 - Electronics **3 credit hours**
- ET 3640 - Digital Circuits Design **3 credit hours**
- ET 3650 - Introduction to Microprocessors **3 credit hours**
- ET 3810 - Engineering Thermodynamics **3 credit hours**
- ET 3860 - Strength of Materials **3 credit hours**
- ET 4450 - Industrial Hygiene **3 credit hours**
- ET 4815 - Heating, Ventilation, and Air Conditioning **3 credit hours**
- ET 4830 - Vibration **3 credit hours**
- ET 4850 - Fluid Power **3 credit hours**
- ET 4860 - Robotics **3 credit hours**
- GEOG 4340 - Historical Geography **3 credit hours**
- GEOG 4370 - Urban Geographies: Key Trends, Problems, and Solutions **3 credit hours**

- GEOG 4550 - Global Issues **3 credit hours**
- GS 4150 - Ecotourism, Geotourism, and Sustainable Development **3 credit hours**
- HLTH 3260 - Environmental Health **3 credit hours**
- HSC 4460 - Global Topics in Human Sciences **3 credit hours**
- MATH 1530 - Applied Statistics **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours**
- PHIL 3340 - Environmental Ethics **3 credit hours**
- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**
- PLSO 3350 - Soil Fertility and Fertilizer **3 credit hours**
- PLSO 3360 - Irrigation and Drainage **3 credit hours**
- PLSO 3370 - Soil Analysis **3 credit hours**
- PLSO 4340 - Genesis of Soil Landscapes **3 credit hours**
- PLSO 4350 - Soil Survey and Land Use **3 credit hours**
- PLSO 4370 - Soil and Water Conservation **3 credit hours**
- PLSO 4500 - Agroecology **3 credit hours**
- PLSO 4730 - Soil Physical Properties **3 credit hours**

Electives (0-8 hours)

Curriculum: Environmental Science

Students should consult their advisors each semester to plan their schedules.

Freshman Fall

- Written Communication **3 credit hours**
- Quantitative Literacy **3 credit hours** (MATH 1530 or MATH 1710 recommended)
- ENVS 2810 - Introduction to Environmental Science **3 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

Subtotal: 13 Hours

Freshman Spring

- Information Literacy **3 credit hours**

- GEOL 1040 - Physical Geology **4 credit hours** AND
- GEOL 1041 - Physical Geology Lab **0 credit hours**

- MATH 1730 - Pre-Calculus **4 credit hours** OR
- MATH 1910 - Calculus I **4 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

Subtotal: 15 Hours

Sophomore Fall

- CSCI 1170 - Computer Science I **4 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Major (PGEO) course **3 credit hours**

Subtotal: 13 Hours

Sophomore Spring

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- History and Civic Learning **3 credit hours**
- Major (GEOL) course **3 credit hours**
- Major (PGEO) course **3 credit hours**

Subtotal: 13 Hours

Junior Fall

- Non-Written Communication **3 credit hours**
- Major (GEOL) course **3 credit hours**
- Major supporting courses **7 credit hours**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**
  OR
- CHEM 1121 - General Chemistry II Lab **0 credit hours** AND
- CHEM 1120 - General Chemistry II **4 credit hours**
  OR
- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

Subtotal: 17 Hours

Junior Spring

- History and Civic Learning **3 credit hours**
- Major (GEOL) or (PGEO) course **3 credit hours**
- Major (GEOL) course **4 to 5 credit hours**
- Major (PGEO) course **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**

Subtotal: 16-17 Hours

Senior Fall

- Major supporting courses **10 credit hours**
- Capstone experience **3 to 4 credit hours**
- Creativity and Cultural Expression **3 credit hours**

Subtotal: 16-17 Hours

Senior Spring

- General elective **2 credit hours**
- Major supporting course **3 credit hours**
- General or major supporting course **4 credit hours**
- Capstone experience **3 to 4 credit hours**
- Human Society and Social Relationships **3 credit hours**

Subtotal: 15-16 Hours

Geology/Earth Science Minor

Geosciences

The minor in Geology/Earth Science requires 18-22 hours.

Required Courses (8 hours)

- GEOL 1040 - Physical Geology **4 credit hours** AND
- GEOL 1041 - Physical Geology Lab **0 credit hours**
  OR
- GEOL 1030 - Introduction to Earth Science **3 credit hours** AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour**
  with a grade of A or B

- GEOL 1050 - Historical Geology **4 credit hours**

Electives (10-14 hours)

- 10-14 hours at the 3000 level or above

Geosciences, Geology Concentration (Earth Science for Teachers), B.S.

Geosciences
Mark Abolins, program coordinator
615-494-7986
Mark.Abolins@mtsu.edu

The Earth Science for Teachers curriculum is designed for those who plan to teach earth science in the secondary school system.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Geoscience, Geology (Earth Science for Teachers), B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**32 hours**
Math/Science Cognate	**31 hours***
MTeach Minor	**30 hours**
TOTAL	**123-134 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 123 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1720 (Quant Lit)
- GEOL 1030/GEOL 1031, or GEOL 1040/GEOL 1041 (Sci Lit)
- PGEO 1030 (Sci Lit)

Major Requirements (32 hours)

- GEOL 1050 - Historical Geology **4 credit hours**

- GEOL 1030 - Introduction to Earth Science **3 credit hours** AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour**
  OR
- GEOL 1040 - Physical Geology **4 credit hours** AND
- GEOL 1041 - Physical Geology Lab **0 credit hours (may be counted in the True Blue Core)**

- GEOL 3010 - Oceanography **3 credit hours**
- GEOL 4020 - Geomorphology **4 credit hours**
- GEOL 4050 - Meteorology **3 credit hours**
- GEOL 4740 - Research Methods **3 credit hours**

- PGEO 1030 - Physical Geography **4 credit hours (may be counted in the True Blue Core)**
- mentor-approved GEOL/Geosciences/Math/Science electives **7 credit hours**

Math/Science Cognate (31 hours)

- ASTR 1030 - Exploring the Universe **3 credit hours** AND
- ASTR 1031 - Observing the Universe **1 credit hour**

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours**
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours**

- CHEM 1020 - Introductory General Chemistry II **4 credit hours** AND
- CHEM 1021 - Intro to General Chemistry II Lab **0 credit hours**
  OR
- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

- MATH 1720 - Plane Trigonometry **3 credit hours (may be counted in the True Blue Core)**

Minor in Secondary Education-MTeach (30 hours)

See **Secondary Education Minor-MTeach** for further information.

Curriculum: Geoscience, Geology Concentration (Earth Science for Teachers)

Following is a suggested pattern of study for the first two years; however, consultation with the assigned advisor is necessary before registration.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Human Society and Social Relationships, **3 credit hours**
- History and Civic Learning **6 credit hours**
- GEOL 1050 - Historical Geology **4 credit hours**
- MATH 1720 - Plane Trigonometry **3 credit hours** (Quant Lit)
- PGEO 1030 - Physical Geography **4 credit hours** (Sci Lit)
- MSE 1010 - Step 1: Inquiry Approaches to Teaching **1 credit hour**
- MSE 2010 - Step 2: Inquiry Lesson Design **1 credit hour**

- GEOL 1030 - Introduction to Earth Science **3 credit hours** (Sci Lit) AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour** (Sci Lit)
  OR
- GEOL 1040 - Physical Geology **4 credit hours** (Sci Lit) AND
- GEOL 1041 - Physical Geology Lab **0 credit hours** (Sci Lit)

Subtotal: 32 Hours

Sophomore

- Non-written Communication **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- GEOL 3010 - Oceanography **3 credit hours**
- GEOL 4020 - Geomorphology **4 credit hours**
- GEOL 4050 - Meteorology **3 credit hours**
- YOED 3520 - Knowing and Learning in Science and Mathematics **3 credit hours**
- YOED 3550 - Classroom Interactions in Mathematics and Science **3 credit hours**

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours**

- CHEM 1010 - Introductory General Chemistry I **4 credit hours** AND
- CHEM 1011 - Intro to General Chemistry I Lab **0 credit hours**
  OR
- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours**

- CHEM 1020 - Introductory General Chemistry II **4 credit hours** AND
- CHEM 1021 - Intro to General Chemistry II Lab **0 credit hours**
  OR
- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 34 Hours

Junior

- Creativity and Cultural Expression Literature **3 credit hours**
- Creativity and Cultural Expression **6 credit hours**
- GEOL elective **4 credit hours**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

- GEOL 4740 - Research Methods **3 credit hours**
- MSE 3330 - Teaching Science in Secondary Grades **3 credit hours**

Subtotal: 31 Hours

Senior

- ASTR 1030 - Exploring the Universe **3 credit hours** AND
- ASTR 1031 - Observing the Universe **1 credit hour**

- GEOL elective **3 credit hours**
- YOED 4040 - Residency I: MTeach **4 credit hours**
- YOED 4050 - Project-Based Instruction in Mathematics and Science **3 credit hours**
- YOED 4400 - Residency II **12 credit hours**

Subtotal: 26 Hours

Geosciences, Geology Concentration (Earth Science), B.S.

Geosciences
Mark Abolins, program coordinator
615-494-7986
Mark.Abolins@mtsu.edu

This Earth Science career pattern is designed for students who plan to become professional earth scientists or who wish to pursue graduate study in earth science.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Geoscience, Geology (Earth Science), B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**60 hours**
Major Core	*42 hours**
Math/Science Cognate	*18 hours**
Electives	**19-26 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041 (Sci Lit)
- MATH 1530 (Quant Lit) required in major or MATH 1730 (Quant Lit) required in cognate

Major Requirements (42 hours)

- GEOL 1030 - Introduction to Earth Science **3 credit hours** AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour**
  OR
- GEOL 1040 - Physical Geology **4 credit hours** AND
- GEOL 1041 - Physical Geology Lab **0 credit hours**

- GEOL 1050 - Historical Geology **4 credit hours**
- GEOL 3000 - Mineralogy **5 credit hours**
- GEOL 3010 - Oceanography **3 credit hours**
- GEOL 3050 - Field Methods in Geology **3 credit hours**
- GEOL 4020 - Geomorphology **4 credit hours**
- GEOL 4050 - Meteorology **3 credit hours**
- MATH 1530 - Applied Statistics **3 credit hours**

- Geoscience electives from any GEOL or PGEO course or any Geosciences mentor-approved math or science electives **13 credit hours**

Math/Science Cognate (18 hours)

- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**
- PGEO 4530 - Geographic Information Systems **3 credit hours**
- MATH 1730 - Pre-Calculus **4 credit hours (3 credit hours may be counted in the True Blue Core)**
- Additional MATH/SCI electives to be approved by Geosciences mentor; 4 hours must be from the True Blue Core Scientific Literacy area **8 credit hours**

Electives (19-26 hours)

- Approved by Geosciences mentor

Curriculum: Geoscience, Geology Concentration (Earth Science)

Following is a suggested pattern of study for the first two years; however, consultation with the assigned advisor is necessary before registration.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Human Society and Social Relationships **6 credit hours**
- History and Civic Learning **6 credit hours**
- GEOL 1050 - Historical Geology **4 credit hours**
- MATH 1730 - Pre-Calculus **4 credit hours** (Quant Lit)
- MATH 1530 - Applied Statistics **3 credit hours**

- GEOL 1030 - Introduction to Earth Science **3 credit hours** (Sci Lit) AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour**
  OR
- GEOL 1040 - Physical Geology **4 credit hours** (Sci Lit) AND
- GEOL 1041 - Physical Geology Lab **0 credit hours**

Subtotal: 33 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- Non-Written Communication **3 credit hours**
- General elective **3** credit hours
- Geoscience elective **3 credit hours**
- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**
- GEOL 3000 - Mineralogy **5 credit hours**
- GEOL 3010 - Oceanography **3 credit hours**
- GEOL 4020 - Geomorphology **4 credit hours**
- GEOL 4050 - Meteorology **3 credit hours**

Subtotal: 30 Hours

Junior

- GEOL 3050 - Field Methods in Geology **3 credit hours**
- Creativity and Cultural Expression **6 credit hours**
- Geoscience electives **6 credit hours**
- Math/Sci cognate electives **8 credit hours**
- General electives **8 credit hours**

Subtotal: 31 Hours

Senior

- PGEO 4530 - Geographic Information Systems **3 credit hours**
- Scientific Literacy **4 credit hours**
- Scientific Literacy/Elective **4 credit hours**
- Geosciences elective **4 credit hours**
- General electives **11 credit hours**

Subtotal: 26 Hours

Geosciences, Geology Concentration (Geology), B.S.

Geosciences
Warner Cribb
615-898-2379
Warner.Cribb@mtsu.edu

This Geology career pattern is designed for students who plan to become professional geologists or who wish to pursue graduate study in geology.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Geoscience, Geology (Geology Career Pattern), B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**89-90 hours***
Major Core	*53 hours*
Cognate 1	*18-19 hours**
Cognate 2	*18 hours**
TOTAL	**120-131 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)
- PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111 (Sci Lit)

Major Requirements (53 hours)

- GEOL 1030 - Introduction to Earth Science **3 credit hours** AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour**
  OR
- GEOL 1040 - Physical Geology **4 credit hours** AND
- GEOL 1041 - Physical Geology Lab **0 credit hours**

- GEOL 1050 - Historical Geology **4 credit hours**
- GEOL 3000 - Mineralogy **5 credit hours**
- GEOL 3050 - Field Methods in Geology **3 credit hours**
- GEOL 3160 - Geologic Literature and Report Writing **2 credit hours**
- GEOL 4000 - Petrology and Petrography **5 credit hours**
- GEOL 4020 - Geomorphology **4 credit hours**

- GEOL 4030 - Invertebrate Paleontology **5 credit hours**
- GEOL 4070 - Sedimentation and Stratigraphy **5 credit hours**
- GEOL 4080 - Structural Geology **5 credit hours**
- GEOL 4130 - Hydrogeology **5 credit hours**
- PGEO 4530 - Geographic Information Systems **3 credit hours**
- GEOL 3000-4000 level elective (Geosciences-mentor approved) **3 credit hours**

Cognate 1 (18-19 hours)

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- MATH 1910 - Calculus I **4 credit hours (3 credit hours counted in the True Blue Core; 1 credit hour remaining)**

- MATH 1920 - Calculus II **4 credit hours** OR
- MATH 1530 - Applied Statistics **3 credit hours** OR
- MATH 2050 - Probability and Statistics **3 credit hours**

- MATH/SCI elective (Geosciences mentor-approved) **3 credit hours**

Cognate 2 (18 hours)

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours (may be counted in the True Blue Core)**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours (may be counted in the True Blue Core)**

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours**
  OR
- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

- GEOL or PGEO elective (Geosciences mentor approved) **3 credit hours**
- Geology Field Camp in Western U.S. (Geosciences chair approved) **4 credit hours**
- MATH/SCI elective (Geosciences mentor approved) **3 credit hours**

Curriculum: Geoscience, Geology Concentration (Geology)

Following is a suggested pattern of study for the first two years; however, consultation with the assigned advisor is necessary before registration.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Non-Written Communication **3 credit hours**
- History and Civic Learning **6 credit hours**
- Human Society and Social Relationships **3 credit hours**
- GEOL 1050 - Historical Geology **4 credit hours**
- PGEO 4530 - Geographic Information Systems **3 credit hours**

- GEOL 1030 - Introduction to Earth Science **3 credit hours** AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour**
  OR
- GEOL 1040 - Physical Geology **4 credit hours** AND
- GEOL 1041 - Physical Geology Lab **0 credit hours**

Subtotal: 29 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- GEOL major courses **10 credit hours**
- Human Society and Social Relationships **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)

- MATH 1920 - Calculus II **4 credit hours** OR
- MATH 1530 - Applied Statistics **3 credit hours** OR
- MATH 2050 - Probability and Statistics **3 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 32 Hours

Junior

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours**
  OR
- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours** (Sci Lit)

- Creativity and Cultural Expression **6 credit hours**
- GEOL required courses **19 credit hours**

Subtotal: 33 Hours

Senior

- MATH/SCI electives **6-7 credit hours**
- Geoscience electives **6 credit hours**
- GEOL required courses **10 credit hours**
- GEOL Field Camp **4 credit hours (GEOL 3401 may not be used for this requirement)**

Subtotal: 26-27 Hours

Geosciences, Physical Geography Concentration (Geospatial Analysis), B.S.

Geosciences
616-898-2726
Jeremy Aber, program coordinator
Jeremy.Aber@mtsu.edu

This program is designed for students who plan to become professional geographers or who wish to pursue graduate study in physical geography and/or related fields.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Geoscience, Physical Geography (Geospatial Analysis), B.S. Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**41 hours***
Cognate	**18 hours***
Supporting Courses	**6 hours***
Electives	**14-24 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1530 and MATH 1710 (Quant Lit)
- GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041 (Sci Lit)
- GEOG 2000 (HSSR)

Major Requirements (41 hours)

A minimum GPA of 2.00 is required in the major.

- GEOL 1030 - Introduction to Earth Science **3 credit hours** AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour**
  OR
- GEOL 1040 - Physical Geology **4 credit hours** AND
- GEOL 1041 - Physical Geology Lab **0 credit hours**
  (may be counted in the True Blue Core)

- PGEO 1030 - Physical Geography **4 credit hours**
- PGEO 3401 - Field Studies in Physical Geography **4 credit hours**

- PGEO 4000 - Climatology and Climate Change **3 credit hours**
- PGEO 4380 - Cartography **3 credit hours**
- PGEO 4490 - Remote Sensing **4 credit hours**
- PGEO 4511 - Advanced Remote Sensing **3 credit hours**
- PGEO 4530 - Geographic Information Systems **3 credit hours**
- PGEO 4560 - Intermediate Geographic Information Systems **3 credit hours**
- PGEO 4570 - Advanced Geographic Information Systems **3 credit hours**
- GEOL 4020 - Geomorphology **4 credit hours**

- PGEO or GEOL electives **3-5 credit hours**

Cognate (18 hours)

- MATH 1530 - Applied Statistics **3 credit hours**
- MATH 1710 - College Algebra **3 credit hours (may be counted in the True Blue Core)**
- Mentor-approved College of Basic and Sciences electives **12 credit hours**

Supporting Courses (6 hours)

- GEOG 2000 - Introduction to Regional Geography **3 credit hours (may be counted in the True Blue Core)**
- GEOG 4360 - Cultural Geography **3 credit hours**

Electives (14-24 hours)

- Geosciences mentor-approved electives

Curriculum: Geoscience, Physical Geography (Geospatial Analysis)

Following is a suggested pattern of study for the first two years; however, consultation with the assigned advisor is necessary before registration.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Non-Written Communication **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Scientific Literacy **4 credit hours**
- GEOG 2000 - Introduction to Regional Geography **3 credit hours** (HSSR)
- MATH 1710 - College Algebra **3 credit hours** (Quant Lit)
- PGEO 1030 - Physical Geography **4 credit hours**

- GEOL 1030 - Introduction to Earth Science **3 credit hours** (Sci Lit) AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour**
  OR
- GEOL 1040 - Physical Geology **4 credit hours** (Sci Lit) AND
- GEOL 1041 - Physical Geology Lab **0 credit hours**

Subtotal: 30 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **6 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- General elective **3 credit hours**
- MATH 1530 - Applied Statistics **3 credit hours**
- PGEO 4000 - Climatology and Climate Change **3 credit hours**
- PGEO 4380 - Cartography **3 credit hours**
- PGEO 4490 - Remote Sensing **4 credit hours**
- PGEO 4530 - Geographic Information Systems **3 credit hours**

Subtotal: 31 Hours

Junior

- GEOG 4360 - Cultural Geography **3 credit hours**
- PGEO 4511 - Advanced Remote Sensing **3 credit hours**
- PGEO 4560 - Intermediate Geographic Information Systems **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Cognate electives **6 credit hours**
- General electives **9 credit hours**

Subtotal: 27 Hours

NOTE:

PGEO 3401 (4-hour field course) is required and offered only during summer.

Senior

- GEOL 4020 - Geomorphology **4 credit hours**
- PGEO 4570 - Advanced Geographic Information Systems **3 credit hours**
- PGEO or GEOL elective **3-5 credit hours**
- Cognate electives **6 credit hours**
- General electives **12-14 credit hours**

Subtotal: 28 Hours

Geosciences, Physical Geography Concentration (Physical Geography), B.S.

Geosciences
616-898-2726
Jeremy Aber, program coordinator
Jeremy.Aber@mtsu.edu

This program is designed for students who plan to become professional geographers or who wish to pursue graduate study in geography and/or related fields.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Geoscience, Physical Geography (Physical Geography Career Pattern), B.S. Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**41 hours***
Cognate	**18 hours***
Supporting Courses	**6 hours***
Electives	**14-24 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041 (Sci Lit)
- MATH 1530 or MATH 1710 (Quant Lit)
- GEOG 2000 (HSSR)

Major Requirements (41 hours)

A minimum GPA of 2.00 is required in the major.

- GEOL 1030 - Introduction to Earth Science **3 credit hours** AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour**
  OR
- GEOL 1040 - Physical Geology **4 credit hours** AND
- GEOL 1041 - Physical Geology Lab **0 credit hours**
  (may be counted in the True Blue Core)
- GEOL 3010 - Oceanography **3 credit hours**
- GEOL 4020 - Geomorphology **4 credit hours**
- GEOL 4050 - Meteorology **3 credit hours**

- PGEO 1030 - Physical Geography **4 credit hours**
- PGEO 3401 - Field Studies in Physical Geography **4 credit hours**
- PGEO 4000 - Climatology and Climate Change **3 credit hours**
- PGEO 4010 - Biogeography **3 credit hours**
- PGEO 4020 - Environmental Issues, Impacts, and Sustainability **3 credit hours**
- PGEO 4380 - Cartography **3 credit hours**
- PGEO 4490 - Remote Sensing **4 credit hours**
- PGEO 4530 - Geographic Information Systems **3 credit hours**

Cognate (18 hours)

- MATH 1530 - Applied Statistics **3 credit hours**
- MATH 1710 - College Algebra **3 credit hours (may be counted in the True Blue Core)**
- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**
- Mentor-approved College of Basic and Applied Sciences coursework **9 credit hours**

Supporting Courses (6 hours)

- GEOG 2000 - Introduction to Regional Geography **3 credit hours (may be counted in the True Blue Core)**
- GEOG 4360 - Cultural Geography **3 credit hours**

Electives (14-24 hours)

- Mentor-approved electives

Curriculum: Geoscience, Physical Geography Concentration (Physical Geography)

Following is a suggested pattern of study for the first two years; however, consultation with the assigned advisor is necessary before registration.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Non-Written Communication **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- MATH 1710 - College Algebra **3 credit hours** (Quant Lit)
- GEOG 2000 - Introduction to Regional Geography **3 credit hours** (HSSR)
- PGEO 1030 - Physical Geography **4 credit hours**
- GEOL 4050 - Meteorology **3 credit hours**

- GEOL 1030 - Introduction to Earth Science **3 credit hours** (Sci Lit) AND
- GEOL 1031 - Introduction to Earth Science Lab **1 credit hour**
  OR
- GEOL 1040 - Physical Geology **4 credit hours** (Sci Lit) AND
- GEOL 1041 - Physical Geology Lab **0 credit hours**

Subtotal: 29 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Cognate(s) **6 credit hours**
- History and Civic Learning **6 credit hours**
- GEOL 4020 - Geomorphology **4 credit hours**
- PGEO 4380 - Cartography **3 credit hours**
- PGEO 4530 - Geographic Information Systems **3 credit hours**
- PGEO 4490 - Remote Sensing **4 credit hours**

Subtotal: 32 Hours

Junior

- PLSO 3340 - Fundamentals of Soil Science **3 credit hours**
- MATH 1530 - Applied Statistics **3 credit hours**
- GEOG 4360 - Cultural Geography **3 credit hours**
- GEOL 3010 - Oceanography **3 credit hours**
- PGEO 4000 - Climatology and Climate Change **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Cognate elective **3 credit hours**
- General electives **6 credit hours**

Subtotal: 27 Hours

NOTE:

PGEO 3401 (4-hour field course) is required and offered only during summer.

Senior

- PGEO 4010 - Biogeography **3 credit hours**
- PGEO 4020 - Environmental Issues, Impacts, and Sustainability **3 credit hours**
- Scientific Literacy **4 credit hours**
- Human Society and Social Relationships/General elective **3 credit hours**
- General electives **15 credit hours**

Subtotal: 28 Hours

Geospatial Analysis Minor

Geosciences

The Geospatial Analysis minor provides students with knowledge of the technologies of geographic information system and remote sensing. This offers preparation for students to augment their field of study with spatial technologies that can be utilized both on campus and in the workforce. The minor in Geospatial Analysis consists of 17 semester hours.

Required Courses (17 hours)

- PGEO 1030 - Physical Geography **4 credit hours**
- PGEO 4490 - Remote Sensing **4 credit hours**
- PGEO 4511 - Advanced Remote Sensing **3 credit hours**
- PGEO 4530 - Geographic Information Systems **3 credit hours**
- PGEO 4560 - Intermediate Geographic Information Systems **3 credit hours**

Physical Geography Minor

Geosciences

The Physical Geography minor provides students a foundational knowledge of geography with a focus on physical components in order to better understand earth processes, human cultures, and the intersections between human and natural systems. The minor in Physical Geography requires a minimum of 18 hours.

Required (13 hours)

- GEOG 2000 - Introduction to Regional Geography **3 credit hours**
- PGEO 1030 - Physical Geography **4 credit hours**
- PGEO 4000 - Climatology and Climate Change **3 credit hours**
- PGEO 4530 - Geographic Information Systems **3 credit hours**

Electives (5 hours)

- Mentor-approved courses with a PGEO prefix **5 credit hours**

Environmental Science

ENVS 2810 - Introduction to Environmental Science
3 credit hours The technical, economic, and political aspects of environmental science. Introduces specific problems dealing with many pollution issues. An overview of energy production processes and climate-related impacts, industrial and agricultural pollution problems, air, noise, solid and hazardous wastes, along with economic and environmental concerns.

Geology

GEOL 1030 - Introduction to Earth Science
3 credit hours
Corequisite: GEOL 1031. The earth and its relationship to its space and environment emphasized. Forces and processes which combine to mold the face of the earth and its atmosphere, as well as the internal constitution of the earth. Three hours lecture.
TBC: Scientific Literacy (Discovery)

GEOL 1031 - Introduction to Earth Science Lab
1 credit hour Laboratory to accompany GEOL 1030.

GEOL 1040 - Physical Geology
4 credit hours
Corequisite: GEOL 1041. The origin, composition, and structure of the solid earth: rock-forming minerals; igneous, sedimentary, and metamorphic rocks; earthquakes and plate tectonics; surface processes; geologic time. Identification and description of minerals and rocks in hand sample. Use of topographic and geologic maps. Three hours lecture and two hours laboratory per week.
TBC: Scientific Literacy (Discovery)

GEOL 1041 - Physical Geology Lab
0 credit hours Corequisite: GEOL 1040.

GEOL 1050 - Historical Geology
4 credit hours Prerequisites: GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041. The major divisions of geologic time with emphasis on earth movements, sea fluctuations, life of the time, and the effect these have had on our present environment. Close attention to the development of the physiographic regions of North America, which are correlated with chronologically similar events in other parts of the world. Topographic maps, geologic maps, and fossil animals and plants. Three hours lecture and two hours laboratory per week.

GEOL 3000 - Mineralogy
5 credit hours Prerequisites: GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041 or permission of instructor. Crystallography and crystal chemistry. Physical and chemical properties of silicate and non-silicate mineral groups. Examination of the common rock-forming minerals in hand sample and thin section. Four hours lecture and two hours laboratory per week.

GEOL 3010 - Oceanography
3 credit hours Prerequisites: GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041 or PGEO 1030. Physiography, structures, and sediments of the ocean floor; coastal and oceanic environments; and the nature of sea water, currents, waves, and tides. Geological processes, geophysical studies, and oceanographic instrumentation discussed.

GEOL 3030 - Geoscience of Energy Resources
3 credit hours Prerequisites: GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041 or PGEO 1030. Geoscience aspects of energy resources and their impact on the environment. Topics include occurrence, exploration, development, and reclamation, as well as historical trends. Three hours lecture per week.

GEOL 3040 - Geoscience of Caves
3 credit hours Prerequisite: GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041. A broad survey of caves emphasizing geologic aspects. Topics include cave geology, archaeology, biology, and conservation. Touches on the intersection between caves and various human uses including recreational, commercial, military, and criminal applications. Includes information about cave surveying, safety, and rescue.

GEOL 3050 - Field Methods in Geology
3 credit hours Prerequisite: GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041; GEOL 1050 and knowledge of trigonometry recommended. An introduction to learning geoscience in the field with an emphasis on those aspects of rock formations relevant to environmental, hazard, natural resources, and energy applications. Topics include use of GPS, the Brunton Pocket transit, smartphone and tablet apps, and the Jacob's staff. Students prepare a map

and report. Two hours lecture/two hours fieldwork per work

GEOL 3060 - Computer Methods in Geology
3 credit hours Prerequisites: GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041 and GEOL 1050; major or minor in Geology/Earth Science. Extensive use of personal computers for processing field data, map contouring, geologic reports and illustrations, lettering and cartography, image processing, geologic databases, and digital maps. Brief treatment of classical cartography. Four to five hours lecture/laboratory per week.

GEOL 3070 - Geochemistry of Earth Systems
3 credit hours Prerequisites: GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041 and CHEM 1010/CHEM 1011 or CHEM 1110/CHEM 1111. Geochemical evolution and compositions of the solid Earth, hydrosphere, and atmosphere; cycling of elements between Earth systems; impacts of human development on geochemical cycles influencing the environment and climate change.

GEOL 3160 - Geologic Literature and Report Writing
2 credit hours Prerequisites: GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041; GEOL 1050 and GEOL 3000; 8 semester hours of upper-division GEOL courses. Acquisition and presentation of geological data from traditional and database sources. Preparation of geologic field and laboratory reports in addition to professional reports and papers.

GEOL 3401 - Field Course
4 credit hours Prerequisite: Permission of department. Supervised study in some geological area preceded by classroom preview and concluded by a time of evaluation. Emphasis on the natural and physical elements of the environment, with special attention directed toward the geomorphology and geology of specific areas. For fees and specific credit, consult the director, division of geology.

GEOL 3402 - Field Course
4 credit hours Prerequisite: Permission of department. Supervised study in some geological area preceded by classroom preview and concluded by a time of evaluation. Emphasis on the natural and physical elements of the environment, with special attention directed toward the geomorphology and geology of specific areas. For fees and specific credit, consult the director, division of geology.

GEOL 4000 - Petrology and Petrography
5 credit hours Prerequisite: GEOL 3000. Igneous, sedimentary, and metamorphic rocks. Theories of formation and evolution based upon mineralogical and geochemical evidence. Examination and classification of rocks in hand sample and thin section. Three hours lecture and three hours laboratory per week.

GEOL 4020 - Geomorphology
4 credit hours Prerequisite: GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041; or consent of the instructor. An introduction to the modern geologic study of Earth's landforms and landscapes and their relationship to surface processes, underlying structure, and the history of geological changes. Emphasis on the relationship between process and form, the linkage between geomorphology and other geoscience disciplines, and Quaternary climate change. Three hours lecture and two hours laboratory per week. A weekend geomorphic field trip is required.

GEOL 4030 - Invertebrate Paleontology
5 credit hours Prerequisite: GEOL 1050. Invertebrate and microscopic animal life of the past, including recently preserved representatives and their ancient fossilized ancestors. Numerous field trips to local fossil-collecting sites. Designed to aid in the preparation of earth science teachers, geologists, and biologists. Three hours lecture and three hours laboratory per week.

GEOL 4040 - Engineering Geology
3 credit hours Prerequisites: GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041 or equivalent; MATH 1710 and MATH 1720 or MATH 1730 or equivalent. Principles and applications of geology in engineering practice. Engineering geology exploration, behavior of soils and rocks for engineering projects, application of engineering geology to the solution of construction and environmental problems.

GEOL 4050 - Meteorology
3 credit hours A general, non-mathematical introduction to the atmosphere. Emphasis on main elements such as temperature, precipitation, clouds, and humidity. In-depth analysis of storms, tornadoes, and hurricanes and human alteration of the atmosphere such as the ozone hole. Weather forecasting and climate change.

GEOL 4070 - Sedimentation and Stratigraphy
5 credit hours Prerequisites: GEOL 1050 and GEOL 3000 or consent of instructor. Sedimentary rocks, the process of sedimentation, the alteration of sediments through time, and examination of resulting stratigraphic units. Designed for geoscience majors and those with interests in soil mechanics and civil engineering. Three hours lecture and three hours laboratory per week.

GEOL 4080 - Structural Geology
5 credit hours Prerequisites: MATH 1720 or MATH 1730; GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041; GEOL 1050. Orientation and deformation of rock. Geometric, analytical, and statistical solutions to structural problems. Emphasis on three-dimensional visualization, geological map interpretation, and the mechanics of deformation. Three hours lecture and three hours laboratory per week.

GEOL 4090 - Problems in Geology
1 to 6 credit hours Prerequisites: A minimum of 12 semester hours of geology (excluding GEOL 1030/GEOL 1031) at least 6 hours of which must be upper division; consent of instructor. A problem-solving course. Includes an independent research-oriented project commensurate with the student's interests and qualifications. May be repeated up to a maximum of 6 hours.

GEOL 4100 - Geophysical Prospecting
4 credit hours Prerequisites: MATH 1910; PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111. (PHYS 2020/PHYS 2021 or PHYS 2120/PHYS 2121, GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041, and MATH 1920 also recommended.) Survey of seismic, gravimetric, and magnetic/electrical exploration methods. An applied course covering some elementary theory, basic field practice, computation fundamentals, interpretation techniques. Three hours lecture and two hours laboratory per week.

GEOL 4120 - Environmental Geology
4 credit hours Prerequisite: GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041 or consent of instructor. Application of geologic information to minimize possible environmental degradation and maximize utilization of resources in the natural and modified environment; local examples and field trips. Topics include engineering properties of earth materials, natural hazard prediction and reduction, water supply, solid and hazardous wastes, mineral resources, global change, land-use planning, environmental impact analysis. Three hours lecture and two hours laboratory per week.

GEOL 4130 - Hydrogeology
5 credit hours Prerequisites: MATH 1720 or MATH 1730; GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041. Basic processes and measurement of the hydrologic cycle, including precipitation, evaporation, surface runoff, stream flow, soil moisture, and ground water. Emphasis on ground water including geology of occurrence, principles of flow, conceptual models of regional flow, chemistry and quality, well hydraulics, aquifer characteristics, resource development, detection of pollutants, and contaminant transport. Three hours lecture and two hours laboratory per week.

GEOL 4140 - Inorganic Geochemistry
3 credit hours Prerequisite: GEOL 3000. Principles of inorganic geochemistry. Geochemistry of the earth and solar system, isotopic geochronometers, thermodynamics and rates of geochemical processes, chemical weathering, chemical compositions of surface and groundwater. Three hours lecture per week.

GEOL 4150 - Environmental Applications of Hydrogeology
3 credit hours Prerequisite: GEOL 4130. An advanced course in hydrogeology that emphasizes applied methods for assessing hazardous and solid waste facilities and contaminated ground water remediation techniques. Included will be site characterization methods, ground water sampling procedures, and monitoring well installation techniques. Three hours lecture per week.

GEOL 4571 - Internship in Geology
3 credit hours Prerequisites: Major or minor in geology; 15 hours of geology/geography with junior or senior standing; permission of employer and department. Practical experience for students in a professional setting relating to geologic work. After completion of one internship, 4571 or GEOL 4572, the other may be taken (total of six credits).

GEOL 4572 - Internship in Geology
3 credit hours Prerequisites: Major or minor in geology; 15 hours of geology/geography with junior or senior standing; permission of employer and department. Practical experience for students in a professional setting relating to geologic work. After

completion of one internship, GEOL 4571 or 4572, the other may be taken (total of six credits).

GEOL 4580 - Seminar in Geology
1 credit hour Prerequisite: Senior standing in geology. A reading and discussion seminar in which current topics in the geological sciences are examined to broaden the major's knowledge of the scope and literature of the discipline.

GEOL 4740 - Research Methods
3 credit hours (Same as ABAS/BIOL/CHEM/PHYS/MATH 4740.) Prerequisite: YOED 3520. Provides secondary science and mathematics teacher candidates with the tools that scientists use to solve scientific problems. Students will use these tools in a laboratory setting, communicate findings, and understand how scientists develop new knowledge.

Physical Geography

PGEO 1030 - Physical Geography
4 credit hours
The physical earth as the home of humans. The global earth in space, tools of the discipline, the atmosphere, the hydrosphere, and the biosphere. Field trips may be required. Three hours lecture and two hours laboratory per week.
TBC: Scientific Literacy (Discovery)

PGEO 3200 - Environment, Society, and Hazards
3 credit hours Introduces geographic variations and interactions of environment, hazards, and society. In-depth analysis and application of demographic, social, and economic perspectives of environmental stewardship and hazards.

PGEO 3401 - Field Studies in Physical Geography
4 credit hours Supervised study in some geographical area, preceded by classroom preview and concluded by a time of evaluation. Emphasis on natural and cultural elements of the environment with special attention directed toward the pattern of human occupancy. For fees and specific credit, consult the instructor.

PGEO 4000 - Climatology and Climate Change
3 credit hours Prerequisites: PGEO 1030 or GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041. Non-mathematical introduction to the causes and patterns of global climates and in-depth analysis of climate change, including paleoclimatology and recent global cooling and warming trends, their natural and human-induced causes, potential future trends, human and environmental adaptation, and mitigation including geoengineering.

PGEO 4010 - Biogeography
3 credit hours Prerequisites: PGEO 1030 or GEOL 1030/ GEOL 1031 or GEOL 1040 GEOL 1041. Examines the science of biogeography, geographic principles, and foundations of biogeography. Topics include patterns of biodiversity, ecological biogeography, specialization and extinction forces, and the frontiers of biogeography.

PGEO 4020 - Environmental Issues, Impacts, and Sustainability
3 credit hours Prerequisites: PGEO 1030 or GEOL 1030/GEOL 1031 or GEOL 1040/GEOL 1041. Examines the geographic aspects of how locations affect such modern issues of air and water pollution, hazardous waste, climate change, and food production. Provides an overview of the modern environmental concerns, their causes, consequences, and factors needing to be examined in order to gain an understanding of these problems.

PGEO 4280 - Special Topics and Problems in Physical Geography
1 to 6 credit hours Prerequisite: Permission of department. Research participation or guided readings in a particular area or topic appropriate to the student's interest and professional objectives.

PGEO 4380 - Cartography
3 credit hours General knowledge of the field including familiarity with the techniques and tools of professional cartography and graphics. Selected lectures, class discussions, and a series of map construction assignments. Three hours lecture per week.

PGEO 4490 - Remote Sensing
4 credit hours The various aspects of remote sensing such as radar, satellite imagery, and infrared data. Use of data in preparation of maps and application to land use and environmental problems examined. Three hours lecture and two hours laboratory per week.

PGEO 4510 - Laboratory Problems in Remote Sensing
4 credit hours Prerequisite: PGEO 4490. Computer processing of selected satellite imagery. Laboratory

will provide practical experience through design, execution, and completion of an applied remote sensing project.

PGEO 4511 - Advanced Remote Sensing
3 credit hours Prerequisite: PGEO 4490. Advanced topics in remote sensing including, but not limited to, active sensors (LiDAR and RADAR), hyperspectral, and spectroscopy. Three hours lecture/laboratory per week.

PGEO 4520 - Image Interpretation
4 credit hours Principles, methods, and techniques of image interpretation, including maps, satellite data, and aerial photos. Three hours lecture and two hours laboratory per week.

PGEO 4530 - Geographic Information Systems
3 credit hours Lecture and laboratory work relative to computer-manipulated geographic data base. Laboratory work will involve experience in practical application of a geographic information system (GIS) to problem solving.

PGEO 4560 - Intermediate Geographic Information Systems
3 credit hours Prerequisite: PGEO 4530. Lecture and laboratory work related to the principles and applications of geographic information (GIS). Continued training in GIS analysis including raster analysis, spatial analysis, network analysis, and geocoding. Examines data management including data editing and geodatabase design and creation. Other topics include resource management, demographic, and civic applications.

PGEO 4570 - Advanced Geographic Information Systems
3 credit hours Prerequisite: PGEO 4560; coursework in statistics and computer programming recommended. Advanced course in spatial analysis. Using spatial statistics, Visual Basic programming, and databases to solve problems involving proximity, density, clustering, the cost of travel paths, etc. Other major topics include environmental modeling and error analysis.

PGEO 4571 - Internship in Physical Geography
3 credit hours Prerequisites: Permission of department; major or minor in geography. Practical experience for students in a professional setting relating to geographic work. Counted as a free elective, not part of major or minor requirements. After completion of one internship, 4571 or GEOG 4572, the other may be taken (total of 6 credits).

Mathematical Sciences

D. Christopher Stephens, Chair

Adamson, Barnwal, Bleiler-Baxter, Calahan, Ding, Green, Hamlin, Hart, Hong, Huang, Kaplan, Kassaee, Khaliq, Kimmins, Leander, Lischka, Liu, Lovett, Manathunga, Martin, Murdock, Nelson, Rimal, Rowell, Saunders, Schmidt, Stephens, Strayer, Walsh, Wang, Q. Wu, Y. Wu, Xiong, Ye, Zha, Zhang, Zijlstra

The purpose of the Department of Mathematical Sciences is to provide students education in the mathematical sciences necessary to function and succeed in an increasingly complex, technological world.

Courses offered by the department are designed to prepare students who plan to enter graduate schools or professional schools of medicine or engineering; to teach in elementary schools, secondary schools, or community colleges; to major in mathematics, in computer science, in the natural or physical sciences, or in other areas with mathematics requirements; or to enter careers in business, industry, or government. Courses also are provided to meet cultural and general education requirements.

Programs in the department lead to the Bachelor of Science degree with a major in Actuarial Science or Mathematics. Mathematics major students choose one of the following concentrations: Professional Mathematics or Mathematics Education. Minors are offered in Actuarial Science; Mathematics; Mathematics for Managerial, Social, and Life Sciences; and Statistics.

Honors College

MATH 1730, MATH 1910, and MATH 1920 are offered regularly for students in the University Honors College. Upon request by the Honors College, MATH 1010 and MATH 1710 are offered. MATH 4600 can also be offered as an Honors course.

Graduate Study

The Master of Science is offered in Mathematics. A minor in Mathematics is offered for the master's degree. Requirements for these degrees and a list of the courses offered for graduate credit are in the Graduate Catalog.

Actuarial Science Minor

Mathematical Sciences

A minor in Actuarial Science consists of 15 credit hours. A 2.0 GPA is required in the Actuarial Science minor.

Required Courses (9 hours)

- ACSI 2100 - Introduction to Actuarial Science **3 credit hours**
- FIN 3050 - Principles of Risk Management and Insurance **3 credit hours**
- MATH 1810 - Applied Calculus I **3 credit hours**

Electives (6 hours)

- ACSI 4140 - Mathematical Foundations of Actuarial Science **3 credit hours**
- ACSI 4220 - Mathematics of Corporate Finance **3 credit hours**
- ACSI 4230 - Mathematics of Compound Interest **3 credit hours**
- ACSI 4330 - Actuarial Mathematics I **3 credit hours**
- ACSI 4430 - Introduction to Loss Models and Credibility **3 credit hours**
- ACSI 4530 - Rate Making and Loss Reserving **3 credit hours**
- ACSI 4600 - Problems in Actuarial Science **1 to 6 credit hours**
- ACSI 4630 - Mathematics of Risk Management **3 credit hours**

Actuarial Science, B.S.

Mathematical Sciences
615-898-2669
Don Hong, program coordinator
Don.Hong@mtsu.edu

The Actuarial Science major is designed for students who have a strong mathematical ability with an interest in applying their mathematical knowledge to insurance, finance, risk management, investments, and other areas of business. The program is classified by the Society of Actuaries (SOA) as an Advanced Undergraduate Actuarial Science program and is in complete compliance with the requirements set forth by the Society of Actuaries and the Casualty Actuarial Society (CAS) in the Year 2018 Syllabus and beyond. Therefore, the student can choose coursework necessary to prepare for all the preliminary and foundational SOA/CAS Course/Exams validation by educational experience (VEE) courses and project course in predictive analytics.

Actuarial Science majors preparing for the actuarial examination series and an actuarial science career should complete this professional program in Actuarial Science.

All courses in the Actuarial Science major or minor (including supporting coursework) must be completed with a grade of C (2.00) or better. All courses transferred from other institutions for credit in the Actuarial Science major or minor must carry a grade of C (2.00) or better and be approved by the department chair.

The following specialized courses do not count toward an Actuarial Science major: MATH 1010, MATH 1410, MATH 1420, MATH 1530, MATH 1630, MATH 1710, MATH 1720, MATH 1730, MATH 1810, and MATH 4010. However, MATH 1630, MATH 1730, and MATH 1810 may count toward a minor in Mathematics for Managerial, Social, and Life Sciences.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Actuarial Science, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**39 hours***
Supporting Courses	**28 hours***
Electives	**12-21 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- ECON 2410 and ECON 2420 (HSSR)

Major Requirements (39 hours)

Mathematics Core (15 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- STAT 3150 - Mathematical Statistics I **3 credit hours**

Actuarial Science Core (24 hours)

- ACSI 2100 - Introduction to Actuarial Science **3 credit hours**
- ACSI 4140 - Mathematical Foundations of Actuarial Science **3 credit hours**
- ACSI 4220 - Mathematics of Corporate Finance **3 credit hours**
- ACSI 4230 - Mathematics of Compound Interest **3 credit hours**
- ACSI 4330 - Actuarial Mathematics I **3 credit hours**
- ACSI 4430 - Introduction to Loss Models and Credibility **3 credit hours**

Select two courses from the following:

- ACSI 4200 - Introduction to Mathematics of Investment **3 credit hours**
- ACSI 4340 - Actuarial Mathematics II **3 credit hours**
- ACSI 4440 - Advanced Topics on Loss Models and Credibility **3 credit hours**
- ACSI 4530 - Rate Making and Loss Reserving **3 credit hours**
- ACSI 4600 - Problems in Actuarial Science **1 to 6 credit hours**
- ACSI 4630 - Mathematics of Risk Management **3 credit hours**
- STAT 4200 - Statistical Methods for Forecasting **3 credit hours**

Supporting Courses (28 hours)

- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**
- ECON 2410 - Principles of Economics, Macroeconomics **3 credit hours (may be counted in the True Blue Core)**
- ECON 2420 - Principles of Economics, Microeconomics **3 credit hours (may be counted in the True Blue Core)**
- FIN 3050 - Principles of Risk Management and Insurance **3 credit hours**
- MATH 4990 - Seminar in Mathematics **3 credit hours**
- STAT 4190 - Mathematical Statistics II **3 credit hours**
- STAT 4320 - Probability and Stochastic Processes **3 credit hours**
- CSCI/INFS/DATA elective **3 credit hours**

Electives (12-21 hours)

NOTE:

Students with a major in Actuarial Science may substitute STAT 3150 for MATH 2010 and MATH 2050.

Curriculum: Actuarial Science

Students should consult their advisors each semester to plan their schedules.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Scientific Literacy **8 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**

Subtotal: 29 Hours

Sophomore

- Non-Written Communication **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **6 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- ECON 2410 - Principles of Economics, Macroeconomics **3 credit hours** (HSSR)
- ECON 2420 - Principles of Economics, Microeconomics **3 credit hours** (HSSR)
- ACSI 2100 - Introduction to Actuarial Science **3 credit hours**
- ACSI 4230 - Mathematics of Compound Interest **3 credit hours**

Subtotal: 31 Hours

Junior

- STAT 3150 - Mathematical Statistics I **3 credit hours**
- STAT 4190 - Mathematical Statistics II **3 credit hours**
- ACSI 4140 - Mathematical Foundations of Actuarial Science **3 credit hours**
- ACSI 4220 - Mathematics of Corporate Finance **3 credit hours**
- ACSI 4330 - Actuarial Mathematics I **3 credit hours**
- ACSI 4430 - Introduction to Loss Models and Credibility **3 credit hours**
- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
- FIN 3050 - Principles of Risk Management and Insurance **3 credit hours**
- Elective **3 credit hours**
- CSCI/INFS/DATA elective **3 credit hours** *(approved by advisor)*

Subtotal: 30 Hours

Senior

- STAT 4320 - Probability and Stochastic Processes **3 credit hours**
- MATH 4990 - Seminar in Mathematics **3 credit hours**
- ACSI/STAT (Core) electives **6 credit hours**
- Human Society and Social Relationships/Elective **6 credit hours**
- Electives **12 credit hours**

Subtotal: 30 Hours

Mathematics for Managerial, Social, and Life Sciences Minor

Mathematical Sciences

A minor in Mathematics for Managerial, Social, and Life Sciences consists of 18 semester hours. A student may count BIA 2610 and BIA 3620 for the 3-hour MATH 2050 course and may count CSCI 1170 as one 3-hour course. All courses in the Mathematics for Managerial, Social, and Life Sciences minor must be completed with a grade of C (2.00) or better. All courses transferred from other institutions for credit in the Mathematics for Managerial, Social, and Life Sciences minor must be completed with a grade of C (2.00) or better and be approved by the department chair.

Required Course (3 hours)

- MATH 1810 - Applied Calculus I **3 credit hours** OR
- MATH 1910 - Calculus I **4 credit hours**

Electives (15 hours)

- MATH 1630 - College Mathematics for Managerial, Social, and Life Sciences **3 credit hours** * OR
- MATH 1730 - Pre-Calculus **4 credit hours** *

- MATH 1920 - Calculus II **4 credit hours**
- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3120 - Differential Equations I **3 credit hours**
- MATH 3260 - Differential Equations II **3 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**
- any upper-level statistics or actuarial science course

NOTE:

**At most one of MATH 1630 or MATH 1730 may be counted for the minor.*

Mathematics Minor

Mathematical Sciences

A minor in Mathematics consists of 18 semester hours. All courses in the Mathematics minor must be completed with a grade of C (2.0) or better. All courses transferred from other institutions for credit in the Mathematics minor must carry a grade of C (2.0) or better and be approved by the department chair. Students must complete at least 3 semester hours at the upper-division level in the minor through MTSU.

The following specialized courses do not count toward a Mathematics minor: MATH 1010, MATH 1410, MATH 1420, MATH 1530, MATH 1630, MATH 1710, MATH 1720, MATH 1730, MATH 1810, MATH 3300, MATH 3310, and MATH 4010. However, MATH 1630, MATH 1730, and MATH 1810 may count toward a minor in Mathematics for Managerial, Social, and Life Sciences.

Required Courses (8 hours)

- MATH 1910 - Calculus I **4 credit hours**
- MATH 1920 - Calculus II **4 credit hours**

Electives 10 hours

Must be selected with the approval of the Mathematics minor advisor.

Mathematics, Mathematics Education Concentration, B.S.

Mathematical Sciences
615-898-2669
Alyson Lischka, program coordinator
Alyson.Lischka@mtsu.edu

Mathematics majors choose either the Professional Mathematics or Mathematics Education concentration.
All courses in the Mathematics major or minor (including supporting coursework) must be completed with a grade of C (2.00) or better. All courses transferred from other institutions for credit in the Mathematics major or minor must carry a grade of C (2.00) or better and be approved by the department chair.
The following specialized courses do not count toward a Mathematics major or minor: MATH 1010, MATH 1410, MATH 1420, MATH 1530, MATH 1630, MATH 1710, MATH 1720, MATH 1730, MATH 1810, MATH 3300, MATH 3310, and MATH 4010. However, MATH 1630, MATH 1730, and MATH 1810 may count toward a minor in Mathematics for Managerial, Social, and Life Sciences.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Mathematics, Mathematics Education, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**36 hours***
Supporting Courses	**19 hours***
Secondary Education Minor-MTeach	**30 hours**
TOTAL	**120-126 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If courses for this program are also used to fulfill True Blue Core requirements, the program of study may be completed in 120 hours.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- COMM 2200 (NWC)

Major Requirements (36 hours)

Mathematics Core (21 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**
- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**

- MATH 2050 - Probability and Statistics **3 credit hours** OR
- STAT 3150 - Mathematical Statistics I **3 credit hours**

Remaining Major Courses (15 hours)

- MATH 3070 - College Geometry **3 credit hours**
- MATH 4510 - Abstract Algebra I **3 credit hours**
- MATH 4620 - History and Philosophy of Mathematics **3 credit hours**
- MATH 4990 - Seminar in Mathematics **3 credit hours**
- Math elective **3 credit hours**

Supporting Courses (19 hours)

- MATH 3320 - Teaching Mathematics in the Middle Grades **3 credit hours**
- MATH 3330 - Teaching Mathematics in the Secondary Grades **3 credit hours**
- MATH 4540 - Topics in Secondary School Mathematics **3 credit hours**
- MATH 4740 - Research Methods **3 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**
- COMM 2200 - Audience-Centered Communication **3 credit hours**

Secondary Education Minor-MTeach (30 hours)

See **Secondary Education Minor-MTeach** for further information.

Curriculum: Mathematics, Mathematics Education

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Scientific Literacy **8 credit hours**
- Human Society and Social Relationships **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**
- MSE 1010 - Step 1: Inquiry Approaches to Teaching **1 credit hour**
- MSE 2010 - Step 2: Inquiry Lesson Design **1 credit hour**

Subtotal: 30 Hours

Sophomore

- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**
- COMM 2200 - Audience-Centered Communication **3 credit hours** (NWC)
- Creativity and Cultural Expression Literature **3 credit hours**
- YOED 3520 - Knowing and Learning in Science and Mathematics **3 credit hours**
- YOED 3550 - Classroom Interactions in Mathematics and Science **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**

Subtotal: 32 Hours

Junior

- MATH 3070 - College Geometry **3 credit hours**
- MATH 3320 - Teaching Mathematics in the Middle Grades **3 credit hours**
- MATH 4510 - Abstract Algebra I **3 credit hours**
- MATH 4620 - History and Philosophy of Mathematics **3 credit hours**
- MATH 4540 - Topics in Secondary School Mathematics **3 credit hours**
- MATH elective **3 credit hours** (approved by advisor)
- Human Society and Social Relationships **3 credit hours**
- History and Civic Learning **6 credit hours**
- MATH 4740 - Research Methods **3 credit hours**
- MSE 3330 - Teaching Science in Secondary Grades **3 credit hours**

Subtotal: 33 Hours

Senior

- MATH 3330 - Teaching Mathematics in the Secondary Grades **3 credit hours**
- MATH 4990 - Seminar in Mathematics **3 credit hours**
- YOED 4040 - Residency I: MTeach **4 credit hours**
- YOED 4050 - Project-Based Instruction in Mathematics and Science **3 credit hours**
- YOED 4400 - Residency II **12 credit hours**

Subtotal: 25 Hours

Mathematics, Professional Mathematics Concentration (Advanced Mathematics), B.S.

Mathematical Sciences
615-898-2669
Dong Ye, program coordinator
Dong.Ye@mtsu.edu

Mathematics majors must declare a concentration chosen from Professional Mathematics or Mathematics Education. Students opting the Professional Mathematics concentration will choose from tracks in general mathematics, advanced mathematics, business, statistics, and industrial mathematics.

All courses in the Mathematics major or minor (including supporting coursework) must be completed with a grade of C (2.00) or better. All courses transferred from other institutions for credit in the Mathematics major or minor must carry a grade of C (2.00) or better and be approved by the department chair.

The following specialized courses do not count toward a Mathematics major or minor: MATH 1010, MATH 1410, MATH 1420, MATH 1530, MATH 1630, MATH 1710, MATH 1720, MATH 1730, MATH 1810, MATH 3300, MATH 3310, and MATH 4010. However, MATH 1630, MATH 1730, and MATH 1810 may count toward a minor in Mathematics for Managerial, Social, and Life Sciences.

Advanced Mathematics Track

Students interested in preparing for a graduate degree in mathematics should pursue this track.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Mathematics, Professional Mathematics (Advanced), B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**36 hours***
Major Core	*21 hours**
Advanced Track	*15 hours*
Supporting Courses	**16 hours**
Electives	**27-30 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following course required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)

Major Requirements (36 hours)

Mathematics Core (21 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**
- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**

- MATH 2050 - Probability and Statistics **3 credit hours** OR
- STAT 3150 - Mathematical Statistics I **3 credit hours**

Advanced Track (15 hours)

- MATH 3120 - Differential Equations I **3 credit hours**
- MATH 4250 - Introduction to Analysis I **3 credit hours**
- MATH 4510 - Abstract Algebra I **3 credit hours**

Choose two courses from the following:

- MATH 3260 - Differential Equations II **3 credit hours**
- MATH 4230 - Vector Analysis **3 credit hours**
- MATH 4270 - Introduction to Topology **3 credit hours**
- MATH 4420 - Number Theory **3 credit hours**
- MATH 4530 - Abstract Algebra II **3 credit hours**
- MATH 4700 - Combinatorics and Graph Theory **3 credit hours**

Supporting Courses (16 hours)

- CSCI 1170 - Computer Science I **4 credit hours**
- MATH 4990 - Seminar in Mathematics **3 credit hours**
- MATH/ACSI/STAT upper-division electives **9 credit hours**

Electives (27-30 hours)

- 36 total credits must be earned at the 3000/4000 level
- At least one sequence in algebra (MATH 4420/MATH 4510), analysis (MATH 4230/MATH 4250) or differential equations (MATH 3120/MATH 3260)
- Six hours of a foreign language recommended

Curriculum: Mathematics, Professional Mathematics (Advanced Mathematics)

Students should consult their advisors each semester to plan their schedules.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Scientific Literacy **4 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**

- MATH 2050 - Probability and Statistics **3 credit hours** OR
- STAT 3150 - Mathematical Statistics I **3 credit hours**

Subtotal: 31 Hours

Sophomore

- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**
- Non-Written Communication **3 credit hours**
- ACSI/MATH/STAT UD elective **3 credit hours**
- Scientific Literacy **4 credit hours**
- History and Civic Learning **3 credit hours**
- Minor or elective courses **6 credit hours**

Subtotal: 29 Hours

Junior

- MATH 3120 - Differential Equations I **3 credit hours**
- MATH 4510 - Abstract Algebra I **3 credit hours**
- Math electives* **6 credit hours**
- Minor or elective courses **6 credit hours**
- Human Society and Social Relationships **6 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**

Subtotal: 30 Hours

Senior

- MATH 4250 - Introduction to Analysis I **3 credit hours**
- MATH 4990 - Seminar in Mathematics **3 credit hours**
- ACSI/MATH/STAT UD electives **6 credit hours**
- Minor or elective courses **6 credit hours**
- Electives **12 credit hours**

Subtotal: 30 Hours

NOTE:

**Choose one course from MATH 4420, MATH 4230, or MATH 3260 and one course from MATH 4270, MATH 4530, or MATH 4700.*

Mathematics, Professional Mathematics Concentration (Business), B.S.

Mathematical Sciences
615-898-2669
Dong Ye, program coordinator
Dong.Ye@mtsu.edu

Mathematics majors must declare a concentration chosen from Professional Mathematics or Mathematics Education. Students opting the Professional Mathematics concentration will choose from tracks in general mathematics, advanced mathematics, business, statistics, and industrial mathematics.

All courses in the Mathematics major or minor (including supporting coursework) must be completed with a grade of C (2.00) or better. All courses transferred from other institutions for credit in the Mathematics major or minor must carry a grade of C (2.00) or better and be approved by the department chair.

The following specialized courses do not count toward a Mathematics major or minor: MATH 1010, MATH 1410, MATH 1420, MATH 1530, MATH 1630, MATH 1710, MATH 1720, MATH 1730, MATH 1810, MATH 3300, MATH 3310, and MATH 4010. However, MATH 1630, MATH 1730, and MATH 1810 may count toward a minor in Mathematics for Managerial, Social, and Life Sciences.

Business Track

This track is appropriate for students who seek a broad background from such diverse but mutually supportive areas as mathematics, statistics, computer science, and business. The program offers preparation for the job market or for further study in the more specialized areas of actuarial science, operations research, statistics, computer science, or finance.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Mathematics, Professional Mathematics (Business), B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**36 hours***
Major Core	*21 hours**
Business Track	*15 hours*
Supporting Courses	**23 hours***
Electives	**20-29 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- ECON 2410 and ECON 2420 (HSSR)

Major Requirements (36 hours)

Mathematics Core (21 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**
- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**

- MATH 2050 - Probability and Statistics **3 credit hours** OR
- STAT 3150 - Mathematical Statistics I **3 credit hours**

Business Track (15 hours)

- STAT 4190 - Mathematical Statistics II **3 credit hours**

- STAT 4200 - Statistical Methods for Forecasting **3 credit hours** OR
- STAT 4360 - Regression Analysis **3 credit hours**

- ACSI 4200 - Introduction to Mathematics of Investment **3 credit hours** OR
- MATH 4200 - Introduction to Mathematics of Investment **3 credit hours**

Choose two courses from the following:

- ACSI 4220 - Mathematics of Corporate Finance **3 credit hours**
- ACSI 4230 - Mathematics of Compound Interest **3 credit hours**
- ACSI 4630 - Mathematics of Risk Management **3 credit hours**
- ACSI 4640 - Mathematics of Options, Futures, and Other Derivatives **3 credit hours**
- STAT 4320 - Probability and Stochastic Processes **3 credit hours**
- STAT 4380 - Experimental Design **3 credit hours**

Supporting Courses (23 hours)

- ECON 2410 - Principles of Economics, Macroeconomics **3 credit hours (may be counted in the True Blue Core)**
- ECON 2420 - Principles of Economics, Microeconomics **3 credit hours (may be counted in the True Blue Core)**
- CSCI/INFS/BIA electives **11 credit hours**
- MATH 4990 - Seminar in Mathematics **3 credit hours**

- ACTG 2110 - Principles of Accounting I **3 credit hours** AND
- ACTG 2120 - Principles of Accounting II **3 credit hours**
  OR
- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**

Electives (20-29 hours)

- 36 total credits must be earned at the 3000/4000 level

Curriculum: Mathematics, Professional Mathematics (Business)

Students should consult their advisors each semester to plan their schedules.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships/Elective **3 credit hours**
- Scientific Literacy **4 credit hours**
- CSCI/INFS/BIA electives **7 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**

Subtotal: 31 Hours

Sophomore

- Non-Written Communication **3 credit hours**
- Scientific Literacy **4 credit hours**
- History and Civic Learning **6 credit hours**
- Human Society and Social Relationships/Elective **3 credit hours**
- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**
- ECON 2410 - Principles of Economics, Macroeconomics **3 credit hours** (HSSR)
- ECON 2420 - Principles of Economics, Microeconomics **3 credit hours** (HSSR)

Subtotal: 32 Hours

Junior

- STAT 4190 - Mathematical Statistics II **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Minor or elective courses **6 credit hours**
- CSCI/INFS/BIA elective **4 credit hours**

- STAT 3150 - Mathematical Statistics I **3 credit hours** OR
- MATH 2050 - Probability and Statistics **3 credit hours**

- ACSI 4200 - Introduction to Mathematics of Investment **3 credit hours** OR
- MATH 4200 - Introduction to Mathematics of Investment **3 credit hours**

- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**
  OR
- ACTG 2110 - Principles of Accounting I **3 credit hours** AND
- ACTG 2120 - Principles of Accounting II **3 credit hours**

Subtotal: 25 Hours

Senior

- STAT 4200 - Statistical Methods for Forecasting **3 credit hours** OR
- STAT 4360 - Regression Analysis **3 credit hours**

- MATH 4990 - Seminar in Mathematics **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Minor or elective courses **12 credit hours**
- Electives **5 credit hours**
- ACSI/STAT electives* **6 credit hours**

Subtotal: 32 Hours

NOTE:

**Choose from ACSI 4220, ACSI 4230, ACSI 4630, ACSI 4640, STAT 4320, or STAT 4380.*

Mathematics, Professional Mathematics Concentration (General Mathematics), B.S.

Mathematical Sciences
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Mathematics majors must declare a concentration chosen from Professional Mathematics or Mathematics Education. Students opting the Professional Mathematics concentration will choose from tracks in general mathematics, advanced mathematics, business, statistics, and industrial mathematics.

All courses in the Mathematics major or minor (including supporting coursework) must be completed with a grade of C (2.00) or better. All courses transferred from other institutions for credit in the Mathematics major or minor must carry a grade of C (2.00) or better and be approved by the department chair.

The following specialized courses do not count toward a Mathematics major or minor: MATH 1010, MATH 1410, MATH 1420, MATH 1530, MATH 1630, MATH 1710, MATH 1720, MATH 1730, MATH 1810, MATH 3300, MATH 3310, and MATH 4010. However, MATH 1630, MATH 1730, and MATH 1810 may count toward a minor in Mathematics for Managerial, Social, and Life Sciences.

General Track

Students desiring a broad general background in mathematics should pursue this track.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Mathematics, Professional Mathematics (General), B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**36 hours***
Major Core	*21 hours**
General Track	*15 hours*
Supporting Courses	**16 hours**
Electives	**27-30 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)

Major Requirements (36 hours)

Mathematics Core (21 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**
- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**

- MATH 2050 - Probability and Statistics **3 credit hours** OR
- STAT 3150 - Mathematical Statistics I **3 credit hours**

General Track (15 hours)

- MATH 3120 - Differential Equations I **3 credit hours**
- MATH 4510 - Abstract Algebra I **3 credit hours**

Choose three courses from the following:

- MATH 3260 - Differential Equations II **3 credit hours**
- MATH 4230 - Vector Analysis **3 credit hours**
- MATH 4250 - Introduction to Analysis I **3 credit hours**
- MATH 4270 - Introduction to Topology **3 credit hours**
- MATH 4310 - Numerical Analysis I **3 credit hours**
- MATH 4320 - Numerical Analysis II **3 credit hours**
- MATH 4420 - Number Theory **3 credit hours**
- MATH 4530 - Abstract Algebra II **3 credit hours**
- MATH 4700 - Combinatorics and Graph Theory **3 credit hours**
- STAT 3150 - Mathematical Statistics I **3 credit hours**
- STAT 4190 - Mathematical Statistics II **3 credit hours**

Supporting Courses (16 hours)

- CSCI 1170 - Computer Science I **4 credit hours**
- MATH 4990 - Seminar in Mathematics **3 credit hours**
- MATH upper-division electives **9 credit hours**

Electives (27-30 hours)

- 36 total credits must be earned at the 3000/4000 level

Curriculum: Mathematics, Professional Mathematics (General Mathematics)

Students should consult their advisors each semester to plan their schedules.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Scientific Literacy **4 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**

- MATH 2050 - Probability and Statistics **3 credit hours** OR
- STAT 3150 - Mathematical Statistics I **3 credit hours**

Subtotal: 31 Hours

Sophomore

- Non-Written Communication **3 credit hours**
- History and Civic Learning **3 credit hours**
- Minor or elective courses **9 credit hours**
- Scientific Literacy **4 credit hours**
- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3120 - Differential Equations I **3 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**

Subtotal: 32 Hours

Junior

- MATH 4510 - Abstract Algebra I **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- MATH/STAT electives* **6 credit hours**
- Human Society and Social Relationships **6 credit hours**
- Minor or elective courses **6 credit hours**
- MATH UD elective **3 credit hours**

Subtotal: 27 Hours

Senior

- MATH 4990 - Seminar in Mathematics **3 credit hours**
- MATH/STAT elective* **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- MATH UD electives **6 credit hours**
- Electives **12 credit hours**
- Minor or elective course **3 credit hours**

Subtotal: 30 Hours

NOTE:

**Choose from MATH 3260, MATH 4230, MATH 4250, MATH 4270, MATH 4310, MATH 4320, MATH 4420, MATH 4530, MATH 4700, STAT 3150, STAT 4190.*

Mathematics, Professional Mathematics Concentration (Industrial Mathematics), B.S.

Mathematical Sciences
615-898-2669
Dong Ye, program coordinator
Dong.Ye@mtsu.edu

Mathematics majors must declare a concentration chosen from Professional Mathematics or Mathematics Education. Students opting the Professional Mathematics concentration will choose from tracks in general mathematics, advanced mathematics, business, statistics, and industrial mathematics.

All courses in the Mathematics major or minor (including supporting coursework) must be completed with a grade of C (2.00) or better. All courses transferred from other institutions for credit in the Mathematics major or minor must carry a grade of C (2.00) or better and be approved by the department chair.

The following specialized courses do not count toward a Mathematics major or minor: MATH 1010, MATH 1410, MATH 1420, MATH 1530, MATH 1630, MATH 1710, MATH 1720, MATH 1730, MATH 1810, MATH 3300, MATH 3310, and MATH 4010. However, MATH 1630, MATH 1730, and MATH 1810 may count toward a minor in Mathematics for Managerial, Social, and Life Sciences.

Industrial Mathematics Track

The industrial mathematics track offers students a program of study that incorporates the areas of mathematics that contribute to business and industry. Coursework is designed to produce graduates who have strong qualifications that make them competitive for positions in industry and provides a solid foundation for students interested in pursuing graduate study in the area.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Mathematics, Professional Mathematics (Industrial), B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**36 hours***
Major Core	*21 hours**
Industrial Math Track	*15 hours*
Supporting Courses	**28 hours**
Electives	**15-22 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- PHYS 2110/PHYS 2111 (Sci Lit)

Major Requirements (36 hours)

Mathematics Core (21 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**
- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**

- MATH 2050 - Probability and Statistics **3 credit hours** OR
- STAT 3150 - Mathematical Statistics I **3 credit hours**

Industrial Mathematics Track (15 hours)

- MATH 3120 - Differential Equations I **3 credit hours**
- MATH 3260 - Differential Equations II **3 credit hours**
- MATH 4250 - Introduction to Analysis I **3 credit hours**
- MATH 4310 - Numerical Analysis I **3 credit hours**
- Advisor-approved MATH elective **3 credit hours**

Supporting Courses (28 hours)

- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**
- MATH 4990 - Seminar in Mathematics **3 credit hours**

- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours (may be counted in the True Blue Core)**

- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Select 9 credit hours from the following:

- MATH 4230 - Vector Analysis **3 credit hours**
- MATH 4270 - Introduction to Topology **3 credit hours**
- MATH 4320 - Numerical Analysis II **3 credit hours**
- MATH 4601 - Problems in Contemporary Mathematics Complex Variables **3 credit hours**
- MATH 4700 - Combinatorics and Graph Theory **3 credit hours**
- STAT 4190 - Mathematical Statistics II **3 credit hours**

Electives (15-22 hours)

- 36 total credits must be earned at the 3000/4000 level

Curriculum: Mathematics, Professional Mathematics (Industrial Mathematics)

Students should consult their advisors each semester to plan their schedules.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- Non-Written Communication **3 credit hours**
- History and Civic Learning **3 credit hours**
- Scientific Literacy **4 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**

Subtotal: 32 Hours

Sophomore

- Creativity and Cultural Expression Literature **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Minor or elective courses **6 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**

- PHYS 2110 - Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours** (Sci Lit)

- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Subtotal: 30 Hours

Junior

- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 3120 - Differential Equations I **3 credit hours**
- MATH 3260 - Differential Equations II **3 credit hours**
- MATH 4250 - Introduction to Analysis I **3 credit hours**
- History and Civic Learning **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Minor or elective courses **6 credit hours**
- MATH UD elective **3 credit hours**

- MATH 2050 - Probability and Statistics **3 credit hours** OR
- STAT 3150 - Mathematical Statistics I **3 credit hours**

Subtotal: 30 Hours

Senior

- MATH 4310 - Numerical Analysis I **3 credit hours**
- MATH 4990 - Seminar in Mathematics **3 credit hours**
- MATH/STAT electives **9 credit hours**
- Minor or elective courses **6 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Scientific Literacy/Elective **4 credit hours**

Subtotal: 28 Hours

Mathematics, Professional Mathematics Concentration (Statistics), B.S.

Mathematical Sciences
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Mathematics majors must declare a concentration chosen from Professional Mathematics or Mathematics Education. Students opting the Professional Mathematics concentration will choose from tracks in general mathematics, advanced mathematics, business, statistics, and industrial mathematics.

All courses in the Mathematics major or minor (including supporting coursework) must be completed with a grade of C (2.00) or better. All courses transferred from other institutions for credit in the Mathematics major or minor must carry a grade of C (2.00) or better and be approved by the department chair.

The following specialized courses do not count toward a Mathematics major or minor: MATH 1010, MATH 1410, MATH 1420, MATH 1530, MATH 1630, MATH 1710, MATH 1720, MATH 1730, MATH 1810, MATH 3300, MATH 3310, and MATH 4010. However, MATH 1630, MATH 1730, and MATH 1810 may count toward a minor in Mathematics for Managerial, Social, and Life Sciences.

Statistics Track

The statistics track offers students a program of study in one of the broadest areas of applied mathematics. Statistical methods are used in many fields, including agriculture, business, communications, government, health, industry, public policy, sports, and science. Courses provide students the opportunity to learn data analysis and to develop skills in statistical methods of wide application. Emphasizing a blend of theory and practice, the program is designed to provide students with the necessary background for employment as statisticians in the public or private sector and to provide a solid foundation for those students interested in graduate studies.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Mathematics, Professional Mathematics (Statistics), B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**51 hours***
Major Core	*21 hours**
Statistics Track	*30 hours*
Supporting Courses	**6 hours**
Electives	**22-25 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)

Major Requirements (51 hours)

Mathematics Core (21 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**
- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 3110 - Calculus III **4 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**

Statistics Track (30 hours)

- CSCI 1170 - Computer Science I **4 credit hours**
- CSCI 2170 - Computer Science II **4 credit hours**
- MATH 2110 - Data Analysis **1 credit hour**
- MATH 2530 - Applied Statistics II **3 credit hours**
- MATH 4990 - Seminar in Mathematics **3 credit hours**
- STAT 3150 - Mathematical Statistics I **3 credit hours**
- STAT 4190 - Mathematical Statistics II **3 credit hours**

Choose 9 hours from the following:

- STAT 4200 - Statistical Methods for Forecasting **3 credit hours**
- STAT 4320 - Probability and Stochastic Processes **3 credit hours**
- STAT 4360 - Regression Analysis **3 credit hours**
- STAT 4370 - Nonparametric Statistics **3 credit hours**
- STAT 4380 - Experimental Design **3 credit hours**
- STAT 4600 - Problems in Statistics **1 to 6 credit hours**

Supporting Courses (6 hours)

- Courses chosen with approval of statistics advisor include computing, information systems, and other relevant courses

Electives (22-25 hours)

- 36 total credits must be earned at the 3000/4000 level

Curriculum: Mathematics, Professional Mathematics (Statistics)

Students should consult their advisors each semester to plan their schedules.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- History and Civic Learning **3 credit hours**
- Scientific Literacy **4 credit hours**
- Supporting course* **3 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**

Subtotal: 30 Hours

Sophomore

- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**
- MATH 2110 - Data Analysis **1 credit hour**
- MATH 3110 - Calculus III **4 credit hours**
- Non-Written Communication **3 credit hours**
- History and Civic Learning **3 credit hours**
- Minor or elective courses **6 credit hours**
- Scientific Literacy **4 credit hours**
- Supporting course* **3 credit hours**

Subtotal: 30 Hours

Junior

- CSCI 1170 - Computer Science I **4 credit hours**
- MATH 2530 - Applied Statistics II **3 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**
- STAT 3150 - Mathematical Statistics I **3 credit hours**
- STAT 4190 - Mathematical Statistics II **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- STAT elective** **3 credit hours**
- Minor or elective courses **6 credit hours**
- Human Society and Social Relationships **3 credit hours**

Subtotal: 31 Hours

Senior

- CSCI 2170 - Computer Science II **4 credit hours**
- MATH 4990 - Seminar in Mathematics **3 credit hours**
- STAT electives** **6 credit hours**
- Minor or elective courses **6 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Electives **7 credit hours**

Subtotal: 29 Hours

NOTE:

**Courses, chosen with approval of statistics advisor, include computing, information systems, and other relevant courses.*
***STAT 4200, STAT 4320, STAT 4360, STAT 4370, STAT 4380, STAT 4600*

Statistics Minor

Mathematical Sciences

A minor in Statistics requires 15 semester hours. All courses in the Statistics minor must be completed with a grade of C (2.00) or better. All courses transferred from other institutions for credit in the Statistics minor must carry a grade of C (2.00) or better and be approved by the department chair. Students must complete at least 3 semester hours at the upper-division level in the minor through MTSU.

Required Courses (9 hours)

- MATH 1810 - Applied Calculus I **3 credit hours** OR
- MATH 1910 - Calculus I **4 credit hours**

- MATH 2050 - Probability and Statistics **3 credit hours**
- MATH 2530 - Applied Statistics II **3 credit hours**

Electives (6 hours)

Two courses selected from

- STAT 4360 - Regression Analysis **3 credit hours**
- STAT 4370 - Nonparametric Statistics **3 credit hours**
- STAT 4380 - Experimental Design **3 credit hours**
- STAT 4600 - Problems in Statistics **1 to 6 credit hours (3 credit hours required)**

Actuarial Sciences

ACSI 2100 - Introduction to Actuarial Science
3 credit hours Foundational course in quantitative literacy, emphasizing mathematical reasoning and statistical methods through the context of actuarial principles, risk assessment, and financial decision-making.

ACSI 4140 - Mathematical Foundations of Actuarial Science
3 credit hours Prerequisites: MATH 3110 and STAT 3150 or consent of instructor. Integrates calculus, probability, and risk management topics into fundamental tools for assessing risk in an actuarial environment. Calculus and probability topics include derivatives, integrals, partials, random variables, distributions, and conditional probability. Risk topics include frequency and severity. Insurance concepts such as retention, deductible, coinsurance, and risk premiums.

ACSI 4200 - Introduction to Mathematics of Investment
3 credit hours (Same as MATH 4200.) Prerequisite: MATH 1920 or consent of instructor. Calculus and probability/statistics used to model and analyze investments in bonds, treasury bills, stocks, and other derivatives. Topics include obtaining the price of a bond as a function of interest rate, developing formulas for duration and convexity to study the sensitivity of price to interest rate, and mathematical modeling of investor preference and attitude toward risk.

ACSI 4220 - Mathematics of Corporate Finance
3 credit hours Prerequisites: ACSI 2100 with grade of C (2.0) or better or consent of instructor. Mathematics of capital budgeting and evaluation models in corporate finance. Topics include net present values, internal rate of return, profitability index; evaluation of projects, corporations, and stocks; capital asset pricing model; cost of capital; quantification of risk and uncertainty; capital budgeting; capital structure; income statement and financial planning.

ACSI 4230 - Mathematics of Compound Interest
3 credit hours Prerequisite: ACSI 2100 with grade of C (2.0) or better or consent of instructor. Topics include measurement of interest (including accumulated and present value factors), annuities certain, yield rates, amortization schedules, sinking funds, and bonds and related securities.

ACSI 4240 - Mathematics of Interest Theory, Economics and Finance
3 credit hours Prerequisite: ACSI 4230 or consent of instructor. Applies calculus and theory of interest tools to intermediate topics in microeconomics and macroeconomics and topics in finance. Topics include pricing activities, the simplified Keynesian model, interest and discount rates, valuation of payment streams, yield rates, amortization, cash flows and internal rate of return, stock and bond valuation, portfolio risks, the Capital Asset Pricing Model (CAPM), efficient markets, capital structure, leverage, financial performance measurement, and basic option pricing and the Black-Scholes model.

ACSI 4280 - Undergraduate Research
1 to 4 credit hours Prerequisite: Permission of department. Independent investigation of a selected research problem under the guidance of a faculty member resulting in an oral and written report of results. May be repeated for a maximum of four credits.

ACSI 4330 - Actuarial Mathematics I
3 credit hours Prerequisites: ACSI 4230 and STAT 4190; or consent of instructor. Concepts and models for long-term actuarial mathematics. Topics include survival distributions and life tables, life insurance, life annuities, and net premiums.

ACSI 4340 - Actuarial Mathematics II
3 credit hours Prerequisite: ACSI 4330. Concepts and models for long-term actuarial mathematics. Topics chosen from net premium reserves, multiple life functions, multiple decrement models, multiple state models, Markov chain and Markov process models, valuation theory and pension plans, and insurance models (including expenses and nonforfeiture benefits and dividends).

ACSI 4430 - Introduction to Loss Models and Credibility
3 credit hours Prerequisites: ACSI 4140 and ACSI 4230 or consent of instructor. Assumes a thorough knowledge of calculus, probability, and mathematical statistics. Topics include insurance and reinsurance coverages; severity, frequency, and aggregate models; parametric and non-parametric estimation; introduction to credibility.

ACSI 4440 - Advanced Topics on Loss Models and Credibility
3 credit hours Prerequisites: ACSI 4140, ACSI 4230, and ACSI 4430 or consent of instructor. Assumes a thorough knowledge of calculus, probability, and mathematical statistics. Provides in-depth knowledge on advanced short-term actuarial mathematics techniques, advanced actuarial methods useful in modeling, and ratemaking and reserving for short-term coverages.

ACSI 4530 - Rate Making and Loss Reserving
3 credit hours Prerequisite: ACSI 2100 with grade of C (2.0) or better or consent of the instructor. Introduces the daily work as a P&C actuary in rate making and loss reserving, summarizing loss run data, compiling of loss triangles, computing loss development factors, incurred method, paid method, case method, Bornhuetter-Ferguson method, trend losses, rate making on losses and exposure, IBNR reserving, make loss payments plan, reporting and communication of analysis results.

ACSI 4600 - Problems in Actuarial Science
1 to 6 credit hours Prerequisites: Senior standing and consent of instructor. Students wishing to enroll must submit a written course/topic proposal to the department prior to the semester in which ACSI 4600 is taken. Proposal must be approved prior to taking the course. At the conclusion, each enrollee must submit a written report to the department.

ACSI 4630 - Mathematics of Risk Management
3 credit hours Prerequisite: ACSI 2100 with grade of C (2.0) or better or consent of instructor. Topics chosen from mathematical modeling of volatility; pricing of bonds and stocks; duration and convexity; asset/liability management; forward contract, future contract, options; spreads, collars and other hedging strategies; option pricing models, Black-Scholes formula, Greeks, Delta hedge, Delta-Gamma hedge; hedge portfolio and hedge ratio.

ACSI 4640 - Mathematics of Options, Futures, and Other Derivatives
3 credit hours Prerequisites: ACSI 4630 and ACSI 4200/MATH 4200. Topics chosen from lognormal model; Black-Scholes equation; volatility; risk neutral pricing; simulation; interest rate models; pricing of bonds, option on bonds, interest rate caps, and other interest rate derivatives.

Mathematics

MATH 1000 - Essentials of Mathematics
3 credit hours The practices of learning mathematics. Required for students whose ACT Mathematics score is 15-16 or whose mathematics assessment indicates placement. Emphasis on problem solving, critical thinking, math study skills, and solving and graphing linear equations and inequalities. Course will meet for three hours in the classroom and will have a required two-hour lab component, which will include structured online activities. Does not fulfill True Blue Core Quantitative Literacy requirement.

MATH 1010 - Mathematics for General Studies
3 credit hours
Prerequisites: Two years of high school algebra and a Math Enhanced ACT of at least 19 or DSPM 0850 or COMPASS placement. Topics include logic, sets, algebraic reasoning, probability, statistics, and consumer mathematics. TBR Common Course: MATH 1010
TBC: Quantitative Literacy

MATH 1020 - Mathematics Colloquium
1 credit hour Introduces new mathematical sciences students to the mathematics major. Topics include degree requirements, faculty resources, technological resources, research opportunities, and career options. About half of the meetings will involve one hour in-class lectures and activities, and half will involve attending talks, some of which may occur outside the scheduled class meeting time.

MATH 1410 - Concepts and Structure of Elementary School Mathematics
3 credit hours Prerequisites: Two years of high school algebra and a Math Enhanced ACT of at least 19 or DSPM 0850 (MATH 1710K) or COMPASS placement. Algebra-based study of school mathematics in keeping with the recommendations of the National Council of Teachers of Mathematics. Tools for problem solving, set theory, functions, number theory, and examinations of number systems from counting numbers to irrational numbers. TBR Common Course: MATH 1410

MATH 1420 - Informal Geometry
3 credit hours Prerequisite: A grade of C or better in MATH 1410. Geometry-based study of school mathematics in keeping with the recommendations of the National Council of Teachers of Mathematics.

Studies of plane, solid, coordinate, and motion geometry as well as constructions, congruence, similarity, and concepts of measurement. A variety of instructional technology tools investigated. TBR Common Course: MATH 1420

MATH 1530 - Applied Statistics
3 credit hours
Prerequisites: Two years of high school algebra and a Math Enhanced ACT 19 or greater or equivalent. Descriptive statistics, probability, and statistical inference. The inference unit covers means, proportions, and variances for one and two samples, and topics from one-way ANOVA, regression and correlation analysis, chi-square analysis, and nonparametrics. TBR Common Course: MATH 1530
TBC: Quantitative Literacy

MATH 1630 - College Mathematics for Managerial, Social, and Life Sciences
3 credit hours
Prerequisites: Two years of high school algebra and a Math Enhanced ACT greater than 25 or MATH 1710. Topics include solving systems of linear equations, Leontief models, linear programming, mathematics of finance, set theory, and probability theory. [TBR Common Course: MATH 1630]
TBC: Quantitative Literacy

MATH 1710 - College Algebra
3 credit hours
Prerequisite: DSPM 0850 or two years of high school algebra; a Math Enhanced ACT 19 or greater or placement testing. Topics include functions--linear, quadratic, exponential, and logarithmic; analysis of graphs; linear systems; inequalities; counting principles; and probability. Graphing calculator required. Not open to those who have had MATH 1730. TBR Common Course: MATH 1710
TBC: Quantitative Literacy

MATH 1720 - Plane Trigonometry
3 credit hours
Prerequisite: Strong background in algebra recommended. Trigonometric functions of the acute and general angle, circular functions, graphs of trigonometric and inverse functions, identities, solutions of right and general triangles, equations, complex numbers, and vectors. Not open to those who have had MATH 1730. Graphing calculator required. [TBR Common Course: MATH 1720]
TBC: Quantitative Literacy

MATH 1730 - Pre-Calculus
4 credit hours
Prerequisite: MATH 1710 or successful completion of high school precalculus course. An integrated and rigorous study of the algebra and trigonometry needed to successfully attempt calculus. Emphasis on functions, their analysis and their applications. Level of algebraic sophistication developed above that found in MATH 1710. Topics include exponentials and logarithms, analysis of graphs, and word problems. Graphing calculator required. TBR Common Course: MATH 1730
TBC: Quantitative Literacy

MATH 1810 - Applied Calculus I
3 credit hours
Prerequisite: MATH Enhanced ACT 19 or greater or MATH 1710. Introduces mathematical modeling applied to real-world problems. Sets, functions, inverse models, limits, continuity, first and second order model building, single variable differentiation, implicit differentiation, inverse problems (exponential and log models). First and second derivatives used to study the behavior of real-world applications.
TBC: Quantitative Literacy

MATH 1910 - Calculus I
4 credit hours
Prerequisite: MATH 1730 with a grade of C or better or Math ACT of 26 or better or satisfactory score on Calculus placement test. An introduction to calculus with an emphasis on analysis of functions, multidisciplinary applications of calculus, and theoretical understanding of differentiation and integration. Topics include the definition of the derivative, differentiation techniques, and applications of the derivative. Calculus topics related to trigonometric, exponential, and logarithmic functions also included. Course concludes with the fundamental theorem of calculus; the definition of antidifferentiation and the definite integral; basic applications of integrations; and introductory techniques of integration. Graphing calculator required. TBR Common Course: MATH 1910
TBC: Quantitative Literacy

MATH 1920 - Calculus II
4 credit hours Prerequisite: MATH 1910 with C (2.00) or better. A topics course providing a wide view of different techniques and applications of calculus in the plane. Techniques of integration and applications of integration fully developed. Power series and Taylor series included. Emphasis on multidisciplinary applications includes Taylor series approximation;

applications of integration to physics, biology, and business; and geometric and power series applications. Graphing calculator required. TBR Common Course: MATH 1920

MATH 2010 - Elements of Linear Algebra
3 credit hours Prerequisite: MATH 1910. Vectors and vector spaces, matrices and systems of linear equations, geometry of vector spaces and linear transformations in a vector space.

MATH 2050 - Probability and Statistics
3 credit hours Prerequisite: MATH 1810 or MATH 1910. Data analysis, probability, and statistical inference. The inference material covers means, proportions, and variances for one and two samples, one-way ANOVA, regression and correlation, and chi-square analysis. TBR Common Course: MATH 2050

MATH 2110 - Data Analysis
1 credit hour Prerequisite or corequisite: MATH 1530 or MATH 2050 or equivalent. Using computer software for graphing and analysis of scientific and statistical data.

MATH 2530 - Applied Statistics II
3 credit hours Prerequisite: MATH 1530 or MATH 2050 or equivalent. Explores the application of the following statistical methods: analysis of variance, simple and multiple regression models, categorical data analysis, and nonparametric methods. Three hours lecture per week.

MATH 2930 - Cooperative Education
1 to 3 credit hours Experiential learning that occurs in real employment situations. Must be taken in sequence or approved by the director of Cooperative Education. Graded on a pass/fail basis.

MATH 2940 - Cooperative Education
1 to 3 credit hours Experiential learning that occurs in real employment situations. Must be taken in sequence or approved by the director of Cooperative Education. Graded on a pass/fail basis.

MATH 3070 - College Geometry
3 credit hours Prerequisite: MATH 3460. Advanced treatment of standard topics in Euclidean geometry using informal and axiomatic approaches. Includes proofmaking techniques, traditional and transformational geometry, finite geometries, and a brief introduction to other geometries.

MATH 3080 - Discrete Structures
3 credit hours (Same as CSCI 3080.) Prerequisites: CSCI 1170 and MATH 1910 with C or better or consent of instructor. Topics include formal logic, proof techniques, matrices, graphs, formal grammars, finite state machines, Turing machines, and binary coding schemes.

MATH 3110 - Calculus III
4 credit hours Prerequisite: MATH 1920. Adjusts calculus techniques developed in the plane (Calculus I and II) to make them applicable in three-dimensional space. Introductory study of the nature of three-dimensional space and definition of the algebraic calculations in three-dimensional space. Differential and integral calculus definitions and techniques revised to appropriately transfer into this new space. Topics include multivariate functions, partial differentiation, partial integration, multiple integration, and multidisciplinary applications.

MATH 3120 - Differential Equations I
3 credit hours Prerequisite: MATH 1920 with C or better. The solution and application of ordinary differential equations with emphasis on first order equations, second order linear equations, Laplace Transform method, systems of differential equations, and numerical methods.

MATH 3180 - Introduction to Numerical Analysis
3 credit hours (Same as CSCI 3180.) Prerequisites: MATH 1910 and CSCI 1170 with C or better. Topics include series approximation, finite differences, interpolation, summation, numerical differentiation and integration, iteration, curve fitting, systems of equations and matrices, and error analysis.

MATH 3260 - Differential Equations II
3 credit hours Prerequisite: MATH 3120. A continuation of MATH 3120 with emphasis on series solutions, method of Frobenius, orthogonal functions, equations of Bessel, Legendre, Gauss, Chebyshev; introduction to partial differential equations.

MATH 3300 - Discrete Mathematics for Middle Grades Teachers
3 credit hours Prerequisites: MATH 1410, MATH 1420, and MATH 1730. Supports the development of prospective middle grades teachers' knowledge of discrete mathematics. Topics include set theoretic topics, logic, counting, probability, graph theoretic topics. Focuses on students' learning discrete mathematics topics as well as the teaching of related

mathematical topics to middle grades students. Field experience in a nearby middle school incorporated.

MATH 3310 - Functions: Connecting Algebra and Geometry for Middle Grades Teachers
3 credit hours Prerequisites: MATH 1410, MATH 1420, and MATH 1730. Supports the development of prospective middle grades teachers' knowledge of functions and connections between algebra and geometry. Focuses on students connecting mathematics topics as well as the teaching of mathematical topics to middle grades students to support learning about the connected nature of mathematics. Field experience in a nearby middle school incorporated.

MATH 3320 - Teaching Mathematics in the Middle Grades
3 credit hours Prerequisite: Admission to the teacher education program. Required of all Mathematics majors seeking a license to teach mathematics in grades 6-12 and all Interdisciplinary Studies (Grades 6-8) Math majors. In-depth study of mathematics learning and teaching strategies in middle school mathematics. Selected topics provide a foundation for student investigations into the conceptual nature of mathematics and applications in the middle school curriculum. Must be taken prior to student teaching.

MATH 3330 - Teaching Mathematics in the Secondary Grades
3 credit hours Prerequisites: Admission to teacher education, completion of the mathematics core, and MATH 3320. Required of all Mathematics majors seeking a license to teach mathematics in grades 6-12 and all Interdisciplinary Studies (Grades 6-8) Math majors. In-depth study of mathematics learning and teaching strategies in secondary school mathematics. Selected topics provide a foundation for student investigations into the conceptual nature of mathematics and applications in the secondary school curriculum. Must be taken prior to student teaching.

MATH 3340 - Statistics and Probability for Teaching
3 credit hours Prerequisite: MATH 1530 or MATH 2050 with a C or better. Supports the development of prospective middle grades and secondary teachers' knowledge of statistics and probability. Examines in greater depth statistics and probability topics to which the student has prior exposure; emphasizes the relevance and implications of these topics to the middle school and secondary classrooms. Attention will be given to exploratory data analysis, probability, statistical association, and simulation-based inference.

MATH 3460 - Foundation of Higher Mathematics
3 credit hours Prerequisite: MATH 1920. The language of mathematics, set theory and proof, relations and functions, number systems, mathematical structures. Focuses on the transition from lower-division study to upper-division study by actively engaging the student in problem solving, mathematical reasoning, and both informal and technical writing.

MATH 3970 - Cooperative Education
1 to 3 credit hours Experiential learning that occurs in real employment situations. Must be taken in sequence or approved by the director of Cooperative Education. Graded on a pass/fail basis.

MATH 3980 - Cooperative Education
1 to 3 credit hours Experiential learning that occurs in real employment situations. Must be taken in sequence or approved by the director of Cooperative Education. Graded on a pass/fail basis.

MATH 4010 - Selected Topics in Elementary Mathematics
3 credit hours Prerequisites: MATH 1410, MATH 1420, and MATH 1730. Required of students who are preparing to teach grades 5-8. Examines in greater depth topics to which the student has prior exposure; emphasizes the relevance and implications of these topics to the middle school classroom.

MATH 4200 - Introduction to Mathematics of Investment
3 credit hours (Same as ACSI 4200.) Prerequisite: MATH 1920 or consent of instructor. Calculus and probability/statistics used to model and analyze investments in bonds, treasury bills, stocks, and other derivatives. Topics include obtaining the price of a bond as a function of interest rate, developing formulas for duration and convexity to study the sensitivity of price to interest rate, and mathematical modeling of investor preference and attitude toward risk.

MATH 4230 - Vector Analysis
3 credit hours Prerequisite: MATH 3110. A review of vector algebra and vector differentiation with emphasis on aspects of these topics not covered in previous calculus courses. Stress on line and surface

integrals; Divergence Theorem and Stokes' theorem with generalizations and related topics.

MATH 4250 - Introduction to Analysis I
3 credit hours Prerequisites: MATH 3110 and MATH 3460 with a grade of C- or better. Theoretical development of limits, continuity, differentiation, and integration in one dimension.

MATH 4251 - Introduction to Analysis II
3 credit hours Prerequisite: MATH 4250, MATH 5250, or equivalent with a grade of C or better. Infinite series; rigorous treatment of limits, continuity, differentiation, and integration in n-dimensional Euclidean space; introduction to metric spaces.

MATH 4270 - Introduction to Topology
3 credit hours Prerequisites: MATH 3110 and MATH 3460. Fundamental concepts of topology including continuity, compactness, connectedness, separation axioms, and metric spaces.

MATH 4280 - Undergraduate Research
1 to 4 credit hours Prerequisite: Permission of department. Independent investigation of a selected research problem under the guidance of a faculty member resulting in an oral and written report of results. May be repeated for a maximum of four credits.

MATH 4310 - Numerical Analysis I
3 credit hours Prerequisites: CSCI 1170 and MATH 2010 or MATH 3180/CSCI 3180 or consent of instructor. Application of computer-oriented numerical algorithms to algebraic equations, differential and integral equations, and linear algebra. Rigorous mathematical treatment of error included.

MATH 4320 - Numerical Analysis II
3 credit hours Prerequisite: MATH 4310. A continuation of MATH 4310.

MATH 4420 - Number Theory
3 credit hours Prerequisite: MATH 3460. Divisibility, congruences, quadratic residues, Diophantine equations, quadratic forms, and continued fractions.

MATH 4470 - Introduction to Modern Algebra
3 credit hours Prerequisite: MATH 3460. A treatment of sets, relations, operations, and the construction of number systems in algebra.

MATH 4510 - Abstract Algebra I
3 credit hours Prerequisite: MATH 3460. An introduction to groups, with a brief introduction to rings, integral domains, and fields.

MATH 4530 - Abstract Algebra II
3 credit hours Prerequisite: MATH 4510. The theory of rings, fields, integral domains, and vector spaces.

MATH 4540 - Topics in Secondary School Mathematics
3 credit hours Prerequisites: Admission to teacher education; MATH 2010, MATH 2050, and MATH 3110. Required of all Mathematics majors seeking a license to teach mathematics in grades 7-12. Examines in greater depth topics to which the student has prior exposure; emphasizes the relevance and applications of these topics to the pre-college level classroom.

MATH 4600 - Problems in Contemporary Mathematics
1 to 6 credit hours Pass/Fail grading in specified sections.

MATH 4601 - Problems in Contemporary Mathematics Complex Variables
3 credit hours Prerequisite: MATH 3460. Fundamental principles and applications of complex variables.

MATH 4602 - Problems in Mathematics
1 to 6 credit hours Prerequisite: Consent of instructor. Problem-oriented course providing opportunities for mathematical study in areas of need.

MATH 4620 - History and Philosophy of Mathematics
3 credit hours Prerequisite: MATH 3460. Background in geometry and number theory helpful. The character of mathematical thought by way of mathematical problems that have occupied the outstanding mathematicians of Babylon, Egypt, Greece, China, the Renaissance, and modern times paralleled with a study of three schools of mathematical philosophy: intuitionism, logicism, and formalism.

MATH 4700 - Combinatorics and Graph Theory
3 credit hours Prerequisites: MATH 2010 and MATH 3460. Selected topics in combinatorics and graph theory emphasizing combinatorial problem solving and algorithmic proof.

MATH 4740 - Research Methods
3 credit hours (Same as ABAS/BIOL/GEOL/CHEM/PHYS 4740.) Prerequisite: YOED 3520. Provides secondary science and mathematics teacher candidates with the tools that scientists use to solve scientific problems. Students will use these tools in a laboratory setting, communicate findings, and understand how scientists develop new knowledge.

MATH 4800 - Seminar in Mathematics with Technology
3 credit hours Prerequisite: 18 semester hours in mathematics including calculus or consent of instructor; junior or senior standing; MATH 3110. Examines and utilizes the technological tools available for doing mathematics. Emphasis on non-numerical tools such as theorem provers and algebraic manipulation systems.

MATH 4990 - Seminar in Mathematics
3 credit hours Open only to Mathematics majors; normally taken during last regular semester of coursework. Required of all Mathematics majors. Offers graduating Mathematics majors a broad perspective of mathematics, mathematical activity, and problem solving in various areas of application; offers preparation for professional examinations; acquaints students with job possibilities and aids in career decisions; acquaints students with the nature of graduate study in mathematics. Pass/Fail.

Statistics

STAT 3150 - Mathematical Statistics I
3 credit hours Prerequisite: MATH 1920. Probability theory including basic probability laws, properties of distributions, mathematical expectation, special discrete and continuous distributions, functions of random variables, and selected applications.

STAT 3550 - Applied Predictive Modeling
3 credit hours) (Same as DATA 3550.) Prerequisite: CSCI 1170. An overview of the modeling process used in data science. Covers the ethics involved in data science, data preprocessing, regression models, classification models, and presenting the model.

STAT 4190 - Mathematical Statistics II
3 credit hours Prerequisite: STAT 3150 or equivalent. Theory of statistical inference. Topics include sampling distributions, decision theory, estimation, test of hypothesis, regression analysis, analysis of variance, and selected applications.

STAT 4200 - Statistical Methods for Forecasting
3 credit hours Prerequisite: STAT 4190. Topics include application of regression models in forecasting and exponential smoothing methods to forecast nonseasonal time-series, seasonal series, and globally constant seasonal models; stochastic time series models; and forecast evaluation.

STAT 4280 - Undergraduate Research
1 to 4 credit hours Prerequisite: Permission of department. Independent investigation of a selected research problem under the guidance of a faculty member resulting in an oral and written report of results. May be repeated for a maximum of four credits.

STAT 4320 - Probability and Stochastic Processes
3 credit hours Prerequisites: Two semesters of calculus and STAT 3150 (or MATH 2050) or consent of instructor. Theoretical basis for stochastic processes and their use as models of real-world phenomena. Topics include Markov chains, Poisson processes, Brownian motion and stationary processes. Applications include Gambler's Ruin, birth and death models, hitting times, stock option pricing, and the Black-Scholes model.

STAT 4360 - Regression Analysis
3 credit hours Prerequisite: MATH 2050 or equivalent. Theory and application of regression models. Approaches to model building and data analysis. Computation and interpretation of results facilitated through the use of statistical software packages.

STAT 4370 - Nonparametric Statistics
3 credit hours Prerequisite: MATH 2050 or equivalent. Statistical tests that require no assertions about parameters or about the form of the population from which the samples are drawn. A wide range of practical problems studied.

STAT 4380 - Experimental Design
3 credit hours Prerequisite: MATH 2050 or equivalent. Topics include one-way analysis of variances, multiple comparison, multifactor analysis of variance, and various practical issues in experimental design. Computation and interpretation of results facilitated through the use of statistical software packages.

STAT 4600 - Problems in Statistics
1 to 6 credit hours Prerequisites: Senior standing and consent of instructor. Students wishing to enroll must submit a written course/topic proposal to the department prior to the semester in which STAT 4600 is taken. Proposal must be approved prior to taking the course. At the conclusion, each enrollee must submit a written report to the department.

STAT 4700 - Analysis of Large-Scale Data Sets
3 credit hours Prerequisites: CSCI 1170 and MATH 2530. The analysis and applications of large-scale data sets. Scalable machine learning and data mining applications in a practical clinical environment. Statistical software used in the application of these techniques.

Military Science

Military Science
LTC Arlin Wilsher, Chair
Professor of Military Science

Bennett, Bujnowski, Currier, Hahn, Page

The Department of Military Science offers courses applicable to all branches of the United States Army and through which a student can earn an academic minor. These courses give students a broad knowledge of Army leadership, management, and technical skills thereby preparing them for an Army commission and subsequent entrance to an officer's basic branch course at one of the Army service schools. The objectives of producing officers through the ROTC (Reserve Officers Training Corps) program are to

1. provide officers a broad educational base;
2. provide a basic military education for students;
3. teach basic fundamentals and techniques of leadership and management;
4. develop, in conjunction with other academic disciplines, individual character and attributes required of an officer in the U.S. Army.

Army ROTC Scholarship Program

Students enrolled at MTSU are eligible to apply for two- and three-year Army ROTC scholarships which pay for tuition, fees, and a book allowance, plus a monthly stipend. High school seniors are eligible to apply for a four-year scholarship during the senior year. Additionally, there are National Guard and Army Reserve Scholarships available.

Uniforms and Pay

Students enrolled in the basic course do not wear uniforms and are not required to have a particular haircut. Textbooks are provided free of charge.

Advanced course students, junior and seniors, are provided uniforms and textbooks free of charge. They must sign a contract with the U.S. government and complete the advanced course, resulting in an active Army, National Guard, or Army Reserve commission as a 2nd lieutenant upon graduation. While enrolled in the advanced course, the student receives $4,500-5,000 per year and approximately $1,000 plus travel costs for Advance Camp attendance.

Military Science and Applied Leadership Minor

Military Science

A minor in Military Science and Applied Leadership consists of 20 semester hours and is available to those students who complete all advanced level requirements.

Required Courses (20 hours)

- MS 3080 - U.S. Army History **2 credit hours**
- MS 3110 - Training Management and the Warfighting Function **3 credit hours**
- MS 3111 - Training Management and the Warfighting Function Lab **0 credit hours**
- MS 3120 - Applied Leadership in Small Unit Operations **3 credit hours**
- MS 3121 - Applied Leadership in Small Unit Operations Lab **0 credit hours**
- MS 3130 - Military Science Field Methods **6 credit hours**
- MS 4110 - The Army Officer **3 credit hours**
- MS 4111 - The Army Officer Lab **0 credit hours**
- MS 4120 - Company Grade Leadership **3 credit hours**
- MS 4121 - Company Grade Leadership Lab **0 credit hours**

Military Science Curriculum

Military Science
615-898-2406
Arlin Wilsher, program coordinator

Military Science courses are designed to fulfill the educational and training requirements for commissioning in the U.S. Army (Regular Army, U.S. Army Reserve, or Army National Guard). The curriculum consists of a basic course (first two years) and an advanced course (final two years). The basic course is open to all MTSU students without incurring any military service obligation. Army, Navy, Marine Corps, or Air Force basic training graduates can be placed directly into the advanced course. Advanced placement may also be earned by attending the four-week leader training course at Fort Knox, Kentucky, normally between the sophomore and junior years. The advanced course is offered during the last four semesters of Military Science and includes a six-week Advance Camp at Fort Knox, Kentucky. Upon successful completion of the advanced course and upon graduation from the University, the student will be commissioned a second lieutenant in the United States Army.

Freshman (Basic)

- MS 1010 - Introduction to the Army **1 credit hour (MS 1011 recommended)**
- MS 1020 - Foundations of Leadership **1 credit hour (MS 1021 recommended)**
- MS 3080 - U.S. Army History **2 credit hours**

Sophomore (Basic)

- MS 2010 - Leadership and Ethics **2 credit hours** AND
- MS 2011 - Leadership and Ethics Lab **0 credit hours**
- MS 2020 - Army Doctrine and Decision Making **2 credit hours** AND
- MS 2021 - Army Doctrine and Decision-Making Lab **0 credit hours**
- MS 3000 - Basic Military Science **6 credit hours** *

Junior (Advanced)

- MS 3110 - Training Management and the Warfighting Function **3 credit hours** AND
- MS 3111 - Training Management and the Warfighting Function Lab **0 credit hours**
- MS 3120 - Applied Leadership in Small Unit Operations **3 credit hours** AND
- MS 3121 - Applied Leadership in Small Unit Operations Lab **0 credit hours**
- MS 3130 - Military Science Field Methods **6 credit hours**

Senior (Advanced)

- MS 4110 - The Army Officer **3 credit hours** AND
- MS 4111 - The Army Officer Lab **0 credit hours**
- MS 4120 - Company Grade Leadership **3 credit hours** AND
- MS 4121 - Company Grade Leadership Lab **0 credit hours**

NOTE:

**MS 3000 is only for students who have not had freshman or sophomore ROTC class or have not been to basic training.*
Students may also enroll in MS 1000 to participate in physical training.

Military Science

MS 1000 - Military Science Practicum (Elective)
1 credit hour Corequisite: Enrollment in MS Basic or Advance course or permission of department chair. For those interested in physical readiness training and improvement of overall physical fitness. This practicum will be administered three times per week in conjunction with Cadet physical readiness training.

MS 1010 - Introduction to the Army
1 credit hour Corequisite: MS 1011 highly recommended. Instruction in adventure-oriented skills such as rappelling, marksmanship techniques, and survival. Focuses on leadership development for aspiring U.S. Army leaders. Also includes a general overview of the U.S. Army's mission, organizational structure, and customs and traditions. Meets once weekly, 55 minutes per class.

MS 1011 - Introduction to the Army Lab
0 credit hours Recommended corequisite: MS 1010. Practical application in an outdoor environment of adventure-oriented skills such as rappelling, marksmanship techniques, and survival. Focuses on leadership development with a hands-on approach to the topics covered during classroom instruction. Also includes a general overview of the U.S. Army's mission, organizational structure, and customs and traditions. Meets once weekly, two hours per lab.

MS 1020 - Foundations of Leadership
1 credit hour Prerequisite: MS 1010 or permission of department chair; corequisite: MS 1021 highly recommended. Continued focus on leadership development founded in MS 1010. Instruction in further development of adventure-oriented skills, basic rifle marksmanship, land navigation, and first aid. Students learn to handle and fire the M4 rifle, conduct land navigation, and learn first aid skills. Meets once weekly, 55 minutes per week.

MS 1021 - Foundations of Leadership Lab
0 credit hours Prerequisite: MS 1010. Recommended corequisite: MS 1020. Practical application in an outdoor environment continuing the lessons of MS 1010 with rifle marksmanship, land navigation, and confidence courses. Focuses on leadership development with a hands-on approach to the topics covered during classroom instruction. Also includes a general overview of the U.S. Army's mission, organizational structure, and customs and traditions. Meets once weekly, two hours per lab.

MS 2010 - Leadership and Ethics
2 credit hours Prerequisites: MS 1010/MS 1011 and MS 1020/MS 1021 or permission of department chair. Development of leadership potential through practical exercise. Leadership, small unit tactics, first aid, basic rappelling, weapons familiarization, oral communication exercises, and team-building skills.

MS 2011 - Leadership and Ethics Lab
0 credit hours Corequisite: MS 2010. An Army-focused training course that meets weekly and is designed to provide Cadets with competencies that will enable them to effectively train and facilitate knowledge acquisition, application, and skills used both during the Cadet Summer Training and during future Army assignments.

MS 2020 - Army Doctrine and Decision Making
2 credit hours Prerequisites: MS 2010 and MS 2011 or permission of department chair. Application of basic map reading and compass principles, unit organization at squad level, small unit tactics, branches of the U.S. Army, discussion of the advanced program. Practical exercises, land navigation, first aid, current events, marksmanship, water safety training. Continues team-building development.

MS 2021 - Army Doctrine and Decision-Making Lab
0 credit hours Corequisite: MS 2020. An Army-focused training course that meets weekly and is designed to provide Cadets with competencies that will enable them to effectively train and facilitate knowledge acquisition, application, and skills used both during the Cadet Summer Training and during future Army assignments.

MS 3000 - Basic Military Science
6 credit hours Prerequisite: Permission of department chair. Four-week training normally taken during the summer between the sophomore and junior academic years by students who have not taken all prerequisite MS 1000 and 2000 level courses. Training conducted at a designated U.S. Army installation; practical experience in leadership, small unit tactics, weapons, drill, and communications under field conditions. U.S. Army pays the student for attending the training.

MS 3080 - U.S. Army History
2 credit hours Prerequisites: MS 1010 and MS 1020 or permission of department chair. Introduces

students enrolled in the ROTC program to the U.S. Army's development and role in military operations from colonial times to the present.

MS 3110 - Training Management and the Warfighting Function
3 credit hours Prerequisites: MS 2010/MS 2011 and MS 2020/MS 2021; or MS 3000; or equivalent credit for previous military service with approval from department chair; corequisite: MS 3111. Formal instruction in troop leading procedures, U.S. Army problem solving, branches of the U.S. Army, combat orders, leadership traits and principles, small unit tactics based on infantry rifle squad and platoon, map reading, land navigation skills, and military briefings. Focus on leadership development, instilling the warrior ethos, and preparation for the Cadet Summer Training and potential for service as a junior officer. Two one-hour, twenty-five-minute periods of class work each week.

MS 3111 - Training Management and the Warfighting Function Lab
0 credit hours Prerequisites: MS 2010/MS 2011, MS 2020/MS 2021; or MS 3000; or equivalent credit for previous military service with approval from department chair. Hands-on instruction in practical application of troop leading procedures, U.S. Army problem solving, combat orders, leadership traits and principles, small unit tactics based on infantry rifle squad and platoon, map reading, land navigation skills, and military briefings. Focus on leadership development, instilling the warrior ethos, and preparation for the Cadet Summer Training and potential for service as a junior officer. One period of two hours of laboratory per week.

MS 3120 - Applied Leadership in Small Unit Operations
3 credit hours Prerequisite: MS 3110/MS 3111; corequisite: MS 3121. Formal instruction in leadership, principles of war, squad and platoon tactics, situational training exercises, patrolling techniques, map reading and land navigation. Hands-on application of troop leading procedures, written and oral combat orders, maneuver techniques, and field craft. Focus on leadership development, instilling the warrior ethos, and preparation for the Cadet Summer Training and potential for service as a junior officer. Two one-hour, twenty-five-minute periods of class work.

MS 3121 - Applied Leadership in Small Unit Operations Lab
0 credit hours Prerequisites: MS 3110/MS 3111; corequisite: MS 3120. Hands-on application of leadership attributes and competencies, squad and platoon tactics, situational training exercises, patrolling techniques, map reading, and land navigation. Further practical applications of troop leading procedures, written and oral combat orders, small unit maneuver techniques, and field craft will be introduced. Focus on leadership development, instilling the warrior ethos, and preparation for Cadet Summer Training and potential for service as a junior officer. Meets for one period of two hours per week.

MS 3130 - Military Science Field Methods
6 credit hours Prerequisites: MS 3110 and MS 3120. Six weeks of training normally taken during the summer between the junior and senior academic years. Training conducted at a designated U.S. military installation; practical experience in leadership, military teaching, weapons, and communications under field conditions. The U.S. Army pays the student for attending the training.

MS 3140 - Military Leadership and Management
2 credit hours Prerequisites: Contracted students in Army ROTC and department chair approval. Dynamics of leadership and officership in the U.S. Army and inherent responsibilities of an officer in today's environment discussed. Explores good and bad leadership, the principles of war, and their applications to war fighting through U.S. history.

MS 4110 - The Army Officer
3 credit hours Prerequisites: MS 3110/MS 3111, MS 3120/MS 3121, and MS 3130; corequisite: MS 4111. Seminar in leadership and management designed to prepare the senior student for active duty responsibilities. Focuses on the commander, the staff, the military team, and U.S. Army ethics. Emphasis on instilling warrior ethos. Two one-hour, twenty-five minute periods of class work.

MS 4111 - The Army Officer Lab
0 credit hours Prerequisites: MS 3110/MS 3111, MS 3120/MS 3121, and MS 3130; corequisite: MS 4110. Hands-on application of leadership attributes and competencies designed to prepare senior students/Cadets for active duty responsibilities as an Army Officer. Learning the roles and responsibilities of the commander, the staff, the military team, and U.S. Army ethics are the main focus. Cadets will be

placed in leadership positions and expected to plan, prepare, and execute concurrent training for the class. Meets for one two- hour period, once per week.

MS 4120 - Company Grade Leadership
3 credit hours Prerequisites: MS 3130 and MS 4110/MS 4111; corequisite: MS 4121. Seminars in leadership and management to prepare the senior student for active or reserve duty responsibilities. Focus is military law, U.S. Army writing standards, and organizational skills. Emphasis on leading soldiers in the complex situations of current military operations. Two one-hour, twenty-five-minute periods of class work per week.

MS 4121 - Company Grade Leadership Lab
0 credit hours Prerequisites: MS 3130 and MS 4110/MS 4111; corequisite: MS 4120. Hands-on application of leadership attributes and competencies designed to prepare senior students/Cadets for active duty responsibilities. The commander, the staff, the military team, and U.S. Army ethics are the main focus. During this lab, Cadets will be placed in leadership positions and expected to plan, prepare, and execute concurrent training for the class and other Military Science classes. Meets for one two-hour period, once per week.

MS 4520 - Leading and Developing Teams
4 credit hours (Same as PRST 4520.) Introduces students to the military definition of leadership and provides knowledge on how to design and implement training strategies to continuously improve their team's performance.

Physics and Astronomy

Ron Henderson, Chair

Erenso, Ford, Frank, Higgins, Kamali, Klumpe, Naseri, McPherson, Neupane, Perevalova, Robertson, Smith, Terletska, Wallin, Youngkins

The Department of Physics and Astronomy offers students the opportunity to study the fundamental principles and methodologies of physics for careers at the bachelor's level or in preparation for graduate study in physics or engineering. The department also offers a program for students interested in teaching physics in a high school setting as well as specially tailored programs in astronomy, astrophysics, and medical physics. The physics common requirements form the framework for the Physics major. Students then choose an area of concentration that parallels their professional goals.

The departmental program of study leads to a Bachelor of Science degree in Physics. Students must also choose from one of the following concentrations: Professional Physics, Physics Teaching, Applied Physics, Quantum Science and Computing, or Astronomy. The department also offers minors in Physics and Astronomy.

Honors College

The Department of Physics and Astronomy offers the following courses in Honors: ASTR 1030 and ASTR 1031. See online class schedule and Honors information.

Astronomy Minor

Physics and Astronomy

The minor in Astronomy consists of 19 semester hours in astronomy and physics. At least four upper-division hours must be taken at MTSU.

Required (10 hours)

- ASTR 1031 - Observing the Universe **1 credit hour**
- ASTR 3401 - Experimental Astronomy **1 credit hour**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  AND
- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours**
  AND
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Electives (9 credits)

- ASTR 1030 - Exploring the Universe **3 credit hours**
- ASTR 2030 - Solar System Astronomy **3 credit hours**
- ASTR 2040 - Stars, Galaxies, and Cosmology **3 credit hours**
- ASTR 3050 - Directed Study in Astronomy **1 to 4 credit hours**
- ASTR 3400 - Fundamentals of Astrophysics **3 credit hours**

Physics Minor

Physics and Astronomy

The minor in Physics consists of 19 semester hours in physics and astronomy. Students minoring in Physics should work closely with their Physics advisor to tailor a program which meets their needs. At least four upper-division hours must be taken at MTSU.

Required (8 hours)

- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours**
  OR
- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**

- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**
  OR
- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**

Electives (11 hours)

- eleven hours physics electives

Physics, Applied Physics Concentration, B.S.

Department of Physics and Astronomy
615-898-2130
Ron Henderson, program coordinator
Ron.Henderson@mtsu.edu

The Applied Physics concentration is designed for students interested in fields not traditionally associated with a physics degree, but that value the critical thinking and problem-solving skills associated with a physics major.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Physics, Applied Physics, B.S., Academic Map

Degree Requirements

A 2.00 GPA is required in the Physics major.

True Blue Core (TBC)	**41 hours**
Major Requirements	**48 hours***
Major Core	*25 hours*
Applied Physics Concentration	*23-24 hours*
Supporting Courses	**20 hours***
Electives	**11-22 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours may increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)
- PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111 (Sci Lit)

Major Requirements (48 hours)

Physics Core (25 hours)

A 2.00 GPA is required in the Physics major.

- PHYS 1010 - Physics Colloquium **1 credit hour**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

- PHYS 3100 - Modern Physics I **3 credit hours**
- PHYS 3110 - Modern Physics II **3 credit hours**
- PHYS 3111 - Modern Physics Laboratory **1 credit hour**

- PHYS 3610 - Thermodynamics **3 credit hours** OR
- PHYS 3400 - Intermediate Physics **3 credit hours**

- PHYS 3800 - Physics Seminar **1 credit hour**
- PHYS 3900 - Physics Practicum **1 credit hour**

- PHYS 4850 - Physics Research **2 credit hours** OR
- ASTR 4850 - Astronomy Research **2 credit hours**

- PHYS 4900 - Physics Senior Thesis **2 credit hours** OR
- ASTR 4900 - Astronomy Senior Thesis **2 credit hours**

Applied Physics Concentration (23-24 hours)

- PHYS 3150 - Topics and Methods of Theoretical Physics I **3 credit hours** OR
- MATH 3120 - Differential Equations I **3 credit hours** OR
- MATH 3110 - Calculus III **4 credit hours**

- PHYS or ASTR electives (upper division) **5 credit hours**
- Cognate electives **15 credit hours**

Supporting Courses (20 hours)

- MATH 1910 - Calculus I **4 credit hours (3 credit hours counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** AND

- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CSCI 1170 - Computer Science I **4 credit hours**

Electives (11-22 hours)

- 36 total credits must be earned at the 3000/4000 level

Cognate Elective Areas (15 hours)

Actuarial

- STAT 3150 - Mathematical Statistics I **3 credit hours**
- STAT 4190 - Mathematical Statistics II **3 credit hours**
- ACSI 4140 - Mathematical Foundations of Actuarial Science **3 credit hours**

- ACSI 4200 - Introduction to Mathematics of Investment **3 credit hours** OR
- MATH 4200 - Introduction to Mathematics of Investment **3 credit hours**

- ACSI 4230 - Mathematics of Compound Interest **3 credit hours**

Advanced Physics or Astronomy

Any upper-division PHYS/ASTR including:

- ASTR 3400 - Fundamentals of Astrophysics **3 credit hours**
- PHYS 3200 - Scientific Modeling and Problem Solving **2 credit hours**
- PHYS 3300 - Classical Mechanics **3 credit hours**
- PHYS 3520 - Optics and Photonics **3 credit hours**
- PHYS 3930 - The Teaching of Physics **3 credit hours**

- PHYS 3150 - Topics and Methods of Theoretical Physics I **3 credit hours** OR
- PHYS 3160 - Topics and Methods of Theoretical Physics II **3 credit hours**

- PHYS 3350 - Concepts and Applications of Analog Electronics **4 credit hours**

- PHYS 3950 - Reasoning in Physics I: Mechanics **1 credit hour** OR
- PHYS 3960 - Reasoning in Physics II: Electricity and Magnetism **1 credit hour**

- PHYS 4310 - Electricity and Magnetism **3 credit hours** OR
- PHYS 4330 - Electricity and Magnetism II **3 credit hours**

- PHYS 4380 - Quantum Mechanics **3 credit hours** OR
- PHYS 4390 - Advanced Quantum Mechanics **3 credit hours**

Business Administration

- ACTG 3000 - Survey of Accounting for General Business **3 credit hours**

- FIN 3000 - Survey of Finance **3 credit hours** OR
- FIN 3010 - Principles of Corporate Finance **3 credit hours**

- BLAW 3400 - Legal Environment of Business **3 credit hours** OR
- BLAW 3430 - Commercial Law **3 credit hours**

- MGMT 3610 - Principles of Management **3 credit hours**
- MKT 3820 - Principles of Marketing **3 credit hours**

Business Analytics

- MGMT 3620 - Supply Chain Operations **3 credit hours**
- BIA 2610 - Statistical Methods **3 credit hours**
- BIA 3620 - Introduction to Business Analytics **3 credit hours**
- BIA 4010 - Business Analytics and Visualization **3 credit hours**

Computational Methods

- CSCI 2170 - Computer Science II **4 credit hours**
- CSCI 3110 - Algorithms and Data Structures **3 credit hours**
- CSCI 3130 - Assembly and Computer Organization **4 credit hours**
- CSCI 3180 - Introduction to Numerical Analysis **3 credit hours**
- CSCI 3240 - Introduction to Computer Systems **4 credit hours**
- CSCI 4330 - Parallel Processing Concepts **3 credit hours**

Engineering Systems

- ENGR 1100 - Engineering Fundamentals **3 credit hours**
- ENGR 2100 - Introduction to Engineering Design **3 credit hours**
- ENGR 2210 - Introduction to Materials Science and Engineering **3 credit hours**
- ENGR 3920 - Engineering Safety **3 credit hours**
- ENGR 3970 - Engineering Economy **3 credit hours**
- ET 4630 - Local Area Networks **3 credit hours**

Information Systems

- INFS 2400 - Web Development **3 credit hours**
- INFS 3100 - Principles of Management Information Systems **3 credit hours**
- INFS 3200 - Business Application Development **3 credit hours**
- INFS 3400 - Object Oriented Programming with C#.NET **3 credit hours**
- CYBM 4300 - Security Assurance for Information Systems Audit **3 credit hours**
- INFS 4790 - Database Design and Development **3 credit hours**

Natural Science

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours**

- BIOL 1120 - General Biology II **4 credit hours** AND
- BIOL 1121 - General Biology II Lab **0 credit hours**

- BIOL 2230 - Microbiology **4 credit hours** AND
- BIOL 2231 - Microbiology Lab **0 credit hours**

- CHEM 3010 - Organic Chemistry I **3 credit hours** AND
- CHEM 3011 - Organic Chemistry I Lab **1 credit hour**

- CHEM 3020 - Organic Chemistry II **3 credit hours** AND
- CHEM 3021 - Organic Chemistry II Lab **1 credit hour**

- CHEM 3530 - Principles of Biochemistry **4 credit hours** AND
- CHEM 3531 - Principles of Biochemistry Lab **0 credit hours**

Supplemental Mathematics

- MATH 2010 - Elements of Linear Algebra **3 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**
- MATH 3070 - College Geometry **3 credit hours**
- MATH 3080 - Discrete Structures **3 credit hours**
- MATH 3260 - Differential Equations II **3 credit hours**
- MATH 3460 - Foundation of Higher Mathematics **3 credit hours**

Curriculum: Physics, Applied Physics

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**
- PHYS 1010 - Physics Colloquium **1 credit hour**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours** (Sci Lit)

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 31 Hours

Sophomore

- PHYS 3100 - Modern Physics I **3 credit hours**
- PHYS 3110 - Modern Physics II **3 credit hours**
- PHYS 3111 - Modern Physics Laboratory **1 credit hour**

- PHYS 3150 - Topics and Methods of Theoretical Physics I **3 credit hours** OR
- MATH 3110 - Calculus III **4 credit hours** OR
- MATH 3120 - Differential Equations I **3 credit hours**

- PHYS 3900 - Physics Practicum **1 credit hour**
- CSCI 1170 - Computer Science I **4 credit hours**
- Creativity and Cultural Expression (Literature) **3 credit hours**
- Non-written Communication **3 credit hours**
- Elective **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- History and Civic Learning **3 credit hours**

Subtotal: 30-31 Hours

Junior

- PHYS 3610 - Thermodynamics **3 credit hours** OR
- PHYS 3400 - Intermediate Physics **3 credit hours**

- PHYS 3800 - Physics Seminar **1 credit hour**
- History and Civic Learning **3 credit hours**
- Creativity and Cultural Expression **6 credit hours**
- Electives **6 credit hours**
- Cognate **6 credit hours**
- Human Society and Social Relationships **3 credit hours**
- PHYS/ASTR (upper division) **3-4 credit hours**

Subtotal: 31-32 Hours

Senior

- PHYS 4850 - Physics Research **2 credit hours**
- PHYS 4900 - Physics Senior Thesis **2 credit hours**
- Cognate **9 credit hours**
- Electives **12 credit hours**
- PHYS/ASTR (upper division) **2-3 credit hours**

Subtotal: 27-28 Hours

Physics, Astronomy Concentration, B.S.

Department of Physics and Astronomy
615-898-2130
Ron Henderson, program coordinator
Ron.Henderson@mtsu.edu

The Astronomy concentration is designed for students interested in a degree specializing in astronomy, but who do not plan to attend graduate school in astronomy or astrophysics.

The physics core consists of 25 semester hours of physics and astronomy. Other requirements include 8 semester hours of chemistry and 8 semester hours of mathematics. A minimum of 12 upper-division semester hours in the physics major must be taken at MTSU.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Physics, Astronomy, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**36 hours***
Major Core	*25 hours*
Astronomy Concentration	*11 hours*
Supporting Courses	**23 hours***
Electives	**20-31 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)
- PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111 (Sci Lit)

Major Requirements (36 hours)

A 2.00 GPA is required in the Physics major.

Physics Core (25 hours)

- PHYS 1010 - Physics Colloquium **1 credit hour**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours (may be counted in the True Blue Core)**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours**
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

- PHYS 3100 - Modern Physics I **3 credit hours**
- PHYS 3110 - Modern Physics II **3 credit hours**
- PHYS 3111 - Modern Physics Laboratory **1 credit hour**

- PHYS 3610 - Thermodynamics **3 credit hours** OR
- PHYS 3400 - Intermediate Physics **3 credit hours**

- PHYS 3800 - Physics Seminar **1 credit hour**
- PHYS 3900 - Physics Practicum **1 credit hour**

- ASTR 4850 - Astronomy Research **2 credit hours** OR
- PHYS 4850 - Physics Research **2 credit hours**

- ASTR 4900 - Astronomy Senior Thesis **2 credit hours** OR
- PHYS 4900 - Physics Senior Thesis **2 credit hours**

Astronomy Concentration (11 hours)

- ASTR 1031 - Observing the Universe **1 credit hour**
- ASTR 2030 - Solar System Astronomy **3 credit hours**
- ASTR 2040 - Stars, Galaxies, and Cosmology **3 credit hours**
- ASTR 3400 - Fundamentals of Astrophysics **3 credit hours**
- ASTR 3401 - Experimental Astronomy **1 credit hour**

Supporting Courses (23 hours)

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- CSCI 1170 - Computer Science I **4 credit hours**
- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**

- MATH 3120 - Differential Equations I **3 credit hours** OR
- PHYS 3150 - Topics and Methods of Theoretical Physics I **3 credit hours**

Electives (20-31 hours)

- 36 total credits must be earned at the 3000/4000 level

Curriculum: Physics, Astronomy

Freshman

- PHYS 1010 - Physics Colloquium **1 credit hour**
- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours** (Sci Lit)

- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 31 Hours

Sophomore

- ASTR 2030 - Solar System Astronomy **3 credit hours** OR
- ASTR 2040 - Stars, Galaxies, and Cosmology **3 credit hours**

- PHYS 3100 - Modern Physics I **3 credit hours**
- PHYS 3110 - Modern Physics II **3 credit hours**
- PHYS 3111 - Modern Physics Laboratory **1 credit hour**

- PHYS 3150 - Topics and Methods of Theoretical Physics I **3 credit hours** OR
- MATH 3120 - Differential Equations I **3 credit hours**

- CSCI 1170 - Computer Science I **4 credit hours**
- Non-Written Communication **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Electives **6 credit hours**

Subtotal: 29 Hours

Junior

- ASTR 3400 - Fundamentals of Astrophysics **3 credit hours** OR
- Elective **3 credit hours**

- PHYS 3610 - Thermodynamics **3 credit hours**
- PHYS 3800 - Physics Seminar **1 credit hour**

- ASTR 1031 - Observing the Universe **1 credit hour** OR
- ASTR 3401 - Experimental Astronomy **1 credit hour**

- ASTR 2040 - Stars, Galaxies, and Cosmology **3 credit hours** OR
- ASTR 2030 - Solar System Astronomy **3 credit hours**

- Electives **9 credit hours**
- Human Society and Social Relationships **6 credit hours**
- Creativity and Cultural Expression **6 credit hours**

Subtotal: 32 Hours

Senior

- ASTR 3401 - Experimental Astronomy **1 credit hour** OR
- ASTR 1031 - Observing the Universe **1 credit hour**

- ASTR 4850 - Astronomy Research **2 credit hours**
- ASTR 4900 - Astronomy Senior Thesis **2 credit hours**
- PHYS 3900 - Physics Practicum **1 credit hour**
- History and Civic Learning **6 credit hours**
- Electives **13 credit hours**

- Elective **3 credit hours** OR
- ASTR 3400 - Fundamentals of Astrophysics **3 credit hours**

Subtotal: 28 Hours

Physics, Physics Teaching Concentration, B.S.

Department of Physics and Astronomy
615-898-2130
Ron Henderson, program coordinator
Ron.Henderson@mtsu.edu

The Physics Teaching concentration offers preparation for careers as physics teachers, as well as serving as an appropriate degree path for other physics majors who do not plan to attend graduate school.
Students seeking a license to teach physics in secondary schools (grades 7-12) must complete (1) a major in physics with a concentration in Physics Teaching, and/or (2) a minor in Secondary Education through MTeach. A minimum of 12 upper-division semester hours in the physics major must be taken at MTSU.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Physics, Physics Teaching, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**33 hours***
Major Core	*25 hours*
Physics Teaching Concentration	*8 hours*
Supporting Courses	**26 hours***
Electives	**20-31 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.
The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)
- PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111 (Sci Lit)

Major Requirements (33 hours)

Physics Core (25 hours)

- PHYS 1010 - Physics Colloquium **1 credit hour**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours (may be counted in the True Blue Core)**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

- PHYS 3100 - Modern Physics I **3 credit hours**
- PHYS 3110 - Modern Physics II **3 credit hours**
- PHYS 3111 - Modern Physics Laboratory **1 credit hour**

- PHYS 3610 - Thermodynamics **3 credit hours** OR
- PHYS 3400 - Intermediate Physics **3 credit hours**

- PHYS 3800 - Physics Seminar **1 credit hour**
- PHYS 3900 - Physics Practicum **1 credit hour**

- ASTR 4850 - Astronomy Research **2 credit hours** OR
- PHYS 4850 - Physics Research **2 credit hours**

- ASTR 4900 - Astronomy Senior Thesis **2 credit hours** OR
- PHYS 4900 - Physics Senior Thesis **2 credit hours**

Physics Teaching Concentration (8 hours)

- PHYS 3930 - The Teaching of Physics **3 credit hours**
- PHYS 3950 - Reasoning in Physics I: Mechanics **1 credit hour**
- PHYS 3960 - Reasoning in Physics II: Electricity and Magnetism **1 credit hour**
- ASTR 1030 - Exploring the Universe **3 credit hours**

Supporting Courses (26 hours)

- BIOL 1110 - General Biology I **4 credit hours** AND
- BIOL 1111 - General Biology I Lab **0 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**
- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- MATH 1910 - Calculus I **4 credit hours (3 credit hours counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**

- MATH 3120 - Differential Equations I **3 credit hours** OR
- PHYS 3150 - Topics and Methods of Theoretical Physics I **3 credit hours**

Electives (20-31 hours)

- 36 total credits must be earned at the 3000/4000 level

NOTE:

The minimum number of hours for graduation is 120; however, the number of hours required for this program may exceed this if students choose the Secondary Education Minor in addition to the Physics Teaching concentration.

Curriculum: Physics, Physics Teaching

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- PHYS 1010 - Physics Colloquium **1 credit hour**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours** (Sci Lit)

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 31 Hours

Sophomore

- PHYS 3100 - Modern Physics I **3 credit hours**
- PHYS 3110 - Modern Physics II **3 credit hours**
- MATH 2050 - Probability and Statistics **3 credit hours**

- MATH 3120 - Differential Equations I **3 credit hours** OR
- PHYS 3150 - Topics and Methods of Theoretical Physics I **3 credit hours**

- Non-Written Communication **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- History and Civic Learning **3 credit hours**
- Electives **6 credit hours**
- PHYS 3111 - Modern Physics Laboratory **1 credit hour**
- PHYS 3900 - Physics Practicum **1 credit hour**
- ASTR 1030 - Exploring the Universe **3 credit hours**

Subtotal: 32 Hours

Junior

- BIOL 1110 - General Biology I **4 credit hours** (Sci Lit) AND
- BIOL 1111 - General Biology I Lab **0 credit hours** (Sci Lit)

- PHYS 3400 - Intermediate Physics **3 credit hours** OR
- PHYS 3610 - Thermodynamics **3 credit hours**

- PHYS 3800 - Physics Seminar **1 credit hour**
- PHYS 3930 - The Teaching of Physics **3 credit hours**
- PHYS 3950 - Reasoning in Physics I: Mechanics **1 credit hour**
- PHYS 4850 - Physics Research **2 credit hours**
- Human Society and Social Relationships **6 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- History and Civic Learning **3 credit hours**
- Elective **3 credit hours**

Subtotal: 29 Hours

Senior

- PHYS 3960 - Reasoning in Physics II: Electricity and Magnetism **1 credit hour**
- PHYS 4900 - Physics Senior Thesis **2 credit hours**
- Creativity and Cultural Expression **3 credit hours**
- Electives **22 credit hours**

Subtotal: 28 Hours

Physics, Professional Physics Concentration, B.S.

Department of Physics and Astronomy
615-898-2130
Ron Henderson, program coordinator
Ron.Henderson@mtsu.edu

The Professional Physics concentration offers preparation for graduate work in physics, medical physics, astrophysics, or engineering. A minimum of 12 upper-division semester hours in the physics major must be taken at MTSU.

Academic Map

Following is a printable, suggested four-year schedule of courses:
Physics, Professional Physics, B.S., Academic Map

Degree Requirements

True Blue Core (TBC)	**41 hours**
Major Requirements	**45 hours***
Major Core	*25 hours*
Professional Physics Concentration	*20 hours*
Supporting Courses	**20 hours***
Electives	**14-25 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours will increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)
- PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111 (Sci Lit)

Major Requirements (45 hours)

A 2.00 GPA is required for the Physics major.

Physics Core (25 hours)

- PHYS 1010 - Physics Colloquium **1 credit hour**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours (may be counted in the True Blue Core)**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

- PHYS 3100 - Modern Physics I **3 credit hours**
- PHYS 3110 - Modern Physics II **3 credit hours**
- PHYS 3111 - Modern Physics Laboratory **1 credit hour**
- PHYS 3610 - Thermodynamics **3 credit hours**
- PHYS 3800 - Physics Seminar **1 credit hour**
- PHYS 3900 - Physics Practicum **1 credit hour**

- PHYS 4850 - Physics Research **2 credit hours** OR
- ASTR 4850 - Astronomy Research **2 credit hours**

- PHYS 4900 - Physics Senior Thesis **2 credit hours** OR
- ASTR 4900 - Astronomy Senior Thesis **2 credit hours**

Professional Physics Concentration (20 hours)

- PHYS 3150 - Topics and Methods of Theoretical Physics I **3 credit hours**
- PHYS 3160 - Topics and Methods of Theoretical Physics II **3 credit hours**
- PHYS 3200 - Scientific Modeling and Problem Solving **2 credit hours**
- PHYS 3300 - Classical Mechanics **3 credit hours**
- PHYS 4310 - Electricity and Magnetism **3 credit hours**
- PHYS 4330 - Electricity and Magnetism II **3 credit hours**
- PHYS 4380 - Quantum Mechanics **3 credit hours**

Supporting Courses (20 hours)

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours (may be counted in the True Blue Core)**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- MATH 1910 - Calculus I **4 credit hours (3 credit hours may be counted in the True Blue Core, 1 credit hour remaining)**
- MATH 1920 - Calculus II **4 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**

Professional Physics: Astrophysics Track (11 hours)

The astrophysics track offers preparation for graduate work in astronomy or astrophysics. In addition to the physics common requirements and the Professional Physics concentration requirements, the following courses are recommended:

- ASTR 1031 - Observing the Universe **1 credit hour**
- ASTR 2030 - Solar System Astronomy **3 credit hours**
- ASTR 2040 - Stars, Galaxies, and Cosmology **3 credit hours**
- ASTR 3400 - Fundamentals of Astrophysics **3 credit hours**
- ASTR 3401 - Experimental Astronomy **1 credit hour**

Professional Physics: Medical Physics Track (15 hours)

The medical physics track offers preparation for graduate work in medical physics and radiation oncology physics, eventually leading to a career as a medical physicist in a clinical or academic setting. In addition to the physics common requirements and the Professional Physics concentration requirements, the following courses are recommended:

- BIOL 2010 - Human Anatomy and Physiology I **4 credit hours** AND
- BIOL 2011 - Human Anatomy and Physiology I Lab **0 credit hours**

- BIOL 2020 - Human Anatomy and Physiology II **4 credit hours** AND
- BIOL 2021 - Human Anatomy and Physiology II Lab **0 credit hours**

Electives (14-25 hours)

- 36 total credits must be earned at the 3000/4000 level

Curriculum: Physics, Professional Physics

Consult with a physics advisor for courses to take during the junior and senior years.

Freshman

- Written Communication **3 credit hours**
- Information Literacy **3 credit hours**
- PHYS 1010 - Physics Colloquium **1 credit hour**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours** (Sci Lit)

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)
- MATH 1920 - Calculus II **4 credit hours**

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

Subtotal: 31 Hours

Sophomore

- PHYS 3100 - Modern Physics I **3 credit hours**
- PHYS 3110 - Modern Physics II **3 credit hours**
- PHYS 3111 - Modern Physics Laboratory **1 credit hour**
- PHYS 3150 - Topics and Methods of Theoretical Physics I **3 credit hours**
- PHYS 3160 - Topics and Methods of Theoretical Physics II **3 credit hours**
- Non-Written Communication **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Electives **7 credit hours** (MATH 3110 and MATH 3120 recommended)

Subtotal: 26 Hours

Junior

- CSCI 1170 - Computer Science I **4 credit hours**
- PHYS 3200 - Scientific Modeling and Problem Solving **2 credit hours** *
- PHYS 3610 - Thermodynamics **3 credit hours** *
- PHYS 3800 - Physics Seminar **1 credit hour**
- PHYS 4380 - Quantum Mechanics **3 credit hours** *
- Electives **6-9 credit hours**
- Creativity and Cultural Expression **6 credit hours**
- Human Society and Social Relationships **6 credit hours**

Subtotal: 31-34 Hours

Senior

- History and Civic Learning **6 credit hours**
- Electives **11-14 credit hours**
- PHYS 3300 - Classical Mechanics **3 credit hours** *
- PHYS 3900 - Physics Practicum **1 credit hour**
- PHYS 4310 - Electricity and Magnetism **3 credit hours** *
- PHYS 4330 - Electricity and Magnetism II **3 credit hours** *
- PHYS 4850 - Physics Research **2 credit hours**
- PHYS 4900 - Physics Senior Thesis **2 credit hours**

Subtotal: 31-34 Hours

NOTE:

**Offered every other year*

Physics, Quantum Science and Computing Concentration, B.S.

Physics and Astronomy
615-898-2130
Ron Henderson, program coordinator
Ron.Henderson@mtsu.edu

Quantum Science is an emerging and rapidly advancing field, and this concentration will ensure that students have the latest skills and knowledge in this evolving workforce. Students will also be trained and coached to complete requirements for professional certification in Quantum Computing.
A minimum of 12 upper-division semester hours in the physics major must be taken at MTSU.

Academic Map

Following is a printable, suggested four-year schedule of courses:

Physics, Quantum Science and Computing Concentration, B.S., Academic Map

Degree Requirements

True Blue Core	**41 hours**
Major Requirements	**38 hours**
Major Core	*25 hours*
Quantum Science and Computing Concentration	*13 hours*
Supporting Courses	**20 hours***
Minor	**15-18 hours**
Electives	**3-14 hours**
TOTAL	**120 hours**

**This program requires courses that can also fulfill requirements of the True Blue Core curriculum. If program requirements are also used to fulfill True Blue Core requirements, the number of elective hours may increase.*

True Blue Core (41 hours)

True Blue Core (TBC) requirements (shown in curricular listings below) include courses in the **Foundational Skills** areas of Written Communication (WC), Information Literacy (Info Lit), Non-Written Communication (NWC), and Quantitative Literacy (Quant Lit). **Knowledge Domains** include Human Society and Social Relationships (HSSR), Scientific Literacy (Sci Lit), Creativity and Cultural Expression (CCE), and History and Civic Learning (HCL), which include **Discovery** and **Explorations** categories. Students must choose at least one course from each **Discovery** category.

The following courses required by the major meet True Blue Core requirements:

- MATH 1910 (Quant Lit)
- CHEM 1110/CHEM 1111 (Sci Lit)
- PHYS 2010/PHYS 2011 or PHYS 2110/PHYS 2111 (Sci Lit)

Major Requirements (38 hours)

A 2.0 GPA is required for the Physics major.

Physics Core (25 hours)

- PHYS 1010 - Physics Colloquium **1 credit hour**

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours**
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

- PHYS 3100 - Modern Physics I **3 credit hours**
- PHYS 3110 - Modern Physics II **3 credit hours**
- PHYS 3111 - Modern Physics Laboratory **1 credit hour**
- PHYS 3610 - Thermodynamics **3 credit hours**
- PHYS 3800 - Physics Seminar **1 credit hour**
- PHYS 3900 - Physics Practicum **1 credit hour**

- PHYS 4850 - Physics Research **2 credit hours** OR
- ASTR 4850 - Astronomy Research **2 credit hours**

- PHYS 4900 - Physics Senior Thesis **2 credit hours** OR
- ASTR 4900 - Astronomy Senior Thesis **2 credit hours**

Quantum Science and Computing Concentration (13 hours)

- PHYS 2270 - Introduction to Quantum Computing **2 credit hours**
- PHYS 3200 - Scientific Modeling and Problem Solving **2 credit hours**
- PHYS 3370 - Quantum Computing Applications **3 credit hours**
- PHYS 4380 - Quantum Mechanics **3 credit hours**
- Upper-division PHYS elective 3 credit hours

Supporting Courses (20 hours)

- CHEM 1110 - General Chemistry I **4 credit hours** AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- MATH 1910 - Calculus I **4 credit hours**
- MATH 1920 - Calculus II **4 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**

Minor (15-18 hours)

Electives (3-14 hours)

- 36 total credits must be earned at the 3000/4000 level

Curriculum: Physics, Quantum Science and Computing

Consult with a physics advisor for courses to take during the junior and senior years.

Freshman Fall

- PHYS 1010 - Physics Colloquium **1 credit hour**
- Written Communication **3 credit hours**
- MATH 1910 - Calculus I **4 credit hours** (Quant Lit)

- CHEM 1110 - General Chemistry I **4 credit hours** (Sci Lit) AND
- CHEM 1111 - General Chemistry I Lab **0 credit hours** (Sci Lit)

- PHYS 2010 - Non-Calculus-Based Physics I **0 credit hours** (Sci Lit) AND
- PHYS 2011 - Physics Problems Laboratory I **4 credit hours** (Sci Lit)
  OR
- PHYS 2110 - Calculus-Based Physics I **0 credit hours** AND (Sci Lit) AND
- PHYS 2111 - Calculus-Based Physics Laboratory I **4 credit hours** (Sci Lit)

Subtotal: 16 Hours

Freshman Spring

- Information Literacy **3 credit hours**
- MATH 1920 - Calculus II **4 credit hours**

- CHEM 1120 - General Chemistry II **4 credit hours** AND
- CHEM 1121 - General Chemistry II Lab **0 credit hours**

- PHYS 2020 - Non-Calculus-Based Physics II **0 credit hours** AND
- PHYS 2021 - Physics Problems Laboratory II **4 credit hours**
  OR
- PHYS 2120 - Calculus-Based Physics II **0 credit hours** AND
- PHYS 2121 - Calculus-Based Physics Laboratory II **4 credit hours**

Subtotal: 15 Hours

Sophomore Fall

- Non-Written Communication **3 credit hours**
- Minor course **3 credit hours**
- Scientific Literacy/Elective **4 credit hours**
- PHYS 2270 - Introduction to Quantum Computing **2 credit hours**
- PHYS 3100 - Modern Physics I **3 credit hours**

Subtotal: 15 Hours

Sophomore Spring

- PHYS 3110 - Modern Physics II **3 credit hours**
- PHYS 3111 - Modern Physics Laboratory **1 credit hour**
- PHYS 3370 - Quantum Computing Applications **3 credit hours**
- Creativity and Cultural Expression Literature **3 credit hours**
- Scientific Literacy/Elective **4 credit hours**

Subtotal: 14 Hours

Junior Fall

- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- PHYS 4380 - Quantum Mechanics **3 credit hours**
- CSCI 1170 - Computer Science I **4 credit hours**

- PHYS 3610 - Thermodynamics **3 credit hours** OR
- PHYS 3400 - Intermediate Physics **3 credit hours**

Subtotal: 16 Hours

Junior Spring

- PHYS 3200 - Scientific Modeling and Problem Solving **2 credit hours**
- PHYS 3800 - Physics Seminar **1 credit hour**
- Creativity and Cultural Expression **3 credit hours**
- Human Society and Social Relationships **3 credit hours**
- Minor course **3 credit hours**
- Minor course **3 credit hours**

Subtotal: 15 Hours

Senior Fall

- ASTR 4850 - Astronomy Research **2 credit hours** OR
- PHYS 4850 - Physics Research **2 credit hours**

- PHYS Upper-division elective **3 credit hours**
- History and Civic Learning **3 credit hours**
- Minor courses **6 credit hours**

Subtotal: 14 Hours

Senior Spring

- PHYS 3900 - Physics Practicum **1 credit hour**
- History and Civic Learning **3 credit hours**
- Minor course or elective **3 credit hours**
- Electives **6 credit hours**

- ASTR 4900 - Astronomy Senior Thesis **2 credit hours** OR
- PHYS 4900 - Physics Senior Thesis **2 credit hours**

Subtotal: 15 hours

Astronomy

ASTR 1030 - Exploring the Universe
3 credit hours
Corequisite: ASTR 1031. A general introduction to astronomy through an overview of planets, stars, systems of stars, and the overall structure of the universe. Topics will be discussed by answering questions such as "How do you weigh stars?" and "Will the universe die?" TBR Common Course: ASTR 1030
TBC: Scientific Literacy (Discovery)

ASTR 1031 - Observing the Universe
1 credit hour Prerequisite or corequisite: ASTR 1030. Introduction to observational astronomy through laboratory exercises and outdoor observing activities. Topics include telescopes, the analysis of starlight, and observations of stars and planets. TBR Common Course: ASTR 1032

ASTR 2030 - Solar System Astronomy
3 credit hours Prerequisite: MATH 1710, MATH 1730, MATH 1810, or MATH 1920. Comprehensive study of the solar system including models of solar and planetary formation. Analysis of the chemical makeup and physical nature of the Sun, planets, moons, and comets using mathematics and the scientific method. Focus on planetary interiors, surfaces, atmospheres, solar-planetary interactions, and solar system evolution. Discussion of spacecraft missions, future solar system exploration, and possibilities of extraterrestrial life.

ASTR 2040 - Stars, Galaxies, and Cosmology
3 credit hours Prerequisite: MATH 1710, MATH 1730, MATH 1810, or MATH 1920. A comprehensive study of stellar, galactic, and cosmological astronomy. Analyzes the basic theories of stellar and galactic formation and evolution using mathematics and the scientific method. Includes the cataclysmic topics of supernovae, neutron stars, pulsars, and black holes as well as the nature of galaxies including the Milky Way galaxy, active galaxies and quasars, and the formation and evolution of our universe, the big bang theory, and the possibility of other life in the universe.

ASTR 3050 - Directed Study in Astronomy
1 to 4 credit hours Individualized intensive study of a specific topic in astronomy or astrophysics not normally covered in the standard undergraduate physics and astronomy curriculum. Arrangements must be made with an approved faculty member prior to registration.

ASTR 3400 - Fundamentals of Astrophysics
3 credit hours Prerequisite: PHYS 2021 or PHYS 2121 and MATH 1910 with C or better. Modern astronomical knowledge and techniques using classical and modern physical principles. Possible topics include star formation, black holes and neutron stars, galaxy structure and evolution, formation of planetary systems, and large-scale structure of the universe.

ASTR 3401 - Experimental Astronomy
1 credit hour Prerequisites: PHYS 2021 or PHYS 2120 or consent of instructor. Principles and techniques of astronomical data acquisition and reduction. Possible research topics involve photometry, spectroscopy, astronomical applications of electronic detectors, and computer modeling.

ASTR 4800 - Special Topics in Astronomy
3 credit hours Prerequisites: PHYS 3100 and PHYS 3150 or approval of department chair. In-depth, organized study of a contemporary topic of interest not normally covered in the undergraduate physics and astronomy curriculum. Possible topics include planetary geology, radio astronomy, stellar atmospheres or interiors, space physics, pulsating stars, dark matter and energy, galactic evolution, and general relativity and cosmology.

ASTR 4850 - Astronomy Research
2 credit hours Prerequisite: Consent of instructor. Independent study of a selected research problem in astronomy. Includes experimental and/or theoretical investigation of an important yet unexplored problem or experimental design. Includes literature research and experimental design/problem formulation and execution resulting in oral and written presentation of results suitable for submission/presentation to a suitable journal/conference. One hour lecture and significant additional time working with research mentor.

ASTR 4900 - Astronomy Senior Thesis
2 credit hours Prerequisites: ASTR 4850 and consent of department chair. Focuses on a specific research/experimental design problem chosen with the consent of the thesis committee and with the potential for original discovery or for creative development of a tool, technique, or instrumentation applicable to scientific research. Independent pursuit

of research objectives outlined in a research proposal results in a written thesis, the approval of which will include an oral defense. One hour lecture and independent writing of thesis.

Physics

PHYS 1010 - Physics Colloquium
1 credit hour Introduces new physics and astronomy students to the physics major. Topics include degree requirements, faculty resources, research opportunities, and career options. Half of the meetings will involve one hour lectures during class, and half will involve attending talks, some of which may occur outside the scheduled class meeting time.

PHYS 1110 - Discovering Physics
4 credit hours
Prerequisite: MATH 1710, MATH 1730, or MATH 1630. Uncovers the fundamental concepts of physics in a hands-on approach that involves observations, measurements, forming hypotheses, and validation of ideas in groups of students' peers. Combined lecture/laboratory sessions.
TBC: Scientific Literacy (Discovery)

PHYS 1600 - Physics of Music
3 credit hours Prerequisite: MATH 1710, MATH 1730, MATH 1810, or MATH 1910 or consent of instructor. The physics of music, acoustics, and sound for students without prior physics background.

PHYS 2010 - Non-Calculus-Based Physics I
0 credit hours
Prerequisite: MATH 1710, MATH 1730, MATH 1810, or MATH 1910 with a minimum grade of C (2.0). Required corequisite: PHYS 2011. Web-based discussion class to be taken in conjunction with cooperative-learning based problems lab PHYS 2011. Classical mechanics traditionally covered in a first-semester college physics course. Kinematics, forces, momentum, angular motion, calorimetry, and sound waves. Class time used for discussion of the Web-lecture material and for the administration of exams. TBR Common Course: PHYS 2010
TBC: Scientific Literacy (Discovery)

PHYS 2011 - Physics Problems Laboratory I
4 credit hours Prerequisite: MATH 1710, MATH 1730, MATH 1810, or MATH 1910 with a minimum grade of C (2.0). Required corequisite: PHYS 2010. Group-oriented problems course taken in conjunction with the Web-based discussion class PHYS 2010. Students work in groups with the topics presented in the PHYS 2010 discussion class. Covers kinematics, forces, momentum, angular motion, calorimetry, and sound waves. Skills associated with the development of experimental investigations including graphical analysis and estimation of uncertainties emphasized. Two two-and-one-half-hour laboratory sessions. TBRCommon Course: PHYS 2011

PHYS 2020 - Non-Calculus-Based Physics II
0 credit hours Prerequisite: PHYS 2011. Required corequisite: PHYS 2021. Web-based discussion class taken in conjunction with the cooperative-learning based problems lab PHYS 2021. Fundamentals of optics, modern physics, and electronics traditionally covered in a second-semester college physics course. Reflection and refraction, vision, diffraction effects, quantum mechanics, atomic and nuclear physics, and analog and digital electronics. Scheduled class time is used for discussions of the Web-lecture material and for the administration of exams. TBR Common Course: PHYS 2020

PHYS 2021 - Physics Problems Laboratory II
4 credit hours Prerequisite: PHYS 2011. Required corequisite: PHYS 2020. Group-oriented problems course to be taken in conjunction with the Web-based discussion class PHYS 2020. Students work in groups with the topics presented in the PHYS 2020 discussion class. Optics, modern physics, and electronics traditionally covered in a second-semester college physics course. Reflection and refraction, vision, diffraction effects, quantum mechanics, atomic and nuclear physics, and analog and digital electronics. The skills associated with the development of experimental investigations including graphical analysis and estimation of uncertainties emphasized. Two two-and-one-half-hour laboratory sessions. TBR Common Course: PHYS 2021

PHYS 2110 - Calculus-Based Physics I
0 credit hours
Prerequisite: MATH 1910 with a minimum grade of C (2.0). Corequisite: PHYS 2111. A calculus-based introduction to mechanics and wave motion. One and one-half hours lecture. TBR Common Course: PHYS 2110
TBC: Scientific Literacy (Discovery)

PHYS 2111 - Calculus-Based Physics Laboratory I
4 credit hours Prerequisite: MATH 1910 with a minimum grade of C (2.0). Corequisite: PHYS 2110. Laboratory course to accompany PHYS 2110. Experiments in mechanics, waves, and thermodynamics. Data reduction, error analysis, and report writing. Two three-hour sessions. TBR Common Course: PHYS 2111

PHYS 2120 - Calculus-Based Physics II
0 credit hours Prerequisites: PHYS 2111; MATH 1920 with a minimum grade of C (2.0). Required corequisite: PHYS 2121. A lecture course that supplements the discussion in PHYS 2121. Topics include a microscopic view of electrical force and field, polarization, electric circuits, magnetic force and field, electric potential, symmetries of fields, Maxwell's equations, electromagnetic radiation, optics, and wave phenomena. One and one-half hours lecture.

PHYS 2121 - Calculus-Based Physics Laboratory II
4 credit hours Prerequisites: PHYS 2111; MATH 1920 with a minimum grade of C (2.0). Required corequisite: PHYS 2120. A laboratory-based course to accompany PHYS 2120. Includes discussions, group problem solving, and hands-on activities. Two three-hour sessions. TBR Common Course: PHYS 2121

PHYS 2270 - Introduction to Quantum Computing
2 credit hours Prerequisite: MATH 1910 with grade of C- or better. Basic of quantum information, quantum fundamentals, qubit, quantum gates, entanglement, quantum algorithms.

PHYS 3050 - Directed Study in Physics
1 to 4 credit hours Prerequisites: PHYS 2021 or PHYS 2120 and approval of department chair. Individualized intensive study of a specific topic in physics not normally covered to the extent desired in the standard curriculum. Arrangements must be made with an approved faculty member prior to registration.

PHYS 3100 - Modern Physics I
3 credit hours Prerequisites: PHYS 2021 or PHYS 2121 and MATH 1920 with a minimum grade of C (2.0). Introduction to the fundamental principles of modern physics (special relativity and quantum mechanics) and their application to atomic physics.

PHYS 3110 - Modern Physics II
3 credit hours Prerequisite: PHYS 3100. Survey of major topics including molecular physics, statistical physics, solid state physics and solid state devices, nuclear models, nuclear decay and reaction, and elementary particle physics.

PHYS 3111 - Modern Physics Laboratory
1 credit hour Prerequisite or corequisite: PHYS 3100. Concepts and ideas which formed the basis for an understanding of the atom and atomic phenomena. One hour lecture and one three-hour independent study laboratory.

PHYS 3150 - Topics and Methods of Theoretical Physics I
3 credit hours Prerequisites: PHYS 2021 or PHYS 2121 and MATH 1920 with a minimum grade of C (2.0). Theoretical techniques used for problem solving in physics. Reference frames and coordinate systems, approximation techniques, solution of electrical circuits and mechanical systems, simple harmonic motion and wave motion, Maxwell's equations.

PHYS 3160 - Topics and Methods of Theoretical Physics II
3 credit hours Prerequisite: PHYS 3150. A continuation of PHYS 3150. The Schroedinger equation, heat flow, diffusion, the Lagrangian description of motion.

PHYS 3200 - Scientific Modeling and Problem Solving
2 credit hours Prerequisites: MATH 1920 and PHYS 2021 or PHYS 2120 or PHYS 2121 or consent of instructor. Techniques of computational physics as applied to the solution of scientific problems.

PHYS 3300 - Classical Mechanics
3 credit hours Prerequisite: PHYS 3110 and MATH 3120 or PHYS 3150. Mechanics (including statics and dynamics) of particles in three dimensions using vector analysis, motion of rigid bodies, Lagrangian mechanics, and Hamilton's equations.

PHYS 3330 - Health Physics and Radiation Protection
3 credit hours Radiation protection methods, dosimetry techniques, and survey instruments. Practical knowledge of the methodology for paramedical personnel, industrial workers, and others who deal with radioisotopes and X-ray equipment. Two hours lecture and one three-hour laboratory.

PHYS 3350 - Concepts and Applications of Analog Electronics
4 credit hours Prerequisite: PHYS 2021 or PHYS 2121 or ET 3610 with C or better. Introduction to contemporary analog electronics utilizing integrated circuits to treat traditional circuits, power supplies, operational amplifiers, comparators, and multivibrators. Conversion of analog to digital signal for interfacing to microcomputers. Emphasis on

practical applications. Three hours lecture and one three-hour laboratory.

PHYS 3370 - Quantum Computing Applications
3 credit hours Prerequisite: PHYS 2270 with a grade of C- or better. Quantum applications, Qiskit, hand-on quantum computing, and quantum algorithms.

PHYS 3400 - Intermediate Physics
3 credit hours Prerequisite: PHYS 2021 or PHYS 2121 and MATH 1920. Provides an intermediated treatment of the principles of thermodynamics, electromagnetics, and oscillatory behavior with applications. Course is not intended for physics majors participating in the Professional Physics concentration. Three hours lecture.

PHYS 3520 - Optics and Photonics
3 credit hours Prerequisites: PHYS 2021 or PHYS 2121 and MATH 1920 both with a minimum grade of C (2.0). Optical science with applications. Addresses geometrical optics and wave optics with a focus on real world applications from the very large to the nanoscale.

PHYS 3610 - Thermodynamics
3 credit hours Prerequisite: PHYS 3110 and PHYS 3150 or MATH 3120 or consent of instructor. Introduction to statistical physics, kinetic theory, and thermodynamics from a unified microscopic point of view. Selected applications to various systems of interest presented.

PHYS 3800 - Physics Seminar
1 credit hour Prerequisite: PHYS 3100. Develops and refines inquiry, communication, and presentation skills through exposure to new developments in physics, technical brief writing, and resume and job interview preparations.

PHYS 3900 - Physics Practicum
1 credit hour Prerequisite: PHYS 3100 and consent of instructor. Refines thinking, communication, and interpersonal skills through exposure to on-the-spot technical questions and a laboratory teaching experience as an assistant in an introductory physics laboratory. One hour lecture and two two-and-one-half hour experiences as a teaching assistant to be scheduled with department faculty.

PHYS 3910 - Advanced Physics Laboratory
1 credit hour Prerequisites: PHYS 2021 or PHYS 2120 and PHYS 2121. The skills, art, and physics important in pursuing independent research. Experiments dealing with mechanical, optical, or thermodynamic principles explored. Report writing, literature research, and the use of analysis tools emphasized. One hour lecture and one three-hour independent study laboratory.

PHYS 3920 - Advanced Physics Laboratory
1 credit hour Prerequisites: PHYS 2021 or PHYS 2120 and PHYS 2121. The skills, art, and physics important in pursuing independent research. Experiments dealing with mechanical, optical, or thermodynamic principles explored. Report writing, literature research, and the use of analysis tools emphasized.

PHYS 3930 - The Teaching of Physics
3 credit hours Prerequisite: PHYS 2021 PHYS 2121 and MATH 1920 with C or better. Introduces physics teaching pedagogies resulting from physics education research. Methods studied to include inquiry, discovery, and modeling-based approaches. Seminar meeting will be supplemented with extensive experience as a learning assistant in a hands-on cooperative-learning and/or discovery-learning based introductory physics course.

PHYS 3950 - Reasoning in Physics I: Mechanics
1 credit hour Prerequisites: PHYS 2021 or PHYS 2121 and MATH 1920 with C or better. Develops skills of reasoning and articulating physics concepts for improved understanding and performance on physics exams and upper-level courses. Focuses on topics typically covered in the first semester of introductory physics. One one-hour, twenty-five minute lecture per week.

PHYS 3960 - Reasoning in Physics II: Electricity and Magnetism
1 credit hour Prerequisites: PHYS 2021 or PHYS 2121 and MATH 1920 with C or better. Develops skills of reasoning and articulating physics concepts for improved understanding and performance on physics exams and upper-level courses. Focuses on topics typically covered in the second semester of introductory physics. One-hour twenty-five minutes lecture per week.

PHYS 4310 - Electricity and Magnetism
3 credit hours Prerequisites: MATH 3110 and MATH 3120 and PHYS 3110 or PHYS 3160. Topics including electric and magnetic fields, electrostatic potential, and potential energy and fields in matter,

discussed in a mathematically rigorous manner. A variety of good applications of mathematical methods in physics.

PHYS 4330 - Electricity and Magnetism II
3 credit hours Prerequisite: PHYS 3160 and PHYS 4310. Topics include theory of electromagnetic radiation, production and propagation of electromagnetic waves, and the solution of boundary-value problems with applications to optics, wave guides, and lasers.

PHYS 4380 - Quantum Mechanics
3 credit hours Prerequisites: PHYS 3110 and MATH 3120 and (PHYS 3110 or PHYS 3160). Topics include both one- and three-dimensional solutions to the Schroedinger equation, including the infinite square-well, finite square-well, tunneling, the harmonic oscillator, and the hydrogen atom with a discussion of angular momentum at a mathematically rigorous undergraduate level.

PHYS 4390 - Advanced Quantum Mechanics
3 credit hours Prerequisite: PHYS 3160 and PHYS 4380. Advanced topics in quantum mechanics, including time-independent and time-dependent perturbation theory, systems of indistinguishable particles, the Aharonov-Bohm effect, Fermi's Golden Rule, and an introduction to quantum field theory.

PHYS 4630 - Principles of the Solid State
3 credit hours Prerequisites: PHYS 3110 and PHYS 3150. Includes crystal structures, lattice dynamics, statistics of conductors and semiconductors, thermal properties, the metallic state, free electron theory, band theory of solids, dielectric and magnetic properties of solids, and the low temperature behavior of matter, particularly solids. Three hours lecture.

PHYS 4740 - Research Methods
3 credit hours (Same as ABAS/BIOL/GEOL/CHEM/MATH 4740.) Prerequisite: YOED 3520. Provides secondary science and mathematics teacher candidates with the tools that scientists use to solve scientific problems. Students will use these tools in a laboratory setting, communicate findings, and understand how scientists develop new knowledge.

PHYS 4800 - Special Topics in Physics, Special Topics A
3 credit hours Prerequisites: PHYS 3110 and PHYS 3160; an extensive physics background and permission of instructor. Detailed study of a selected topic of current interest in physics not normally covered in the regular undergraduate physics curriculum. Possible topics include advanced atomic physics, high-energy physics (nuclear and elementary particles), scattering theory, astrophysics, and general relativity.

PHYS 4810 - Special Topics in Physics, Special Topics B
3 credit hours Prerequisites: PHYS 3110 and PHYS 3160; an extensive physics background and permission of instructor. Detailed study of a selected topic of current interest in physics not normally covered in the regular undergraduate physics curriculum. Possible topics include advanced atomic physics, high-energy physics (nuclear and elementary particles), scattering theory, astrophysics, and general relativity.

PHYS 4850 - Physics Research
2 credit hours Prerequisite: PHYS 3110 and consent of instructor. Independent study of a selected research problem in physics. Includes experimental and/or theoretical investigation of an important, yet unexplored, problem. Includes literature research, experiment design/problem formulation and execution, resulting in oral and written presentation of results suitable for submission for publication in a suitable journal. One hour lecture and significant time working with research mentor.

PHYS 4860 - Physics Research
2 credit hours Prerequisite: Consent of instructor. Independent study of a selected research problem in physics. Includes experimental and/or theoretical investigation of an important, yet unexplored, problem. Includes literature research, experiment design/problem formulation and execution, resulting in oral and written presentation of results suitable for submission for publication in a suitable journal. One hour lecture and significant additional time working with research mentor.

PHYS 4900 - Physics Senior Thesis
2 credit hours Prerequisites: PHYS 4850 or PHYS 4860 and consent of department chair. Brings undergraduate experience to focus on a specific research problem; chosen with the consent of the thesis committee and with the potential for original discovery or for creative development of a tool or technique applicable to scientific research. Independent pursuit of research objectives outlined in a research proposal results in a written thesis whose approval will include an oral defense. One hour lecture and independent writing of thesis.