

## Automotive Engineering Technology

*College of Science, Engineering & Technology*

*Department of Automotive & Manufacturing*

*Engineering Technology*

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Chair: Dr. Bruce E. Jones, Ph.D.

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**Accreditation.** The AET degree program is accredited by the Engineering Technology Accreditation Commission (ETAC) of the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012, Phone: 410-347-7700, Fax: 410-625-2238, e-mail: [tac@abet.org](mailto:tac@abet.org), Website: <http://www.abet.org>.

The mission of the Automotive Engineering Technology (AET) degree program at Minnesota State Mankato, is to provide a broad-based education for graduates to enter globally competitive automotive careers to serve the citizens of Minnesota, and the world by:

- providing the highest quality education to prepare application-oriented graduates for a broad range of career opportunities in product research, design, development, and technical sales environments;
- encouraging and supporting faculty and students to engage in scholarly research and activities through partnerships with government, industry, and other constituencies that support effective and ethical transfer of technology;
- providing access to state of the art equipment, facilities, and methodologies, along with faculty expertise to benefit (AET) students; and
- broadening access to the program for diverse populations and support of K-12 pipeline development.

**Program Description.** The Automotive Engineering Technology (AET) degree program awards a Bachelor of Science degree (BS) to successful students through a four-year curriculum.

Engineering technology has been defined as the part of the technological field which requires the application of scientific and engineering knowledge and methods combined with technical skills in support of engineering activities; it lies in the occupational spectrum between the craftsman and the engineer at the end of the spectrum closest to the engineer. Engineering technology is oriented less toward theory and more toward practical applications. - American Society of Engineering Education (ASEE).

The Automotive Engineering Technology degree program prepares graduates for careers in product research, design and development, manufacturing, and technical sales in the original equipment and aftermarket industries. Fields include passenger cars, trucks, motorcycles, recreational vehicles, vehicle emissions, safety, fuels and lubricants, construction, industrial, and agricultural equipment. Graduates from the program are currently working for original equipment manufacturers (OEMs), such as General Motors, Polaris, John Deere, AGCO, and Ford along with aftermarket companies such as Competition Cams, OTC, and S&S Cycle. A more complete reference to companies employing (AET) graduates may be obtained from the Department Chair.

The Society of Automotive Engineers ([sae.org](http://sae.org)) and National Institute of Automotive Service Excellence ([ase.com](http://ase.com)) are the lead professional societies used in developing program criteria, guiding program relevance, and making continuous improvement.

The primary goal of the (AET) program is to provide all graduates with the solid technical foundation necessary to insure their success in a wide variety of employment opportunities. To accomplish this goal, program outcomes and objectives are defined and assessed for continuous improvement. They are as follows:

**Program Outcomes.** Students at the time of graduation are prepared to:

1. apply knowledge of science, math, statistics, and engineering technology to solve problems encountered in a professional career in the automotive industry.
2. design, analyze and build virtual and real models, and conduct testing in product development environments through applied computer technologies.
3. define and communicate a set of requirements for a system, component or process and develop solutions to satisfy given criteria in an optimal fashion using creativity in design.
4. function effectively as a manager, leader, or member of a team.
5. understand and practice professional, ethical, environmental, and global responsibilities.
6. communicate effectively across all design and management interface levels of an organization.
7. recognize the need for and then develop the skills for life-long learning.
8. understand and engage in behavior which respects diversity and global cultures
9. practice timeliness and quality with regard to work requirements

**Program Objectives.** AET graduates two to three years into their careers should have the foundation to:

1. deliver products, services, and support to both internal and external organizations by applying technical knowledge, problem solving techniques and hands-on skills in traditional and emerging technologies.
2. actively participate in on-going professional development, professional growth, and increasing professional responsibility.
3. effectively communicate ideas to technical and non-technical people.
4. perform in or manage cross-functional teams.
5. work within the accepted standards of professional integrity and conduct.
6. design, analyze, build, and test virtual or real models in product development and continuous improvement environments.
7. implement, and continuously improve cost, quality, time, and goals using world class management methodologies.

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**Admission to the AET.** major is granted by the AMET Department. Admission to the major is required to register for 300-level courses. Minimum requirements for acceptance into the AET major include a cumulative GPA of 2.0 or higher and the completion of the following courses with a grade of "C" (2.0) or higher: AET 102, AET 160, AET 261, AET 262, CMST 100 or CMST 102, EET 113, ENG 101, MET 142, MET 144, MET 177, MATH 121, PHYS 211.

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### POLICIES/INFORMATION

**GPA Policy.** A GPA of 2.5 or higher in courses required for the major or minor in Automotive Engineering Technology in order to proceed in the program sequence and graduate. This GPA calculation is based on the following areas: Required Communications; Required Basic Science and Mathematics; Required Major and Required Elective Courses. Refer to the College of Science Engineering and Technology Student Advising Center regarding required advising for students on academic probation.

**Department Grade Policy.** All courses in the AET major, and the required Communications, Basic Science and Mathematics courses must be completed with a grade of "C" or better except for AET 387, AET 488, and AET 489.

**P/N Grading Policy.** No more than 1/4 of all undergraduate credits may be P/N, except those courses offered P/N only.

**Residency.** A minimum of 50 percent of the credits for a major or minor in Automotive Engineering Technology must be taken at Minnesota State Mankato.

# AUTOMOTIVE ENGINEERING TECHNOLOGY

Prerequisites and co-requisites must be observed unless written permission is obtained from the instructor and the Department of AMET. A flow chart of prerequisites is available at the Department Office.

The scheduling of all department courses is done bi-annually, based on enrollment and staffing. To obtain a current class schedule, contact the Department.

## **AUTOMOTIVE ENGINEERING TECHNOLOGY BS**

Degree completion = 128 credits

### **Required General Education**

CHEM	104	Introduction to Chemistry (3)
ENG	271W	Technical Communication (4)
MATH	115	Precalculus Mathematics (4)
STAT	154	Elementary Statistics (3)

### **Prerequisites for Major**

AET	102	Introduction to Automotive Engineering Technology (1)
AET	160	Automotive Technology & Systems (4)
AET	261	Automotive Driveability & Diagnosis (4)
AET	262	Automotive Computers and Electronics (4)
EET	113	DC Circuits (3)
ENG	101	Composition (4)
MATH	121	Calculus I (4)
MET	142	Introduction to Parametric Modeling (3)
MET	144	Product Development & Design (3)
MET	177	Materials Processing and Metallurgy (4)
PHYS	211	Principles of Physics I (4)
<u>Communication Studies</u> (choose 3 credits)		
CMST	100	Fundamentals of Speech Communication (3)
CMST	102	Public Speaking (3)

### **Major Common Core**

AET	334	Fluid Power (3)
AET	364	Chassis Design and Performance Testing (4)
AET	366	Automotive Thermodynamics and Engine Design (3)
AET	378	Composite Materials (3)
AET	387	Junior Design Project (1)
AET	465	Automotive Laboratory Experience (2)
AET	468	Automotive Research Methods (4)
AET	488	Senior Design Project I (3)
AET	489	Senior Design Project II (3)
MATH	122	Calculus II (4)
MET	323	Statics (3)
MET	324	Strength of Materials and Dynamics (4)
MET	341	Advanced Parametric Modeling (3)
MET	424	Industrial Safety (2)
PHYS	212	Principles of Physics II (4)

### **Major Restricted Electives**

Programming (choose 2-3 credits)

CS	171	Introduction to C++ Programming (2)
EET	315	Programmable Instrumentation (3)

**Required Minor: None**

## **AUTOMOTIVE ENGINEERING TECHNOLOGY MINOR (16 Credits)**

### **Required for Minor (9 credits)**

AET	102	Introduction to Automotive Engineering Technology (1)
AET	160	Automotive Technology & Systems (4)
AET	261	Automotive Driveability and Diagnosis (4)
AET	262	Automotive Computers and Electronics (4)

**Electives** (choose 3 additional credits of AET/MET courses)

## **COURSE DESCRIPTIONS**

### **AET 102 (1) Introduction to Automotive Engineering Technology**

An overview of careers, technology and requirements of the Automotive Engineering Technology program. Careers in engineering technology are examined along with professional organizations and ethics.  
Fall

### **AET 160 (4) Automotive Technology & Systems**

This course is centered on the theory, operation and service of the systems found in modern automobiles. Lectures and demonstrations cover the course topics and open lab sessions allow students to practice procedures on their own vehicles in the completion of course assignments.

Fall, Spring

### **AET 261 (4) Automotive Driveability and Diagnosis**

This course focuses on the engine's mechanical, ignition, fuel, and emission system using a systems approach to diagnose problems. Test equipment used in the course includes: fuel and fuel system; emission system; ignition oscilloscopes; valve refurbishing and mechanical diagnostic equipment.

Pre: MATH 113 or MATH 115 or higher or ACT Math sub-score of 20 or higher or Accuplacer score = 86 or higher.

Fall, Spring

### **AET 262 (4) Automotive Computers and Electronics**

This course is centered on the theory, components, and diagnostic procedures related to modern automobile electrical and electronic systems. The major emphasis of the course involves the computer, sensors, and actuators as used in vehicles to control the ignition, fuel, emission, ABS, and chassis systems.

Pre: AET 160, AET 261, EET 113

Fall, Spring

### **AET 334 (3) Fluid Power**

Course provides a fundamental understanding of the physical principles of fluid power, along with a practical working knowledge of the components utilized in designing, installing, operating, and maintaining hydraulic and pneumatic power systems.

Fall, Spring

Pre: MATH 121, PHYS 211

### **AET 364 (4) Chassis Design and Performance Testing**

This course is an exploration of the theory and design of chassis systems, in addition to evaluation of these designs. Research tools include software design simulators, chassis geometry gauges, and dynamometers.

Pre: MATH 121, PHYS 211

Fall, Spring

### **AET 366 (3) Automotive Thermodynamics and Engine Design**

This course focuses on the study of thermodynamics as it relates to internal combustion engines and their design. Static and dynamic engine measurements are thoroughly covered along with an introduction to fuel cell and hybrid applications. Thermochemistry topics are covered including fuel characteristics, mixture ratios and emission characteristics.

Pre: CHEM 104, MATH 121, PHYS 211

Fall, Spring

### **AET 378 (3) Composite Materials**

Fiber reinforced plastic composite materials used in the manufacturing and transportation industries are the focus of this course. Matrix and reinforcement materials are examined and their properties identified. Manufacturing methods, fabrication, assembly techniques, testing, repair, and design of composite products are covered.

Pre: MET 177, MET 324, CHEM 104

Fall, Spring

**AET 387 (1) Junior Design Project**

An examination of automotive design and research along with a review of topics such as ethics, professionalism, measurement, statistics, and career development/ placement. This course prepares the student for AET 488, Senior Design Project I, where the design proposal, design project and final report are completed.

Pre: ENG 271W, MET 144, STAT 154

Spring

**AET 398 (0) CPT: CO-Operative Experience**

Curricular Practical Training: Co-Operative Experience is a zero-credit full-time practical training experience for one summer and on adjacent fall or spring term. Special rules apply to preserve full-time student status. Please contact an advisor in your program for complete information.

Pre: AET 102. At least 60 credits earned; in good standing; instructor permission; co-op contract; other prerequisites may also apply.

Fall, Spring, Summer

**AET 435 (1-4) Automotive Design and Construction**

Focuses on the design and construction of prototype vehicles. Topics include: vehicle design decisions, rules, budgets, chassis design, body and aerodynamics, drivetrain choices, construction techniques, and test procedures. An experimental vehicle will be built in the course. May be repeated.

Pre: Permission Required

Fall, Spring

**AET 436 (3) Hybrid and Electric Vehicles**

This course covers advanced vehicle propulsion systems within the electric and hybrid electric category. Fundamentals of the operation of electric motors, controllers, inverters, and batteries utilized in electric and hybrid platforms will be covered. In addition a significant focus will be placed on the application, modeling, integration, testing, and optimization of the systems in electric and hybrid electric vehicles.

Pre: AET 366, MATH 122, PHYS 212

Variable

**AET 465 (2) Automotive Laboratory Experience**

This course designed to provide experience in management, organization, supervision, and maintenance in a laboratory environment. Enrollment is limited. Sign up at least two semesters ahead.

Pre: AET 364, Permission required

Fall, Spring

**AET 468 (4) Automotive Research Methods**

Automotive research techniques and equipment form the basis for this course. Environmental measurement, air flow testing, dynamometer testing, emission measurement and fuel efficiency testing is covered. Emphasis is placed on research procedures, data acquisition and interpretation.

Pre: AET 366, PHYS 211, STAT 154

Fall, Spring

**AET 488 (3) Senior Design Project I**

The first of a two-course sequence where students carry out their capstone design project. Weekly meetings are scheduled where the design team carries out the tasks required for completion. Formal design presentations and research papers are presented at the end of the course.

Pre: AET 364, AET 387, MET 324, MET 341

Coreq: AET 468

Fall

**AET 489 (3) Senior Design Project II**

The second of a two course sequence where students build upon the first semester's work. The course culminates with the completion of the capstone project with a formal technical paper following SAE format that would be ready to be submitted for publication.

Pre: AET 468, AET 488

Spring

**AET 492 (1-4) Automotive Seminar**

Selected automotive topics.

Pre: Permission required

On-Demand

**AET 497 (1-10) Internship: Automotive**

Automotive work experience in an area pertinent to the student's career objectives.

Consent of internship coordinator required prior to the beginning of employment and registration. Typically done between the junior and senior year.

Pre: 40 earned credits in AET/MET

Fall, Spring, Summer

**AET 499 (1-4) Individual Study**

Pre: Permission required