

METROPOLITAN STATE COLLEGE *of* DENVER

June 3, 2009

Mechanical Engineering Technology -

Mechanical Engineering Technology (MET) offers a rigorous bachelor's degree program that prepares students for the field of engineering technology—the aspect of technology that requires scientific and engineering knowledge and methods, combined with technical skills to support engineering activities. The specialized fields within the Mechanical Engineering Technology Program include the two concentrations: Computer - Aided Manufacturing, and Mechanical. With a goal of 3 years to help meet the increased public and private demand in the space and aerospace industries, we will have completed addition of a new concentration called: **Aerospace Systems Engineering Technology**.

Faculty — The faculty in the MET program gives top priority to teaching, and emphasizes high levels of faculty-student interaction as a critical part of each student's education. The faculty has many years of industrial experience and brings a wealth of expertise, relevancy, and currency to the classes. The faculty-student ratio is small, encouraging an interactive classroom atmosphere.

Students - The low faculty-student ratio provides each student with individual academic counseling and assistance in meeting graduation requirements. Many MET students work part-time or full-time. For the working student the department offers many courses during evening hours. The students may participate in campus clubs, such as **American Society of Mechanical Engineers (ASME)**, Society of Automotive Engineers (SAE) Student Organizations. Other organizations also have had student chapters in the past such as American Society of Quality (ASQ), Society of Manufacturing Engineers (SME), and American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE). These clubs are active in promoting professional development, academic scholarships, and interaction with industry. They invite guest speakers to meetings, arrange field trips, host social functions, participate in inter-university design contests, and provide community service. If they choose, they can design, build, and test vehicles and systems for different national design competitions, including the SAE Mini Baja-West, ASME Human Powered Vehicle. Students have participated in the NASA sponsored Colorado Space Grant Consortium's Demo - Sat program for workforce development.

Students are encouraged to enroll in the college's Cooperative Education Program gaining valuable work experience.



Graduates — Virtually all MET graduates have been able to find industrial jobs, even during soft economic times. Employment opportunities exist in both the private and public sector.

Accreditation — The Mechanical Engineering Technology Bachelor of Science degree program is **Accredited by the Technology Accreditation Commission (TAC) of ABET**, 111 Market Place, Suite 1050, Baltimore, MD 21202, Telephone: (410) 347-7700, www.abet.org.

What Courses Will I Take?

Engineering Science

- Technical Drawing
- CAD Drawing
- Statics
- Dynamics
- Mechanics of Materials
- Fluid Mechanics
- Thermodynamics

Analysis and Design

- Quality Assurance
- Materials of Engineering
- N/C Computer Programming
- Computer Aided Engineering
- Computer Aided Design

Mathematics

- Pre-calculus
- Calculus

Natural Science

- General Chemistry
- Physics

Communication Skills

- English Composition
- Effective Speaking
- Technical Writing

General Studies

- Liberal Arts
- History
- Social Studies

Technical Electives

Accredited

ABET

Technology
Accreditation
Commission

Careers - Graduates are employed in a variety of positions in the following areas:

Design - The MET graduates are involved in the process that translates an idea, demand, or identified need into a working prototype of a product or service.

Management – MET graduates can be managers who combine engineering technical skills with managerial abilities to direct resources toward the efficient production of goods and services.

Manufacturing - The MET graduate in the area of manufacturing is engaged in the continuous development of efficient systems for the production of goods and services.

Research and Development - Research and Development is directed toward obtaining new technical information and knowledge. The technology graduate is a member of the R&D team and his or her work may involve the development and construction of prototypes, test and evaluation of equipment and software, or other necessary support activities.

Sales - The sales engineer must intimately know the product he or she is selling. The sales engineer will be meeting customers and providing solutions to their technical problems using the equipment represented. Often the sales engineer will represent several manufacturers. Strong interpersonal skills are needed as well as technical skills.

Service and Support - The Service and Support Technologist supports the companies system after they are delivered to the customer. Often this is the only contact the customer has with the company, and strong interpersonal skills are needed as well as technical skills.

Professional Licensure - Under revised rules and regulations of the Colorado State Board for Registration for Professional Engineers and Professional Land Surveyors, students within 30 semester hours of graduation may take the **Fundamentals of Engineering (F.E.) Examination**. The Department offers an F.E. Refresher Course at least once a year.

Curriculum - The MET curriculum gives a solid foundation in sciences, mathematics, technical skills, and mechanical systems. The theoretical knowledge base consists of two years of mathematical and engineering sciences. Professional skills consist of two years of analytical, experimental, and design methodologies. Design experience is emphasized. Laboratory experience is an integral part of engineering technology education, with two of every three courses requiring laboratory work to supplement lectures. The student may specialize in one of two concentrations. Classes are available in Manufacturing Processes, Technical Drawing, Principles of Quality Assurance, Statics, Materials of Engineering, Thermodynamics, Mechanics of Materials, Dynamics, Fluid Mechanics, Computer Aided Engineering – Programming, Geometric Dimensioning and Tolerancing, Project Engineering, Manufacturing Analysis, N/C Computer Programming, Tool Design and Production Tooling, Statistical Process Control, Robotics for Manufacturing, Advanced Manufacturing Technology, Computer Aided Manufacturing, Machine Design, Heat Transfer, Instrumentation, Computer Aided Design, and Advanced Energy Technology.

Cooperative Education Internship - The MET program at MSCD encourages students to get hands-on experience through an internship. Internships provide an excellent way to kick off your career and offer many benefits.

- Apply classroom knowledge to actual on-the-job experiences.
- Gain additional experience that builds skills in your career.
- Enhance your resume.
- Receive college credit.
- Earn money for tuition and expenses.

Internships are coordinated through the Cooperative Education Internship Center at 1045 Ninth Street Park. This office will offer guidance on how to write a good resume and find an internship. They also have internship postings that can be e-mailed directly to you. To enroll, call them at 303 556-3290 and make an appointment for an orientation. Check the web-site (www.mscd.edu/cooped) for more details about the internship program.

Location - Department is located on the Auraria campus at the corner of **Speer Boulevard and Colfax Avenue, in downtown Denver, Colorado.**

For More Information

If you would like more information about the Mechanical Engineering Technology program at The **Metropolitan State** College of Denver, please contact:

Metropolitan State College of Denver
Mechanical Engineering Technology
Campus Box 29, Room SO226
P.O. Box 173362
Denver, CO 80217-3362
Phone: (303) 556-2976
Fax: (303) 556-2972
Or on the web at:
<http://www.mscd.edu/met>



For admissions information:

Metropolitan State College of Denver, **OFFICE OF ADMISSIONS**, Campus Box 16, P.O. Box 173362, Denver, CO 80217-3362, PHONE: (303) 556-3058, TTY: (303) 556-8484, <http://www.mscd.edu/admissions>

Metropolitan State College of Denver, **MECHANICAL ENGINEERING TECHNOLOGY**
Campus Box 29, Bldg. SO Room 226, P.O. Box 173362, Denver, Colorado 80217-3362
Phone: (303) 556-2976, Fax: (303) 556-2972, <http://www.mscd.edu/et>

MECHANICAL ENGINEERING TECHNOLOGY PROGRAM

Department of Engineering Technology

Date revised: May 29, 2009

The MET program offers the Bachelor of Science degree, which is accredited by the Technology Accreditation Commission (TAC) of the Accreditation Board for Engineering and Technology (ABET). The educational approach is hands-on with more than 60 percent of the courses requiring laboratory work in addition to lectures. Under the revised rules and regulations of the Colorado State Board for Professional Engineers and Professional Land Surveyors, ET students at MSCD may take the Fundamentals of Engineering Examination within 30 semester hours of graduation. It is recommended that students take Fundamental Engineering (F.E.) Exam during their senior year in lieu of the MET assessment test.

The MET program offers both day and evening classes to meet the needs of its diverse student population. The MET curriculum is continually upgraded to reflect state-of-the-art technology while meeting the needs of industry and employers of the mechanical engineering technology graduates. An advisory committee, which includes employers, graduates, and students of the program, meets with faculty and administrators to review curriculum, student and faculty recruitment, program needs, progress, problems and probable solutions, laboratory equipment, facilities, and to assist in the placement of graduates. The committee assures a high level of community awareness and support of the program.

Besides traditional classes, the MET program also offers state-of-the-art computer-aided engineering courses to keep students updated with current engineering technology and computer applications in the industry. These new computer-aided engineering courses will provide students with training in the areas of computer programming, computer-aided design, computer-aided manufacturing, three-dimensional modeling, and computer-aided analysis.

Graduates enter the engineering profession as engineering technologists. After taking the Fundamentals of Engineering (F.E.) examination, some graduates choose to begin the six-year process, at a minimum, to become a registered professional engineer (P.E.). Some attend graduate school to pursue further education.

The majority obtain gainful employment in a variety of industries ranging from large aerospace companies to small manufacturing and custom-design businesses. Job titles range from technician and engineering technologist to engineer.

For every MET course, a minimum grade of "C" is required for all prerequisites before a student can progress. If considering graduate school studies in engineering or physical sciences, students are encouraged to elect the recommended mathematics minor. A full-time student may complete the program in four years (eight semesters). Since many of the courses build on each other, it is important that the courses are taken in a proper order.

All students completing the mechanical engineering technology major and minor must participate in assessment during their last semester. This assessment is a series of examinations in mechanical engineering technology courses. See the Mechanical Engineering Technology Coordinator for details.

MECHANICAL ENGINEERING TECHNOLOGY MAJOR FOR BACHELOR OF SCIENCE

Required Technical Courses:	Semester Hours
MET 1000 Introduction to Mechanical Engineering Technology	3
MET 1010 Manufacturing Processes	3
MET 1200 Technical Drawing I	3
MET 1210 3D Modeling	3
MET 1310 Principles of Quality Assurance	3
MET 2200 Materials of Engineering	3
MET 3110 Thermodynamics	3
MET 3160 Mechanics II–Dynamics	3
MET 3180 Fluid Mechanics I	3
MET 3210 Introduction to Computer Aided Engineering – Programming	4
MET 3410 Geometric Dimensioning and Tolerancing.....	3
MET 4000 Project Engineering	3
CET 2150 Mechanics I–Statics	3
CET 3130 Mechanics of Materials.....	3
CET 3140 Mechanics of Materials–Laboratory	1
EET 2000 Electric Circuits and Machines	3
EET 3010 Industrial Electronics	4
<i>Subtotal</i>	51

Additional Courses Requirements:	Semester Hours
CHE 1800 General Chemistry I*.....	4
COM 2610 Introduction to Technical Writing.....	3
ECO 2010 Principles of Economics—Macro*	3
ENG 1010 Freshman Composition: The Essay	3
ENG 1020 Freshman Composition: Analysis, Research and Documentation*.....	3
MTH 1400 Pre-Calculus Mathematics (MTH 1110, and MTH 1120 may be substituted)*.....	4
MTH 1410 Calculus I*.....	4
MTH 2410 Calculus II*.....	4
PHY 2311 General Physics I*.....	4
PHY 2331 General Physics II*.....	4
PHY 2321 General Physics I Laboratory*	1
PHY 2341 General Physics II Laboratory*	1
PHI 1030 Ethics*.....	3
SPE 1010 Public Speaking*	3
Three credit hours Level II General Studies – Historical*.....	3
Three credit hours Level II General Studies – Arts and Letters*.....	3
Three credit hours Level II General Studies - Social Science*	3
<i>Subtotal</i>	53

*Some of these courses may be used to satisfy General College Requirements, including the 3 credit hour Multicultural requirement.

At least one Level II General Studies course that has the Multicultural designation must be completed.

AREAS OF CONCENTRATION (Choose One Concentration)**COMPUTER-AIDED MANUFACTURING**

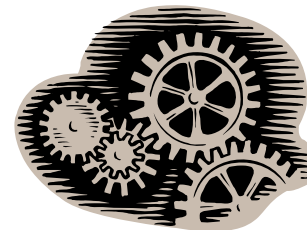
Required Courses	Semester Hours
MET 3000 Manufacturing Analysis	4
MET 3100 N/C Computer Programming.....	3
MET 3250 Tool Design and Production Tooling	3
MET 3300 Statistical Process Control	3
MET 3330 Robotics for Manufacturing	3
MET 3XXX Upper Division Elective	3
MET 4010 Advanced Manufacturing Technology** ..	3
MET 4080 Computer Aided Manufacturing	3
<i>Subtotal</i>	25
<i>Total for Computer- Aided Manufacturing</i>	129

**Senior Experience course.

MECHANICAL

Required Courses	Semester Hours
MET 3070 Machine Design	3
MET 3120 Heat Transfer	2
MET 3140 Heat Transfer Laboratory	1
MET 3190 Fluid Mechanics II	3
MET 3320 Instrumentation Laboratory	3
MET 3XXX Upper Division Elective	3
MET 3XXX Upper Division Elective	3
MET 4070 Computer Aided Design**	3
MET 4280 Advanced Energy Technology	3
<i>Subtotal</i>	24
<i>Total for Mechanical</i>	128

**Senior Experience course.



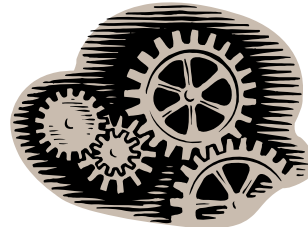
RECOMMENDED (OPTIONAL) MATHEMATICS MINOR FOR MET MAJORS

The Mechanical Engineering Technology Program recommends that students pursue an optional minor in Mathematics.

The following is the combination of math classes for MET students to obtain a minor in Math.

Required Courses	Semester Hours
MTH 1410 Calculus I	4
MTH 2410 Calculus II	4
MTH 2420 Calculus III	4
MTH 3130 Advanced Matrix Methods for Physical Sciences	4
MTH 3210 Probability and Statistics	4
MTH 3420 Differential Equations	4
<i>Subtotal</i>	<i>24</i>

Note: Some of the classes are required for the MET major.



MECHANICAL ENGINEERING TECHNOLOGY MINOR

Required Courses	Semester Hours
MET 1000 Materials and Manufacturing Technology	3
MET 1010 Manufacturing Processes	3
MET 1310 Principles of Quality Assurance	3
MET 2200 Materials of Engineering	3
Upper-division MET Electives	6
<i>Total</i>	<i>18</i>



Mechanical Engineering Technology Major Bachelor of Science 2009-2010
SAMPLE SCHEDULE (revised 7-30-2008)

F
R
E
S
H
M
A
N**FIRST SEMESTER**

ENG 1010-3 Freshman Composition
 MET 1000-3 Introduction to Mechanical Engineering
 Technology
 MET 1010-3 Manufacturing Processes
 MET 1200-3 Technical Drawing I
 MTH 1400-4 Pre-calculus Mathematics (see note 1)

16 Hours

SECOND SEMESTER

ENG 1020-3 Freshman Composition
 CHE 1800-4 General Chemistry
 MET 1210-3 3D Modeling
 MET 1310-3 Principals of Quality Assurance
 MTH 1410-4 Calculus I

17 Hours

S
O
P
H
O
R
E**THIRD SEMESTER**

COM 2610-3 Introduction to Technical Writing
 MET 2200-3 Materials of Engineering
 MTH 2410-4 Calculus II
 PHY 2311-4 General Physics I
 PHY 2321-1 General Physics I Lab

15 Hours

FOURTH SEMESTER

ECO 2010-3 Principles of Economics - Macro
 CET 2150-3 Mechanics I – Statics
 PHI 1030-3 Ethics
 PHY 2331-4 General Physics II
 PHY 2341-1 General Physics Lab II
 SPE 1010-3 Public Speaking

17 Hours

J
U
N
I
O
R**FIFTH SEMESTER**

EET 2000-3 Electric Circuits and Machines
 MET 3110-3 Thermodynamics
 CET 3130-3 Mechanics of Materials
 CET 3140-1 Mechanics of Materials – Lab
 MET 3160-3 Mechanics II – Dynamics
 XXX XXXX-3 Hours of GS-II Electives (see note 2)

16 Hours

SIXTH SEMESTER

EET 3010-4 Industrial Electronics
 MET 3180-3 Fluid Mechanics I
 MET 3210-4 Introduction to Computer Aided Engineer –
 Programming
 MET 3410-3 Geometric Dimensioning & Tolerancing
 MET XXXX-3 Upper Division Elective

17 Hours

S
E
N
I
O
R**SEVENTH SEMESTER (See Note MECH)**

MET 3070-3 Machine Design (MECH)
 MET 3120-2 Heat Transfer (MECH)
 MET 3140-1 Heat Transfer Laboratory (MECH)
 MET 4000-3 Project Engineering
 MET 4280-3 Advanced Energy Technology (MECH)
 XXX XXXX-3 Hours of GS-II Electives (see note 2)

15 Hours

EIGHTH SEMESTER (See Note MECH)

MET 3190-3 Fluid Mechanics II (MECH)
 MET 3320-3 Instrumentation Laboratory (MECH)
 MET 4070-3 Computer Aided Design (MECH)
 MET XXXX-3 Upper Division Elective
 XXX XXXX-3 Hours of GS-II Electives (see note 2)

15 Hours

SEVENTH SEMESTER (See Note CAM)

MET 3000-4 Manufacturing Analysis (CAM)
 MET 3100-3 CNC Programming (CAM)
 MET 3250-3 Tool Design and Production Tooling (CAM)
 MET 4000-3 Project Engineering
 XXX XXXX-3 Hours of GS-II Electives (see note 2)

16 Hours

EIGHTH SEMESTER (See Note CAM)

MET 3300-3 Statistical Process Control (CAM)
 MET 3330-3 Robotics for Manufacturing (CAM)
 MET 4010-3 Advanced Manufacturing Technology
 (CAM)
 MET 4080-3 Computer Aided Manufacturing (CAM)
 XXX XXXX-3 Hours of GS-II Electives (see note 2)

15 Hours

NOTES:

- 1) MTH 1110-4 College Algebra and MTH 1120-3 College Trigonometry may be substituted for MTH 1400.
- 2) Total of nine hours of Level II General Studies as follows: 3 hours Historical, 3 hours Arts and Letters, 3 hours Social Sciences. Multicultural requirement of 3 credits may be applied to any Level II category or taken as additional hours. Please consult the general course requirements handout for a current list of courses designated as multicultural.

CAM These courses are for the Computer - Aided Manufacturing Concentration.

MECH These courses are for the Mechanical Concentration.

Mechanical Engineering Technology**COURSE DESCRIPTIONS 2009-2010****MET 1000 - Introduction to Mechanical Engineering Technology** 3 (3 + 0)

Prerequisite: MTH 1110 with a grade of "C" or better; or permission of instructor

This is an introductory course in mechanical engineering technology. Emphasis is placed on the design and creative process with examples from different areas within engineering technology. Students will learn how to develop the tools necessary to be successful in school and in industry by using theory, computer software, and working real world problems. The engineering profession and its relation to current national, social, industrial, ethical, and international issues and problems will be discussed.

MET 1010 - Manufacturing Processes 3 (2 + 2)

Basic fundamentals in the operation of machine tools are studied, including measuring tools, benchwork and layout, and tool grinding. The student performs various machine operations using the engine lathe, milling machine, vertical drills, and surface grinders.

MET 1050 - Introduction to Space 3 (2 + 2)

This is a hands-on course which introduces students to the challenges of working in space. Course activities lead to the design and construction of a working satellite for launch. This course is designed for engineering and non-engineering students.

MET 1200 - Technical Drawing I 3 (1 + 4)

This is an introductory course in technical drawing. It covers the use of manual drawing instruments, lettering, various geometric constructions, and multi-view orthographic engineering drawings. It introduces 2-D technical drawing using computer-aided design software.

MET 1210 - 3D Modeling 3 (2 + 2)

Prerequisite: MET 1200 with a grade of "C" or better; or permission of instructor

This course is designed to familiarize students with functional 3-D modeling using an appropriate software package. The course covers the basic functions needed to create part models, assemblies, and drawings. Emphasis is on the design philosophy, used in creating parts and assemblies.

MET 1310 - Principles of Quality Assurance 3 (3 + 0)

Prerequisite: Intermediate algebra or equivalent with a grade of "C" or better

The course introduces the scope and function of quality assurance, including basic definitions, statistics, quality policy and objectives, manuals and procedures, concept of variation, inspection and sampling techniques, meteorology process control, methods and the elements of reliability. Current TQM and ISO 9000 standards are reviewed.

MET 2200 - Materials of Engineering 3 (2 + 2)

Prerequisite: MTH 1110 or MTH 1400 with grades of "C" or better

Prerequisite/Corequisite: CHE 1100 or CHE 1800 with grade of "C" or better

This lecture/laboratory course deals with basic properties of metals and non-metals, including the properties and behavior that govern their selection and design. Materials covered include ferrous and nonferrous metals, composites, plastics, ceramics, glass, wood, rubber and adhesives.

MET 2310 - Quality Assurance: Statistical Methods 3 (3 + 0)

Prerequisite: MET 1310 and MTH 1210 with grades of "C" or better

Statistical analysis is studied using fundamental concepts and guidelines including the theory of probability, specifications and tolerances, sampling, life testing and the cost of quality decisions.

MET 2400 - Welding Processes 3 (2 + 2)

Prerequisite: MTH 1010 and MTH 2200 with grades of "C" or better

This course introduces industrial welding processes. These include fusion welding with the oxyacetylene and arc processes, brazing of ferrous and nonferrous metals, oxyacetylene cutting, inert gas welding and the study of advanced welding techniques, e.g., lasers.

MET 3000 - Manufacturing Analysis 4 (4 + 0)

Prerequisite: MET 1010; MET 1310; and MTH 1110 or MTH 1400 with grades of "C" or better

This course introduces the organizational and functional requirements for effective production. Tolerance charts and work piece control are used to plan the manufacturing sequence, select the preferred manufacturing equipment and the operational sequence.

MET 3050 - Heat Power 3 (2 + 2)

Prerequisite: MTH 1410; and PHY 2010 or PHY 2311 with grades of "C" or better

This energy conversion course combines lecture and laboratory for the manufacturing and industrial student. Emphasis is given to real processes, compression, expansion, heat transfer and to safety and efficiency of engines (stationary and mobile).

MET 3070 - Machine Design 3 (2 + 2)

Prerequisite: CET 3130 and MET 2200 with grades of "C" or better

The art of designing machines to accomplish specific purposes is studied. The student is introduced to the fundamental principles required to design the separate machine elements. The economics of design are stressed along with strength and safety considerations. The lab work uses selected software, e.g., ALGOR and AutoCAD, to produce the preferred design.

MET 3100 - N/C Computer Programming 3 (2 + 2)

Prerequisite: MET 1010, MET 1210, and MTH 1120 with grades of "C" or better

The theory is reviewed to control machines numerically. Algorithms are developed to program NC machines. N/C language and programming emphasizes APT, Compact II and suitable post-processors. The lab work includes operation of machines to demonstrate the programming skills.

MET 3110 - Thermodynamics 3 (3 + 0)

Prerequisite: PHY 2020 or PHY 2331 and MTH 1510 (or equivalent) with grades of "C" or better

The fundamental laws of thermodynamics are studied. Basic concepts of energy, the thermodynamic system, dimensions and units, and the ideal-gas equation of state are studied. The course also covers closed and open systems, heat engines as well as reversible and irreversible processes.

MET 3120 - Heat Transfer 2 (2 + 0)

Prerequisite: PHY 2020 or PHY 2331 and MTH 1510 (or equivalent) with grades of "C" or better

The three basic mechanisms of heat transmission are studied. Conduction, convection (free and forced), plus radiant transmission are treated for both steady-state and transient conditions. The transient study is aided by computer solutions.

MET 3140 - Heat Transfer Laboratory 1 (0 + 2)

Prerequisite: MET 3120 with grade of "C" or better (concurrent enrollment preferred)

The laboratory course provides experimental results for various conduction and convection tests. The student selects and installs thermocouples, calibrates equipment, records transient and steady-state data, analyzes results, compares data to theoretical predictions and reports findings.

MET 3160 - Mechanics II-Dynamics 3 (3 + 0)

Prerequisite: CET 2150 and MTH 2410 with grades of "C" or better; or permission of instructor

This course covers the principles of dynamics: Students learn about kinematics which is the study of the geometry of motion of a body without reference to the forces that cause the resulting motion. The course also covers kinetics which is the study of the relation existing between the forces acting on the body, the mass of the body, and the motion of the body.

MET 3180 - Fluid Mechanics I 3 (3 + 0)

Prerequisite: MET 3160 with a grade of "C" or better; or permission of instructor

This course covers physical properties of fluids, hydrostatics, kinematics, energy considerations, momentum, and incompressible flow in pipes. Compressible fluid flow will also be studied.

MET 3190 - Fluid Mechanics II 3 (2 + 2)

Prerequisite: MET 3110 and MET 3180 with grades of "C" or better

This course covers the study of compressible internal flow with application to industrial, pneumatic systems. The study of isentropic, isothermal and flow of real gases is applied for nozzles, venturis, Pitot-tubes, and pipe systems. Flow loss calculations are made using the Darcy-Weisbach and Fanno Line techniques. Compressors, valves, ejectors, diffusers, and pneumatic components are studied to design and cost air service systems. The laboratory work supports lectures using various gas flow systems, including an instrumented fan test rig.

Mechanical Engineering Technology

COURSE DESCRIPTIONS 2009-2010

MET 3210 - Introduction to Computer Aided Engineering 4 (4 + 0)

Prerequisite: MTH 1120 or MTH 1400, either MET 1000 or CET 1100, all with a grade of "C" or better

This is an introductory course in computer-aided engineering (CAE). The use of the computer as a tool for the solution of engineering technology problems is demonstrated. Included are high-level languages, spreadsheet techniques, and computer modeling.

MET 3250 - Tool Design and Production Tooling 3 (2 + 2)

Prerequisite: MET 2200 and MTH 1120 with grades of "C" or better

The course deals with production tooling requirements and tooling cost estimates. Design of tooling for turret lathes, automatic screw machines, multiple spindle lathes, and production milling machines is treated.

MET 3300 - Statistical Process Control 3 (3 + 0)

Prerequisite: MET 1310 and MET 3000 with grades of "C" or better

This course focuses on statistical process control with emphasis on process capability, troubleshooting, analysis of variance and hypothesis testing.

MET 3310 - Thermodynamics II 3 (2 + 2)

Prerequisite: MET 3110 and MTH 2410 with grades of "C" or better

This, the second course in thermodynamics, deals with the consequence of the Second Law. The TDS equations are studied, as are entropy and efficiencies of some heat power engines. Standard gas and vapor cycles are investigated. The laboratory work includes various calorimetry, gravimetric and volumetric analyses, nozzles and internal combustion engine tests.

MET 3320 - Instrumentation Laboratory 3 (2 + 2)

Prerequisite: MET 3010 with a grade of "C" or better

The student is introduced to standard mechanical tests and measurement techniques, e.g., installing thermocouples, strain gages, positioning static and total probes. ASME and ASTM test codes are studied, as are OSHA standards. Various physical property and system performance tests are set up, conducted and analyzed.

MET 3330 - Robotics for Manufacturing 3 (2 + 2)

Prerequisite: MET 3100 and EET 2000 with grades of "C" or better

The course examines robotic components utilized in robots and automated systems. Manufacturing automation is analyzed as the robot is integrated with other flexible automation equipment. The focus is how to apply and design robotic, integrated, manufacturing systems. The laboratory work supplements the lectures using industrial robots for different applications.

MET 3410 - Geometric Dimensioning and Tolerancing 3 (2 + 2)

Prerequisite: MET 1210 and MET 1310 with grades of "C" or better

Dimensioning practices as defined by ASME National Standards (Y14.5M-1994) are studied. Tolerance of form, tolerances of position, datums, concentricity, symmetry, and functional gaging concepts are also treated to produce low-cost and high-quality products.

MET 3550 - Rockets and Stars: A Space Trek 3 (2 + 2)

Prerequisite: Junior or Senior standing and satisfaction of all Level I General Studies course requirements

In this course, the exciting vehicle of space is used to carry the student through basic theories and concepts of the natural sciences. Experts on outer-space and space exploration are guest lecturers. Students visit Gates Planetarium, NOAA, Martin-Marietta, etc. (General Studies— Level II, Natural Science)

MET 3610 - 3D Modeling 3 (3 + 0)

Prerequisite: MET 1200 with a grade of "C" or better

This is a Pro/Engineer basic design course, which is designed to familiarize students with the basic functionality of Pro/Engineer software package. The course covers the basic functions needed to use Pro/E to create part models, assemblies, and drawings. Emphasis is on the Pro/E design philosophy, used in creating parts and assemblies.

MET 4000 - Project Engineering 3 (3 + 0)

Prerequisite: Senior standing

The student is introduced to the project or team effort. The need for planning, control, and communication is stressed. Critical path methods are used to develop schedules. Figure-of merit methods are used to select preferred approaches/designs. Technical writing is stressed with an introduction to competitive proposal writing.

MET 4010 - Advanced Manufacturing Technology 3 (3 + 0)

Prerequisite: MET 3000, MET 3330 and EET 2000, all with grades of "C" or better, satisfaction of all Level I and Level II General Studies course requirements and Senior standing

The course includes micromonitor process control analysis, fiber optics technology, CMOS technology, ultra precision controlled devices with artificial intelligence systems, industrial robots, fiber optics, and imagineering future applications. (Senior Experience)

MET 4040 - Plant Layout 3 (2 + 2)

Prerequisite: MET 1210 and MET 3000 with grades of "C" or better

Basic principles of plant layout to meet production needs are studied along with the application of materials handling devices to the process. Selection and arrangement of production machinery, product and process layout schemes, techniques of making layouts, and the balance and flexibility of operations are traded to select the preferred layout. Management's role is stressed.

MET 4070 - Computer Aided Design 3 (2 + 2)

Prerequisite: MET 3070, either MET 3210 or MTH 1510, all with a grade of "C" or better, satisfaction of all Level I and Level II General Studies course requirements and Senior standing

The student studies combined stresses, gearing, brakes, curved beams, etc., and undertakes the design of a complete machine. This is the second in the two-course machine design series. The analysis includes computer solutions. (Senior Experience)

MET 4080 - Computer Aided Manufacturing 3 (2 + 2)

Prerequisite: MET 3000, MET 3100, MET 3210 or MTH 1510, all with grades of "C" or better

Computer applications in configuration control, purchasing, vendor ratings, production control, inventory control and final product acceptance documentation are treated. The SMARTCAM software is used.

MET 4130 - Finite Element Analysis 3 (2 + 2)

Prerequisite: MET 3070, MET 1210, and MTH 2410, all with a grade "C" or better

This is an introductory course to computer-aided analysis, which is designed for the students to familiarize with modern computer application in stress analysis. The course will cover fundamentals of finite element analysis (FEA) and the applications to engineering analysis. Commercially available software packages will be used to conduct the class.

MET 4240 - Cost Estimating for Manufacturing 3 (3 + 0)

Prerequisite: MET 3000 and MET 3210 or MTH 1510 with grades of "C" or better

Manufacturing costs, types of estimates, computer applications to cost estimating, cost-estimating controls, and cost-estimating procedures are studied. The ASME approach to realistic cost estimating is emphasized throughout the course.

MET 4280 - Advanced Energy Technology 3 (2 + 2)

Prerequisite: MET 3120, PHY 2010 or PHY 2311, and PHY 2020 or PHY 2331, all with grades of "C" or better

Global energy flows, sources, and uses of energy are studied. Biological energy and ecosystems are introduced from the viewpoint of the engineering technologist. Energy-related environment problems including air and thermal pollution plus radioactivity are treated.

MET 4480 - Air Conditioning/Refrigeration 3 (3 + 0)

Prerequisite: MET 3120 with a grade of "C" or better

Refrigeration cycles are studied. Operation and rating of system components are evaluated with heat flow in condensers, evaporators, and cooling towers treated. The control of temperature and humidity along with air-handling equipment and ducting, are studied.

Engineering Technology

Frequently Asked Questions 2009-2010 (revised June 2, 2009)

Does Metropolitan State College of Denver offer Engineering? – Yes, MSCD offers a form of engineering called Engineering Technology. Four-year Bachelors of Science Engineering Technology degrees are available in Civil, Electrical, and Mechanical.

What is the difference between Engineering Technology and Engineering? - The engineering technology degree is a hands-on, applications oriented method of engineering that is primarily aimed at the work force to fit between an Engineer and a Technician. Sometimes they are called Technologists. After several years of experience many of our engineering technology graduates have obtained titles of engineer. The engineering degree is more of a theory and research oriented degree. The Bureau of Labor Statistics (1998) wrote the following about the difference:

Engineer vs. Engineering Technology

"In addition to the standard engineering degree, many colleges offer degrees in engineering technology, which are offered as either 2- or 4-year programs. These programs prepare students for practical design and production work rather than for jobs that require more theoretical, scientific and mathematical knowledge. Graduates of 4-year technology programs may get jobs similar to those obtained by graduates with a bachelor's degree in engineering. Some employers regard them as having skills between those of a technician and an engineer."

"Many 4-year colleges offer bachelor's degrees in engineering technology, but graduates of these programs are often hired to work as technologists or applied engineers, not technicians."

How do I decide which degree is right for me, Engineering or Engineering Technology?

1. Research the various degree options that are available.
2. Ask questions of different schools.
3. Ask if they have any alumni or industry contacts that you can talk to.
4. Some students find out that they want to switch degrees after they have started the program. The later you switch the harder it becomes.

I am interested in computers, what forms of degrees are available? - The college has several degree programs in Computers, some of which are: Computer Information Systems (CIS) from the School of Business, Computer Science (CS) from the School of Arts and Letters, Electrical Engineering Technology with a Computer Engineering Technology Concentration which is part of the School of Professional Studies, and available through MSCD's Individualized Degree Program (IDP) a Bachelor of Science in Computer Engineering Technology. Computer Engineering Technology through the IDP is not ABET accredited.

I am interested in a second degree. Do I have to take all the classes listed as required?

- No, in fact many first four-year degrees satisfy the general studies requirements of the college. Exceptions tend to occur in the general college requirements areas of: a three-credit multicultural requirement (lots of four-year degree do not require a multicultural course) and the senior experience requirement (which must be taken in residency at Metro State). If the student in their first degree meets the Mathematics, Chemistry, Physics requirements, a second degree can be met in a minimum amount of time. An advisor can work out with the student which classes they will need, for a second degree. The student must keep in mind we still must maintain standards that are set by our TAC of ABET accreditation and the college.

What is ABET accreditation? – To quote ABET, Inc.:

"In the United States, accreditation is a non-governmental, peer review process that ensures educational quality. Educational institutions or programs volunteer to periodically undergo this review to determine if minimum criteria are being met. Accreditation verifies that an institution or program meets the criteria, ensuring a quality educational experience."

There are two types of accreditation: institutional and specialized. Institutional accreditation evaluates overall institutional quality. Regional accreditation of institutions is one form of this. Specialized accreditation, however, examines specific programs of study to determine if graduates are prepared to enter the profession. This type of accreditation is granted to specific programs at specific levels. Programs of architecture, nursing, law, medicine and engineering are often evaluated through this type of accreditation. In the United States, the Accreditation Board for Engineering and Technology (ABET) is responsible for the specialized accreditation of educational programs in engineering, engineering technology and engineering-related fields. Programs either receive accreditation or are denied, but they are not ranked."

ABET began in 1932 as the Engineers' Council for Professional Development (ECPD) and was formed to promote the status of the engineering profession and enhance the quality of engineering education. In 1980, the ECPD became the Accreditation Board for Engineering and Technology, focusing its efforts on the accreditation of educational programs."

ABET now accredits some 2,300 engineering, engineering technology and engineering-related educational programs at over 500 colleges and universities in the U.S. ABET is recognized by the Council for Higher Education Accreditation (CHEA) for its responsibility in these areas. In 1997, ABET expanded its mission to include the accreditation of applied science programs.

ABET is a federation of 31 professional engineering and technical societies. Representatives from these societies, who are practicing professionals from industry and academe, form the body of ABET through its Board of Directors and four working Commissions:

- Engineering Accreditation Commission (EAC)
- Technology Accreditation Commission (TAC)
- Computing Accreditation Commission (CAC)
- Applied Science Accreditation Commission (ASAC)

The ABET Board of Directors sets policy and approves accreditation criteria while the Commissions implement accreditation procedures and decisions. The active participation of practicing professionals allows accreditation to reflect standards set by the profession itself. This approach provides a better-prepared graduate, which ultimately translates into a valuable employee.

Why is accreditation important?

Accreditation helps many people make important decisions about education including:

- Students choosing an educational program
- Parents seeking assurance of a quality education
- Institutions seeking to improve the education provided by their programs
- Employers recruiting well-prepared graduates
- State registration, licensure and certification boards screening applicants for entry into professional practice
- Industry seeking to voice educational needs to institutions"

What degrees are ABET accredited at Metro? – Only Six: **Civil Engineering Technology, Electrical Engineering Technology, and Mechanical Engineering Technology** programs are accredited by the ABET *Technology Accreditation Commission (TAC)*. **Surveying and Mapping Program** is accredited through September 30, 2010 by the ABET *Applied Science Accreditation Commission (ASAC)*. **Computer Information Systems, and Computer Science Programs** are accredited by the ABET *Computing Accreditation Commission (CAC)*. ABET, Inc. www.abet.org, 111 Market Place, Suite 1050, Baltimore, MD 21202, Telephone: (410) 347-7700.

What are the pay differences between Engineering and Engineering Technology?

– In the early 1990's the pay differences started to disappear as the demand for engineers grew. Our Engineering Technology grads now make about the same as Engineers. While in the 1980's the pay difference was about \$5000.00 less to start and any pay difference disappearing after five years experience.

What is the demand for engineers? – According to the Occupational Employment Statistics from Bureau of Labor Statistics over the period 2006-2016:

- Civil Engineering an 18% growth
- Computer Hardware Engineering a 4.6% growth
- Electrical Engineering a 6.3% growth
- Mechanical Engineering a 4.2% growth
- Electronics Engineers, Except Computer a 3.7% growth

What are the salaries (pay) like? – From the Wage Occupational Employment Statistics Survey Data for 2008 in Colorado, Source CO LMI, OES. National data Source BLS.

Hourly:

Occupational Title	Colo. Entry Level	Colo. Mean	Colo. Median	Colo. Experienced	National Hourly Mean
Civil Engineers	\$24.66	\$36.53	\$35.28	\$42.46	\$37.77
Computer Hardware Engineers	\$35.58	\$51.42	\$51.05	\$59.33	\$48.16
Electrical Engineers	\$25.20	\$39.63	\$38.66	\$46.84	\$41.04
Electronics Engineers, Except Computer	\$31.32	\$44.79	\$43.40	\$51.53	\$42.63
Mechanical Engineers	\$27.66	\$43.92	\$42.10	\$52.05	\$37.59

Annual:

Occupational Title	Colo. Entry Level	Colo. Mean	Colo. Median	Colo. Experienced	National Annual Mean
Civil Engineers	\$51,287.00	\$75,978.00	\$73,383.00	\$88,323.00	\$78,560
Computer Hardware Engineers	\$74,013.00	\$106,946.00	\$106,175.00	\$123,413.00	\$100,180
Electrical Engineers	\$52,418.00	\$82,424.00	\$80,420.00	\$97,427.00	\$85,350
Electronics Engineers, Except Computer	\$65,141.00	\$93,171.00	\$90,266.00	\$107,186.00	\$88,670
Mechanical Engineers	\$57,530.00	\$91,348.00	\$87,578.00	\$108,257.00	\$78,200

Can I become a licensed Professional Engineer with an engineering technology degree? – Yes, Colorado law and the Colorado State Board of Licensure for Architects, Professional Engineers, and Professional Land Surveyors rules allows graduates of an Engineering Technology program that is ABET accredited to sit for the EI and PE exams. When PE or EI is the goal of the student we might recommend an engineering degree program based on that students needs. Certainly the Engineering Technology student should select all electives courses taken with regards to suitability as possible courses that might help passage of the Fundamentals of Engineering (FE) Exam.

Note: we used to display the State of Colorado Revised Statutes and Board of Licensure rules as part of this answer on professional licensure. Several changes have occurred in the Colorado Revised Statutes and instead of maintaining our own listing we have decided that it is best just to refer the student or prospective student to THE COLORADO STATE BOARD OF LICENSURE FOR ARCHITECTS, PROFESSIONAL ENGINEERS, AND PROFESSIONAL LAND SURVEYORS.

For more information on professional licensure please check these sites:

<http://www.dora.state.co.us/aes> and <http://www.NCEES.org>

For professional licensure exam format: http://www.ncees.org/exams/fundamentals/fe_exam_specs.pdf



METROPOLITAN STATE
COLLEGE *of* DENVER