The College of Science, Technology, Engineering, and Mathematics (STEM)

Martin A. Abraham, Dean

The College of Science, Technology, Engineering and Mathematics (STEM) is the academic unit of the University comprising the following departments: Biological Sciences, Chemistry, Civil/Environmental and Chemical Engineering, Computer Science and Information Systems, Electrical and Computer Engineering, Engineering Technology, Geological and Environmental Sciences, Mechanical and Industrial Engineering, Mathematics and Statistics, and Physics and Astronomy.

Formed in 2007 through an administrative reorganization, the STEM College is committed to strengthening core areas of its departments as well as facilitating collaborations between its faculties and students at all levels in their disciplines. Its formation is a bold initiative in coupling higher education to economic development by enhancing research activities and collaboration with industry.

College of STEM Mission

The College of STEM is committed to furthering the mission of Youngstown State University by delivering integrated programs of excellence to an engaged learning community. The College uses state-of-the-art

technology in teaching and research to meet the educational objectives of students, both undergraduate and graduate, enrolled in all its programs. The College fosters intellectual growth through integration of teaching, scholarship, and service that expands the talents of its constituencies—including students, faculty, business, industry, and government—with synergistic activities in and beyond the classroom; prepares our graduates for a multidisciplinary world through a flexible and diverse curriculum; and meets the need for a well-educated, skilled workforce for economic growth with industrial partnerships, research, and scholarship.

Core Values

The College of STEM fully subscribes to the core values of the University—the centrality of students; excellence and innovation; integrity/human dignity; and collegiality and public engagement.

- We are a learning-centered College committed to the intellectual, ethical, and career growth of all learners, both inside and outside the classroom.
- We foster intellectual inquiry, exploration, and discovery that transcends traditional boundaries and facilitates interdisciplinary scholarship. We expand and apply knowledge and encourage creativity through research and scholarship.
- We are committed to the social development of students, by promoting ethical behavior and collegiality in all endeavors, and to enrichment of the University through diversity of the faculty and student body.
- We enhance the quality of life and economic health of the region, the state, and beyond by providing students with the knowledge and skills to meet the challenges of modern society, and by providing business, industry, government, K–12 schools, and the public with technical expertise and leadership to support innovation and growth.

Degrees/Programs

The College offers four bachelor's degrees: Bachelor of Arts (B.A.), Bachelor of Engineering (B.E.), Bachelor of Science (B.S.), and the Bachelor of Science in Applied Science (B.S. in A.S.). It offers three associate degrees: Associate in Arts (A.A.), Associate in Applied Science (A.A.S.), and the Associate in Technical Studies (A.T.S.). Also, in conjunction with FirstEnergy Corporation, two options are available for lineworker and power plant technology.

Please visit our website at www.ysu.edu/powersystems for more information regarding the lineworker and power plant technology programs, or see p. 232 of this *Bulletin*.

A certificate program is offered in construction management technology.

Students whose needs are not met by existing conventional programs may wish to investigate and apply for the Individualized Curriculum Program (see Academic Policies and Procedures).

Degree Requirements

Requirements for completion of a baccalaureate degree and an associate degree within the College of STEM include all University requirements detailed in the Academic Policies and Procedures section of the Bulletin (i.e., graduation and general education requirements, course levels requirements including majors (and minors, where applicable), grade point average, residency, and degree applications). Specific requirements for each major in the College of STEM are listed by department or school. Consult the Rayen School of Engineering and Engineering Technology section in the *Bulletin* for additional graduation requirements for the B.E. degree (see p. 210).

Minors are not required for every program/major in the STEM College. Consult the curricula listed the department sections of the bulletin for specific requirements for each major. For programs/majors requiring minors, at least eighteen (18) semester hours are required for the minor, and one-third of the hours must be upper-division.

Prospective Teachers. Prospective elementary or secondary teachers may work toward a B.A., B.S., or B.S. in Ed. degree. Prospective high school teachers with major concentration areas offered in the College of STEM are advised by those departments except for the requirements for teacher certification, for which academic advisement is provided in the Beeghly College of Education.

Foreign Language Requirement for the Bachelor's Degree

All candidates for the B.A. and B.S. degree in the College are required to complete the elementary (1550) and the intermediate level (2600) of any foreign language offered. Students with a foreign language background may desire to take the foreign language placement test in order to place into the intermediate level (2600) to satisfy the requirement. It may be possible to satisfy the foreign language requirement through appropriate college transfer coursework and credit by exam.

Candidates for the B.E. degree and candidates for the B.S.A.S. degree do not have a foreign language requirement.

Associate of Arts Concentration in the College of STEM

Science Concentration. Courses must be taken from among the following disciplines: astronomy, biology, chemistry, physical geography, geology, and physics.

DEPARTMENT OF BIOLOGICAL SCIENCES

Professors Chuey, Cooper, Leipheimer (Chair), Krontiris-Litowitz, Toepfer, Usis, Walker; Associate Professors Asch, Diggins, Fagan, Johnston, Lorimer, Womble; Assistant Professors Butcher, Caguiat, Min, Renne, Sims, Tall.

Courses in the Department of Biological Sciences may be applied toward a Bachelor of Science or a Bachelor of Arts degree. The department offers specialized courses in three major divisions: molecular biology and microbiology, physiology and anatomy, and evolution, ecology and environmental biology. The department offers courses to prepare a student for a wide variety of fields and future careers including dentistry, botany, health-related careers, physical therapy, nursing, medicine, veterinary medicine, medical technology, microbiology, molecular biology, biomedical research and biotechnology. Advisement is available concerning course selection appropriate for a specific field in biology and in the choice of a minor or minors. These degrees may be earned in eight semesters if students average 16 hours per semester.

BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES

The Bachelor of Science degree is recommended for those who wish to pursue careers in the biological sciences, medicine, dentistry or other related health fields.

Learning Outcomes

The student learning outcomes for the major in biological sciences are as follows:

B.S. degree option

- Students will be prepared for entry into professional health or research related schools, post-graduate (M.S.) programs, or the work place.
- Students will master the subjects found on standardized tests (molecular biology, physiology, immunology) required for entrance into professional schools (MCAT, GRE, etc.).
- Students will demonstrate an understanding of basic biological principles.
- Students should be able to reason critically, both individually and in collaboration with other students.

Curriculum

The B.S. degree in biological sciences requires a minimum of 37 semester hours from within the Department of Biological Sciences. (Courses at the 1000 level are not applicable to a Bachelor of Science degree.)

All biological sciences majors must take the following courses for the B.S. degree:

1) BIOL 2601 General Biology: Molecules and Cells, 4 s.h.; and BIOL 2602 General Biology: Organisms and Ecology, 4 s.h. The general biology courses are prerequisites for genetics and all core and upper-division courses.
2) BIOL 3721 Genetics 3 s.h.
3) Core Courses: One course must be taken from two of the following groups for a total of two courses: (7-9 s.h.)

   Group A: Cell Biology: Fine Structure (BIOL 3711, 3 s.h.)

   Group B: Human Physiology (BIOL 3730, 5 s.h.)

   Group C: either Plant Diversity (BIOL 3740, 4 s.h.) or Animal Diversity (BIOL 3741, 4 s.h.)
4) 15-17 semester hours of courses in the Department of Biological Sciences at the 3000-5000 level. A minimum of two of these courses must have a laboratory component, with at least one lab course at the 4000-5000 level.
5) Capstone course (BIOL 4861) 2 s.h.

Additional required course work in the sciences.

Chemistry—Chem. 1515 & 1515L and 1516 & 1516L, General Chemistry I and II; 3719 & 3719L and 3720 & 3720L, Organic Chemistry I and II. (Chem. 3785, Biochemistry, strongly recommended)

Physics—Physics 1501, 1501L, 1502, and 1502L (Fundamentals of Physics I and II and Fundamentals of Physics I and II Labs)

Math—Math 1570, Applied Calculus I, or Math 1571 (Calculus I) and Math 3717 (Statistics)

BACHELOR OF ARTS IN BIOLOGICAL SCIENCES

The Bachelor of Arts is recommended only for those who plan careers in business or secondary education careers related to the Biological Sciences.

Learning Outcomes

The department's learning outcomes for the B.A. in biology are as follows:

- Students will be fluent in the terminology of the biological sciences.
- Students will be competitive for entry into the workplace.
- Students will be familiar with the scientific process and the process of hypothesis testing.
- Students should be able to reason critically, both individually and in collaboration with other students. All Biological Sciences majors must take the following courses for the B.A. degree:

Curriculum

The B.A. degree in biological sciences requires a minimum of 32 semester hours from within the Department of Biological Sciences. (Courses at the 1000 level are not applicable to a Bachelor of Arts degree.)

All biological sciences majors must take the following courses for the B.A. degree:

1) BIOL 2601 *General Biology: Molecules and Cells,* 4 s.h. and BIOL 2602 *General Biology: Organisms and Ecology* 4 s.h. The General Biology courses are prerequisites for all core and upper division Biology courses.
2) Core courses: One course must be taken from two of the following groups: (7-9 s.h)

   Group A—either *Cell Biology: Fine Structure* (BIOL 3711) or *Genetics* (BIOL 3721)

   Group B—*Human Physiology* (BIOL 3730)

   Group C—either *Plant Diversity* (BIOL 3740) or *Animal Diversity* (BIOL 3741)
3) 13-15 semester hours of courses in the Department of Biological Sciences at the 3000-5000 level. At least two of these courses must have a laboratory component.
4) Capstone course (BIOL 4861) 2 s.h.
5) Additional required course work: Chemistry: CHEM 1515/1515L and CHEM 1516/1516L are required.

Organic Chemistry (CHEM 3719, 3719L, 3720, and 3720L) and Fundamentals of Physics (PHYS 1501, 1501L, 1502, and 1502L) are strongly recommended.

Students seeking admission to medically related professional schools should complete the B.S. program. Elective courses under either degree may be in any discipline; however, advanced chemistry, mathematics and psychology are particularly recommended.

The mathematics, physics and chemistry courses may not be taken under the credit/no credit option. (For general University requirements, see the Academic Policies and Procedures section of this *Bulletin*).

Recommended core curriculum meeting science requirements of medically related and other professional schools.

Biology

2601 General Biology: Molecules and Cells
2602 General Biology: Organisms and Ecology

Core courses
3711 Cell Biology: Fine Structure
3721 Genetics
3730 Human Physiology

Additional courses
3702 Microbiology
3703 Clinical Immunology
3705 Introduction to Human Gross Anatomy
4813 Vertebrate Histology
4890 Molecular Genetics
5832 Principles of Neurobiology
5834 Advanced Systems Physiology
5836 Cell Biology: Molecular Mechanisms

Chemistry

1515 General Chemistry I
1516 General Chemistry II
3719 Organic Chemistry I
3720 Organic Chemistry II
(Biochemistry Chem 3785, is strongly recommended)

Physics

1501 Fundamentals of Physics I
1502 Fundamentals of Physics II

Mathematics

1570 Applied Calculus I or 1571 Calculus I
3717 Statistical Methods

BOTANY

See Biological Sciences.

DEPARTMENT OF CHEMISTRY

Professors Hunter, Linkous, Mettee, Mincey (Chair), Norris, Wagner; Associate Professors Balendiran, Curtin, Jackson, Lovelace-Cameron, Serra, Simeonsson; Assistant Professors Leskiw, Stourman.

The Bachelor of Science degree is recommended for those who plan to make a career in chemistry; a recommended program which meets the standards of the American Chemical Society is provided below. The Bachelor of Arts degree is recommended for those who plan to go into a medical, pre-pharmacy, or dental field and for those who plan to enter business or secondary education careers related to chemistry. The required courses for a B.S. degree with a major in chemistry are listed in the B.S. curriculum. The courses required for a B.A. degree are those listed in the B.A. curriculum below. Chemistry majors may not count Chemistry 1500 toward the major. These degrees may be earned in eight semesters if students average 16 hours per semester.

Learning Outcomes

The undergraduate student learning outcomes for the major in chemistry are as follows:

- Students will demonstrate independent and critical thinking.
- Students will understand the fundamentals of modern chemical instrumentation.

- Students will understand the basic principles of the chemical disciplines included in their curriculum.
- Students will effectively communicate their ideas both orally and in writing.

Students in pre-professional programs such as pre-optometry may obtain appropriate curricula and advisement in the Department of Chemistry.

The segments of chemistry courses extending through two semesters must be taken in sequence unless otherwise indicated.

Eye protection and lab coats must be worn in chemistry laboratories at all times.

Each student majoring in chemistry will be assigned a faculty advisor by the department. The advisor will discuss the overall curriculum necessary for a degree in chemistry and will assist the student in the preparation of a suitable course sequence and choice of a minor or minors.

All chemistry majors are urged to consult their advisors regularly to avoid curricular problems.

In both of the following curricula, the electives must satisfy the general requirements for the degree sought (see Degree Requirements). German is strongly recommended for meeting the foreign language requirement in the B.S. curriculum.

Recommended Curriculum Leading to a B.S. Degree with a Major in Chemistry

Core Courses

YEAR ONE
FALL I

Courses	s.h.
CHEM 1515 + 1515R	5
MATH 1571	4

SPRING I

Courses	s.h.
CHEM 1516 + 1516R	5
MATH 1572	4

YEAR TWO
FALL II

Courses	s.h.
CHEM 3719 + 3719R	5
CHEM 2604	5
PHYS 2610 + 2610L	5
MATH 2673	4

SPRING II

Courses	s.h.
CHEM 3720 + 3720R	5
PHYS 2611 + 2611L	5

YEAR THREE
FALL III

Courses	s.h.
CHEM 3739	4
CHEM 3785	3

SPRING III

Courses	s.h.
CHEM 3740	4
CHEM 3729	3

In addition to BS core, BS majors must complete twelve (12) hours of upper-division chemistry electives (from the list below), four (4) hours of which must be in upper-division laboratory. Majors must also complete the capstone sequence CHEM 4850 + 4850L.

Credit Hour Summary

Chemistry Hours in BS-Core:	39
Chemistry Elective Hours:	12
Capstone Course Hours:	+3
Total Hours in Chemistry:	**54**
Other major-required hours: (Math/Physics)	+22
Total Hours in Major:	76

B.S. CHEM Electives

3764	Chemical Toxicology	3
3786	Biochemistry 2	3
3790	Undergraduate Seminar	1
4860	Regulatory Aspects of Industrial Chemistry	1
5804	Chemical Instrumentation	4
5821	Intermediate Organic Chemistry	3
5822	Advanced Organic Lab	3
5830	Intermediate Inorganic Chemistry	2
5831	Inorganic Lab	2
5832	Solid State Structural Methods	3
5836	Chemical Bonding and Structure	3
5861, 5862	Polymer Science 1, 2	3 + 3
5876	Enzyme Analysis	2

Recommended Curriculum Leading to a B.A. Degree with a Major in Chemistry

Core Courses

YEAR ONE
FALL I

Courses	s.h.
CHEM 1515 + 1515R	5
MATH 1571	4

SPRING I

Courses	s.h.
CHEM 1516 + 1516R	5
MATH 1572	4

YEAR TWO
FALL II

Courses	s.h.
CHEM 3719 + 3719R	5
CHEM 2604	5
PHYS 2610 + 2610L	5

SPRING II

Courses	s.h.
CHEM 3720 + 3720R	5
PHYS 2611 + 2611L	5

YEAR THREE
FALL III

Courses	s.h.
CHEM 3739	4

In addition to B.A. core, B.A. majors must complete nine (9) hours of upper-division chemistry electives (from the list below). Majors must also complete the capstone CHEM 4850.

Credit Hour Summary

Chemistry Hours in AB-Core:	29
Chemistry Elective Hours:	9
Capstone Course Hours:	+1
Total Hours in Chemistry:	**39**
Other major-required hours: (Math/Physics)	+18
Total Hours in Major:	57

B.A. CHEM Electives

Courses		s.h.
3729	Inorganic Chemistry 1	3
3740	Physical Chemistry 2	4
3764	Chemical Toxicology	3
3785, 3786	Biochemistry 1, 2	3, 3
3790	Undergraduate Seminar	1
4850L	Research Lab	2 - 3
4860	Regulatory Aspects of Industrial Chemistry	1
5804	Chemical Instrumentation	4
5821	Intermediate Organic Chemistry	3
5822	Advanced Organic Lab	3
5830	Intermediate Inorganic Chemistry	2
5831	Inorganic Lab	2
5832	Solid State Structural Methods	3
5836	Chemical Bonding and Structure	3
5861, 5862	Polymer Science 1, 2	3, 3
5876	Enzyme Analysis	2

COMBINED B.S./M.S. PROGRAM IN CHEMISTRY

This is a five-year program. Prospective students seeking admission to the program may submit an application to the Department of Chemistry during their senior year in high school. Students in the program start graduate studies after three years. They will normally receive the B.S. degree in chemistry after 3 years and the M.S. degree after 5 years.

COMBINED B.S./M.D. PROGRAM

This is a six- or seven-year program open to graduating high school seniors; however, if a student has already graduated from high school and has taken no coursework for college-level credit, she or he is still eligible to apply to the program. After two to three years of college-level credit, students in the program are then eligible for admission to the second, or medical school, phase. Each student successfully completing the program will be awarded the B.S. degree in combined science from Youngstown State University and the M.D. degree from the Northeastern Ohio Universities College of Medicine (NEOUCOM). (See **Northeastern Ohio Universities College of Medicine**, on p. 72.)

DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION SYSTEMS

Professor Schueller; Associate Professors Bodnovich (Chair), Hogue, Kramer, Lazar, Sullins; Assistant Professors Arslanyilmaz, Gaydos, Harper, Perera, Zhang; Instructors Ickert, Roberts.

The Department of Computer Science and Information Systems offers a wide range of education programs. The Computer Science program is offered as the Bachelor of Science degree and is a traditional, analytical program which involves extensive computer programming and support courses in mathematics. The Computer Information Systems program is offered as the Associate in Applied Science and the Bachelor of Science in Applied Science. Coursework involves extensive programming with an emphasis on applied business programming. The Information Technology program is also offered as the Associate in Applied Science and the Bachelor of Science in Applied Science. Coursework emphasizes applying high-end computer applications and system management.

Curriculum sheets and suggested schedules for each program may be obtained from the department office in Meshel Hall or on the Department's web site, at http://www.cis.ysu.edu.

COMPUTER SCIENCE

The Computer Science program leads to the degree of Bachelor of Science. The flexibility of the program allows the student many choices upon graduation. Three major possibilities are: first, graduates will be qualified to pursue graduate work in computer science; second, all graduates will be qualified to work as systems analysts, systems programmers, or software engineers. The student may study another discipline as a minor field to become an application programmer in that discipline. This degree may be earned in eight semesters if students average 16 hours per semester.

Learning Outcomes

Computer science students in the BS degree program will:

- experience at least one large computer-based system.
- communicate effectively with written reports.
- be able to analyze, design, implement and test computer programs by using the appropriate data structures and algorithms.

- obtain full-time employment as programmers, systems analysts, computer specialists and in other closely related fields or/and acceptance to graduate programs.

In addition to completing all general University requirements, students wishing to receive the Bachelor of Science in computer science must complete the following:

1. CSIS 2610, 3700, 3701, and 3740.
2. CSCI 3710, 5806, 5814, 5870, and at least 2 s.h. of 4890.
3. At least 12 additional semester hours of upper-division CSCI or CSIS courses not including CSCI 4885 or 4886. CIS or IT courses numbered 4800 and above may also be used as electives with advisor approval.
4. A minor in mathematics comprising at least 18 semester hours to include MATH 1571, 1572, 3720, and either STAT 3743 or MATH 3760.
5. ENGL 3743, PHIL 2619, and PHIL 2625.
6. University general education requirements in essential skills, knowledge domains, and skill-intensive courses.
7. College requirements of study in a foreign language equivalent to 2600.

COMPUTER INFORMATION SYSTEMS

The computer information systems program offers students the flexibility of earning either a two-year AAS degree or continuing for an additional two years to obtain a four-year BSAS degree through the two-plus-two program.

This discipline covers both the technical and end-user aspects of computing, using PCs through mainframe computers with hands-on experience. Student skills are developed in computation that includes application programming, networking and telecommunications, database design, cyber security, and analysis of complex business and technical environments.

Learning Outcomes

Computer information systems students in the AAS and BSAS degree programs will:

- write computer programs in two or more programming languages.
- solve computer networking problems.
- communicate effectively with written reports.

CIS graduates of the AAS degree program will continue their studies towards a bachelor's degree in a computer or information technology area or obtain employment as programmers, computer specialists and in other closely related fields.

CIS graduates of the BSAS degree program will obtain full-time employment as programmers, network administrators, systems analysts, computer specialists and in other closely related fields.

Associate Degree Program

The computer information systems associate degree program emphasizes the use of computers to solve business or science problems. The graduate may be employed in positions involving direct use of microcomputers and mainframe computers for business or science administration and decision support applications. This degree may be earned in four semesters if students average 16 hours per semester.

Students wishing to receive the Associate in Applied Science in computer information systems must complete the following:

1. CSIS 1590, 2610, 3722, and 3723.
2. CIS 3741.
3. At least 9 additional semester hours of upper-division CIS elective courses.
4. ACCT 2602 and 2603.
5. ENGL 3743.
6. PHIL 2619.
7. MATH 1552.
8. University general education requirements in basic skills and one general education course in each of the areas of artistic and literary perspectives, societies and institutions, and speech.

Bachelor's Degree Program

The computer information systems professional will develop his or her ability to conceptualize, design, and implement high quality information systems based upon computer systems ranging from a single-user system to complex, interactive, and multi-user distributed systems. This degree may be earned in eight semesters if students average 16 hours per semester.

Students wishing to receive the Bachelor of Applied Science in computer information systems must complete the following:

1. CSIS 1590, 2610, 3722, and 3723.
2. CIS 3741 and CIS 4840.
3. At least 21 additional semester hours of upper-division CIS or CSIS courses. CSCI or IT courses numbered 4800 and above may also be used as electives with advisor approval.
4. A minor of at least 18 semester hours.
5. ACCT 2602 and 2603.
6. MATH 1552.
7. ENGL 3743, PHIL 2619, and PHIL 2625.

8. University general education requirements in basic skills, knowledge domains, and skill intensive courses.

INFORMATION TECHNOLOGY

Information Technology provides systematic foundations that include methodologies and models for conceptualizing the complex dynamics of the Information Technology environment as it applies to information systems design and implementation.

The program supports work processes and employee performance enhancements; is designed to improve overall workgroup and individual productivity; and addresses the creation, distribution, storage, and use of information in all its states. Business process are incorporated as an integral part of all course content. Information Technology encompasses end-user computing, information centers, computer-supported work, performance support, project management, multimedia, networks, database systems, system analysis, and information security.

Learning Outcomes

Information technology students in the AAS and BSAS degree programs will:

- write and produce interactive programs.
- be able to design a 3NF database and extract information using QBE and SQL.
- communicate effectively with written reports.

IT graduates of the AAS degree program will continue their studies towards a bachelor's degree in a computer or information technology area or will obtain full-time employment as web technicians, help desk support, network technicians and in other closely related fields.

IT graduates of the BSAS degree program will obtain full-time employment as web designers, network administrators, multimedia specialists and in other closely related fields.

Associate Degree Program

Graduates of the associate degree program can pursue careers in service and support of information systems, as well as continuing on to a bachelor's degree in information technology. This degree may be earned in four semesters if students average 16 hours per semesters.

Students wishing to receive the Associate in Applied Science in information technology must complete the following:

1. CSIS 1525, 1590, and either 1560 or 2610.
2. INFO 1575, 2663, 3774, 3704, 3714 and 3775.
3. CSIS 2699 or 4893, 3720 or 3782, 3722, and 3723 or 3783.
4. MATH 2623, 1552 or 1571.
5. An advisor-approved specialization area of at least 8 or 9 semester hours.
6. University general education requirements in basic skills and one general education course in each of the areas of artistic and literary perspectives, societies and institutions, and speech.

Bachelor's Degree Program

The information technology professional will develop his or her ability to conceptualize, design, and implement high-quality information systems based upon computer systems ranging from single-user systems to complex, interactive, and multi-user distributed systems. (Students who wish to teach in public schools follow the content and add the professional education coursework to earn a teaching license.) This degree may be earned in eight semesters if students average 16 hours per semester.

IT majors may follow the generic curriculum or may choose to follow one of several options: database, e-commerce programming, multimedia/web design, networking, security, or technical support. See the CSIS department secretary for curriculum sheets for the options.

Students wishing to receive the Bachelor of Applied Science in information technology must complete the following:

1. CSIS 1525, 1590 and either 1560 or 2610, and either 2699 or 4893.
2. INFO 1575, 2663, 3704, 3774, 3714 and 3775.
3. CSIS 3720 or 3782, 3722, 3723 or 3783, and 3726.
4. At least 15 additional semester hours of upper-division Information Technology or CSIS courses. CSCI or CIS courses numbered 3000 and above may also be used as electives with advisor approval.
5. An unspecified minor of 18 or more semester hours.
6. University general education requirements in essential skills, knowledge domains, and skill-intensive courses.

DEPARTMENT OF GEOLOGICAL AND ENVIRONMENTAL SCIENCES

Professors Beiersdorfer, Jacobs; Associate Professors Amin, Dick; Assistant Professors Armstrong, Norris (Interim Chair), Smith.

GEOLOGY PROGRAMS

Geology may be the major for the degree of Bachelor of Science or Bachelor of Arts.

The major in geology provides the student with a background for professional work, teaching, and graduate study in geology, environmental science, and related fields. This degree may be earned in eight semesters if students average 16 hours per semester.

Learning Outcomes

The student learning outcomes for the B.S. in geology are as follows:

- Communicate effectively using the language, concepts, and models of geology in written, visual, and numerical formats.
- Properly apply the scientific method to research a geologic problem and formulate conclusions.
- Demonstrate ability to apply appropriate field- and laboratory-based methods (of acquiring, quantitatively and qualitatively analyzing and interpreting geologic data and information).
- Demonstrate understanding of plate tectonics regarding the petrologic, stratigraphic, and structural evolution of continents and oceans.

Curriculum for the Bachelor of Science—Geology

For the Bachelor of Science degree, the student majoring in Geology must complete a minimum of 37 s.h. in Geology (28 Specified, 9 Elective), including a course in Field Geology, an additional 24-26 s.h. in science support courses.

I. Required Courses (28 s.h.)

Courses			s.h.
GEOL	1505/ 1505L	Physical Geology/ Physical Geology Lab	4
GEOL	2605	Historical Geology	4
GEOL	3700	Mineralogy	4
GEOL	3701	Geomorphology	3
GEOL	3704	Structural Geology	2
GEOL	3704L	Structural Geology Lab	1
GEOL	3718	Igneous & Metamorphic Petrology	4
GEOL	5802	Sedimentology & Stratigraphy	3
GEOL	48XX	Field Camp (Minimum)	3
		Total	**28**

II. Geology Electives (Minimum 9 s.h.)

Courses			s.h.
GEOL	2602	Introduction to Oceanography	3
GEOL	2615	Geology & the Environment 1	3
GEOL	3702	Glacial Geology	3
GEOL	3706	Geology of Economic Mineral Deposits	3
GEOL	3709	Subsurface Investigations	3
GEOL	3714	Principles of Paleontology	3
GEOL	3716	Environmental Impact of Abandoned Mines	3
GEOL	3720	Field Investigations in Geology	1-4
GEOL	4804	Ground Water	3
GEOL	5805	Special Problems in Geology	1-2
GEOL	5815	Geology & the Environment 2	3
GEOL	5817	Environmental Geochemistry	3
ENST	5810	Environmental Safety	1

III. Required Science Courses (24-26 s.h.)

Courses			s.h.
CHEM	1515	General Chemistry I	4
CHEM	1516	General Chemistry II	4
MATH	1571	Calculus I	4
	(and)		
MATH	1572	Calculus II	4
	(or)		
STAT	3717	Statistical Methods	3
PHYS	1501, 1501L	Fundamentals of Physics I + Lab	4+1
PHYS	1502, 1502L	Fundamentals of Physics II + Lab	3+1
	(or)		
PHYS	2610, 2610L	General Physics I + Lab	4+1
PHYS	2611, 2611L	General Physics II + Lab	1+1

Curriculum for the Bachelor of Arts –Geology

GEOSCIENCE OPTION

Learning Outcomes

The student learning outcomes for the B.A. in geology are as follows:

- Communicate effectively using the language, concepts, and models of geology in written, visual, and numerical formats.
- Properly apply the scientific method to research a geologic problem and formulate conclusions.
- Demonstrate ability to apply appropriate field- and laboratory-based methods (of acquiring, quantitatively and qualitatively analyzing and interpreting geologic data and information).
- Demonstrate understanding of human impacts from geologic hazards (e.g., earthquakes, geologic global warming, landslides, and subsidence) and human impact on the environment (e.g., global warming from industry emissions, mining, and water and air pollution).

For the Bachelor of Arts degree, the student majoring in geology must complete a minimum 40 s.h. of required courses and a minimum of 8 s.h. in geoscience electives for a total of 48 s.h. A minor is not required.

I. Required Courses			**s.h.**
GEOL	1505/ 1505L	Physical Geology/ Physical Geology Lab	4
GEOL	2605	Historical Geology	4
GEOL	3700	Mineralogy	4
GEOL	3701	Geomorphology	3
GEOL	3704	Structural Geology	2
GEOL	3704L	Structural Geology Lab	1
GEOL	3718	Igneous & Metamorphic Petrology	4
GEOL	5802	Sedimentology & Stratigraphy	3
*Science Electives II (See list below)			12
One of the following:			
	(or)		
MATH	1570	Applied Calculus	4
	(or)		
MATH	1571	Calculus I	4
STAT	3717	Statistical Methods	3

II. *12 s.h. from the following science electives			**s.h.**
GEOL	2602	Introduction to Oceanography	3
GEOL	2615	Geology & the Environment 1	3
CHEM	1515	General Chemistry I	4
CHEM	1516	General Chemistry II	4
PHYS	1501	Fundamentals of Physics I	4
PHYS	1502	Fundamentals of Physics II	3
BIOL	2601	Principles of Biology I	4
BIOL	2602	Principles of Biology II	4
ASTRO	2609	Moon & Planets	3
GEOG	2630	Weather	3
GEOG	3737	Soils and Land Use	3
ENST	2600	Foundations of Environmental Studies	3
ENST	5810	Environmental Safety	1

III. Geoscience Electives	
**Upper-division Geology Courses	8

****GEOL 48XX Field Camp may count up to 3 s.h.**
(The field camp is chosen in consultation with the advisor and the department's Curriculum Committee.)

Curriculum for the Bachelor of Arts – Geology

ENVIRONMENTAL OPTION

For the Bachelor of Arts degree, the student majoring in geology must complete a minimum 42 s.h. of required courses and a minimum of 6 s.h. in environmental electives for a total of 48 s.h. A minor is not required.

I. Required Courses			**s.h.**
GEOL	1505/ 1505L	Physical Geology/ Physical Geology Lab	4
GEOL	2605	Historical Geology	4
GEOL	3700	Mineralogy	4
GEOL	3701	Geomorphology	3
GEOL	3706	Geology of Economic Mineral Deposits	3
GEOL	3709	Subsurface Investigations	3
GEOL	4804	Ground Water	3
Capstone Course *(one of the following)*			
GEOL	5802	Sedimentology and Stratigraphy	3
	(or)		
GEOL	48xx	Field Camp (minimum)	3
	(or)		
ENST	5830	Risk Assessment	3
*Science Electives II *(see list below)*			12
One of the following:			
MATH	1570	Applied Calculus	4
	(or)		
MATH	1571	Calculus I	4
	(or)		
STAT	3717	Statistical Methods	3

II. *12 SH from the following science electives			**s.h.**
GEOL	2602	Introduction to Oceanography	3
GEOL	2615	Geology & the Environment I	3
CHEM	1515	General Chemistry I	4
CHEM	1516	General Chemistry II	4
PHYS	1501	Fundamentals of Physics I	4
PHYS	1502	Fundamentals of Physics II	3
BIOL	2601	Principles of Biology I	4
BIOL	2602	Principles of Biology II	4
ASTRO	2602	Moon & Planets	3
GEOG	2630	Weather	3
GEOG	3737	Soils and Land Use	3
ENST	2600	Foundations of Environmental Studies	3
ENST	5810	Environmental Safety	1

III. Environmental Electives	
Upper-division geology or environmental studies courses	6

EARTH SCIENCE

Earth science may be the major for the Bachelor of Arts degree or the Bachelor of Science in Education degree.

The earth science major is designed to meet the needs of students desiring a broad background in the field. The major also provides the necessary background for graduate students and for a teaching field in earth science. Interested students should consult the chair of the Department of Geological and Environmental Sciences.

Learning Outcomes

The student learning outcomes for the B.A. in earth science are as follows:

- Communicate effectively using the language, concepts, and models of geology in written, visual, and numerical formats.
- Properly apply the scientific method to research a geologic problem and formulate conclusions.
- Demonstrate ability to apply appropriate field- and laboratory-based methods (of acquiring, quantitatively and qualitatively analyzing and interpreting geologic data and information).
- Demonstrate understanding of the interrelationships between geology and astronomy, oceanography, meteorology, and environmental science.

Curriculum for the Bachelor of Arts—Earth Science

An Earth Science major consists of 47 semester hours of science courses distributed as follows: 29 hours of specified courses, and 18 hours of elective courses. Elective courses must be taken from at least three (3) disciplines. A minor is not required

I. Specified: (29)

Courses			s.h.
ASTRO	1504	Descriptive Astronomy	3
ASTRO	2609	Moon & Planets	3
GEOG	2630	Weather	3
GEOL	1505/ 1505L	Physical Geology/ Physical Geology Lab	4
GEOL	2602	Introduction to Oceanography	3
GEOL	2605	Historical Geology	4
GEOL	2615	Geology & Environment 1	3
GEOL	5815	Geology & Environment 2	3

II. Electives: (18)

Courses			s.h.
BIOL	2601	Principles of Biology I	4
CHEM	1515	General Chemistry I	4
ENST	2600	Foundations of Environmental Studies	4
GEOG	3730	Global Climates	3
GEOG	3737	Soils & Land Use	3
GEOL	3700	Mineralogy	4
GEOL	3701	Geomorphology	3
GEOL	3702	Glacial Geology	3
GEOL	3704	Structural Geology	2
GEOL	3704L	Structural Geology Lab	1
GEOL	3706	Geology of Economic Min. Deposits	3
GEOL	3709	Subsurface Investigations	3
GEOL	3714	Principles of Paleontology	3
GEOL	3718	Igneous & Metamorphic Petrology	4
GEOL	4804	Ground Water	3
GEOL	5802	Sedimentology & Stratigraphy	3

ENVIRONMENTAL STUDIES PROGRAM

Associate Professor Amin (Director).

The environmental studies program leading to a Bachelor of Science (B.S.) degree will prepare students to enter the job market as environmental specialists or to continue in their education in a graduate program. Students in environmental studies will complete 33 s.h. of environmental studies courses, 26-27 s.h. of support courses in science and mathematics, and a prescribed minor of 18 s.h.

The minor may be in chemistry, biological sciences, environmental geology, environmental geography, economics, or political science, and must include 9 s.h. of upper division courses (3000 level and above). Credits may include those required for support science and mathematics, as applicable. The courses for the minor must be offered in one department. The student is welcome to take additional courses in other departments as electives. Students are encouraged to develop teamwork, communication, computer and problem-solving skills. This degree may be earned in eight semesters if students average 15.5 hours per semester.

Learning Outcomes

The student learning outcomes for the B.S. in environmental studies are as follows:

- Communicate effectively using the language, concepts, and models of environmental science in written, visual, and numerical formats.
- Properly apply the scientific method to research an environmental problem and formulate conclusions.
- Demonstrate ability to apply appropriate field- and laboratory-based methods (of acquiring, quantitatively and qualitatively analyzing and interpreting environmental data and information).
- Demonstrate understanding of pollution sources, pollution prevention strategies, and waste management.

REQUIRED ENVIRONMENTAL STUDIES COURSES

ENST Courses (all, 33 s.h.)			s.h.
ENST	2600	Foundations of ENST	3
ENST	2600L	Foundations Lab	1
ENST	3700	Environmental Chem.[a]	3
ENST	3730	Air Quality	3
ENST	3750	Seminar	1
ENST	3751	Water Quality	3
ENST	3780	Research	2
ENST	3781	Environmental Sampling[b]	3
ENST	3790	Internship	4

ENST	5800	Environ. Impact Assessment[c]	3
ENST	5810	Environmental Safety	1
ENST	5830	Risk Assessment[d]	3
ENST	5860	Environmental Regulations	3

a- Critical Thinking Intensive
b- Writing Intensive
c- Oral Intensive
d- Capstone

Support Courses in Science and Mathematics (all, 21 s.h. +2 s.h. optional)

Courses	s.h.
BIOL 2601/L Principles 1[1]	4
CHEM 1515/L Principles 1[1]	4
CHEM 1516/L Principles 2[1]	4
CHEM 1515R/1516R Recitation (optional)	1+1
GEOL 1505/L Physical[1]	4
MATH 1570 Applied Calculus[2] or MATH 1571 Calculus[2] (Recommended for Technology minors)	4

Plus two of the following support courses (6-7 s.h.)

PHYS 1501 Principles 1[3] (Recommended for Technology minors)	4
GEOG 2630 Weather (Recommended for Geography minors)	3
STAT 2601 Statistics or STAT 3717 Statistics (Recommended for upper-division credit)	3 or 4

[1] Satisfies General Education Science or Science Lab Domain

[2] Satisfies General Education Mathematics Domain

[3] Satisfies General Education Science Domain

Recommended Curriculum Leading to a B.S. Degree with a Major in Environmental Studies*

FIRST YEAR

Courses	s.h.
CHEM 1515/L, 1516/L	8
WRITING I, II	6
Courses	**s.h.**
MATH 1570 or 1571	4
ENST 2600/L	4
Gen. Ed.	12
	34

SECOND YEAR

Courses	s.h.
BIOL 2601/L	5
GEOL 1505/L	4
ENST 3730, 5810, 5800, 3730	11
PHYS 1501 or STAT 2601/3717 or GEOG 2630	3-4
Gen. Ed.	9
	32-33

THIRD YEAR

Courses	s.h.
ENST 3700, 3751/L, 3790, 3781	9
PHYS 1501 or STAT 2601/3717 or GEOG 2630	3-4
Gen. Ed.	9
Minor	9-12
	30-34

FOURTH YEAR

Courses	s.h.
ENST 3780, 5860, 5830	8
Gen. Ed./electives	3-9
Electives	5-12
Minor	0-9
	28-31

* Majors transferring in from other programs at YSU or from other universities may use up free electives and/or require additional semesters or summers of study. College and university requirements apply (total hours, upper division hours, general education goals, etc.). One writing intensive, oral intensive, critical thinking intensive, and capstone course can be satisfied within this program.

Environmental Studies Minor

Students interested in choosing environmental studies as a minor may inquire in the department of their major program. Requirements will be established by the department of their major program in consultation with the environmental studies director.

There is an approved prescribed list of courses for the environmental studies minor below:

ENST 2600	3
ENST 2600L	1
ENST 5810	1
ENST 3750	1
ENST 5860	3
plus 6 credits of	
ENST 2650	3
ENST 3700	3
ENST 3730	3
ENST 3751L	3
ENST 3781	3
ENST 5800	3
ENST 5830	3

DEPARTMENT OF MATHEMATICS AND STATISTICS

Professors Chang, Fabrykowski, Kent, O'Mellan, Piotrowski, Ritchey (Chair), Rodabaugh, Smotzer, Stanek, Wingler; Associate Professors Burden, Kerns, Pollack, Spalsbury, Tartir, Yates; Assistant Professors Flowers, Goldthwait, Jalics, Mimna, Taylor; Instructor Carlson.

Mathematics may be the major subject for the following degree programs: Bachelor of Science (B.S.),

Bachelor of Arts (B.A.), and Bachelor of Science in Education (B.S. in Ed.). The B.A. and B.S. degrees may be earned in eight semesters if students average 16 hours per semester.

In addition to satisfying general University requirements, all students majoring in mathematics must complete the following core courses: Mathematics 1571, 1572, 2673, 3715, 3720, 3721, 3751, and 4896 or 4897H or 4893; also STAT 3743 and CSIS 2610.

B.S. DEGREE
Learning Outcomes

The student learning outcomes for a B.S. in mathematics are as follows:

- Students will develop and demonstrate the ability to reason mathematically by constructing mathematical proofs and recognizing and analyzing accurate numerical data in all core courses. Students will learn that truth in mathematics is verified by careful argument, and will demonstrate the ability to make conjectures and form hypotheses, test the accuracy of their work, and effectively solve problems.
- Students will learn to identify fundamental concepts of mathematics as applied to science and other areas of mathematics, and to interconnect the roles of pure and applied mathematics.
- Students will demonstrate that they can communicate mathematical ideas effectively by completing a senior capstone project involving an investigative mathematical project and presenting their findings and results in both a written format and as an oral presentation to faculty and other students.

Tracks

Students may select one of the following four tracks:

Traditional Mathematics Track. In addition to the core, MATH 5852, 5822, and 5880, together with at least one of 3760, 3705, or 5845 and one additional 5800-level course in mathematics . The minor course of study must be a recognized minor selected from one of the following disciplines: biology, chemistry, computer science, economics, geology, physics, psychology, one engineering specialty (from chemical, civil, electrical, industrial, mechanical), or statistics. The total number of required semester hours of credit in mathematics (excluding statistics courses) for this track is 41.

Statistics Track. In addition to the core, MATH 3760, 5845, and a minor in statistics that would consist of STAT courses 3743, 5817, 5843, 5844, and two elective courses which can be chosen from the STAT courses 5840, 5846, 5847, 5849 and 5895. One of the elective courses may be chosen from outside the Department of Mathematics and Statistics with the permission of the chairperson. Such a course can be ECON 5824 or ISEN 3720 or another statistics-related course. The total number of required semester hours of credit in mathematics for this track is 32.

Applied Mathematics Track. In addition to the core, MATH 3705, 3760, and two electives from 5825, 5835, 5845, 5855, 5861, and 6942, and a recognized minor in one of the following areas: statistics, computer science, engineering, physics, geology, chemistry, biology, logistics, economics, geoscience, or another area with approval of the chair. The total number of required semester hours of credit in mathematics for this track is 38.

Quantitative Business Track. In addition to the core, MATH 5845 and 3760; STAT 5817 and a minor course of study in business or finance. The total number of required semester hours of credit in mathematics for this track is 32.

B.A. DEGREE
Learning Outcomes

The student learning outcomes for a B.A. in mathematics are as follows:

- Students will develop and demonstrate the ability to reason mathematically by constructing mathematical proofs and recognizing and analyzing accurate numerical data in all core courses. Students will learn that truth in mathematics is verified by careful argument, and will demonstrate the ability to make conjectures and form hypotheses, test the accuracy of their work, and effectively solve problems.
- Students will learn to identify fundamental concepts of mathematics as applied to science and other areas of mathematics, and to interconnect the roles of pure and applied mathematics.
- Students will demonstrate that they can communicate mathematical ideas effectively by completing a senior capstone project involving an investigative mathematical project and presenting their findings and results in both a written format and as an oral presentation to faculty and other students.

Requirements

In addition to the core, B.A. candidates must take 12 additional semester hours of mathematics at the upper-division level, with at least two at the 4800 level. The minor field of study may be any discipline. The total number of required semester hours of credit in mathematics for this program is 38.

Tracks

In selecting the appropriate track, the student should consult a department advisor, since certain tracks are to be preferred according to whether the student contemplates graduate study in mathematics or statistics, secondary school teaching, or a career in business, industry or government.

The **Traditional Mathematics Track** enrolls students seeking classical training in mathematics. Students will study the nature of mathematics in fields such as algebra, real analysis, complex analysis, and topology. Connections to, and generalizations of, earlier formulations of mathematical concepts will constantly occur. Generally, new results in mathematics are developed and proven by those with a Ph.D. in mathematics. Students planning to pursue a Ph.D. will be well prepared for graduate school with this track and should also study at least one of the languages French, Russian, or German.

The **Applied Mathematics Track** emphasizes areas of mathematics used in government and industry. Students learn mathematical models for the study of physical and computational processes. Mathematical techniques are also used to study uncertainty, scheduling, and decision theory. Many graduates find employment in consulting firms and large corporations where computing and mathematical problem solving skills are valued. Students are also prepared to pursue a master's degree in applied mathematics.

The **Statistics Track** is for students interested in the analysis of data. Statistical techniques are utilized in many fields of research such as medicine, biology, business, and sociology. Statisticians learn proper methodology for collecting, summarizing, and interpreting data subject to sampling variability. The increase in affordable computing and the ease of statistical software have placed statistical expertise in demand. Generally, students interested in statistics pursue further study at the graduate level, but positions are available for students upon completion of a bachelors degree.

Students enrolled in the **Quantitative Business Track** will be well prepared to bring quantitative problem solving skills to various fields of business. Students interested in using mathematics and statistics to study logistics or financial and business situations should enroll in this track. By enrolling in this track and carefully planning electives, students will be well prepared to pursue an MBA degree from many programs across the country. Students can also pursue a career in actuarial science, which is concerned with such things as assessing pension plans, mortality rates, and accident rates. Students from this program can find employment in banks, insurance firms, public accounting firms, investment firms, labor unions, government, and large corporations.

The **Bachelor of Arts Track** is available for students interested in a liberal arts education. This degree is also recommended for students who wish to pursue another discipline, including possibly a double major.

Transfer Credit

Students receiving transfer credit from another institution for courses in mathematics should consult the department chair to determine how this credit will apply toward the major requirements.

Mathematics Minors

Interested students should consult the Department of Mathematics and Statistics for more information.

DEPARTMENT OF PHYSICS AND ASTRONOMY

Professors Andrews, Carroll, Sturrus (Chair), Tabak; Associate Professors Crescimanno, Oder; Assistant Professors Durrell, Feldmeier.

Courses are organized with the following aims: (1) To provide well-rounded training in physics and astronomy for those needing it for graduate study, industry, or for secondary school teaching; (2) To provide basic training for engineering and pre-professional students; (3) To acquaint the non-specializing student with scientific methods and with the place of physics and astronomy in the modern world.

Following the course descriptions below are the curricula and minimum requirements for the degrees of Bachelor of Arts and Bachelor of Science with a major in physics and a Bachelor of Science degree with a combined major in physics and astronomy. These degrees may be earned in eight semesters if students average 15.5 hours per semester.

Learning Outcomes

The Department of Physics & Astronomy has established the following learning outcomes for the B.S. and B.A. programs:

- Students will learn to reason critically about physical systems as individuals and in groups.
- Students will learn to apply the concepts of physical laws to solve numeric problems in physical systems.
- Students will learn to measure the properties of physical systems using modern test equipment and report the results of the measurements with their associated accuracy and precision.
- Students of the B.S. program in physics will be prepared for entry into physics graduate programs or scientific and technical positions in industry and government.
- Students of the B.S. program in physics/astronomy will be prepared for entry into astronomy graduate programs or scientific and technical positions in industry and government.

Degree Options

The B.A. degree program in physics is designed for students who are interested in fields that benefit from a strong background in physics or for students planning to terminate their education at the bachelor's degree level. The B.S. degree program in physics is designed for students who plan to pursue graduate studies in physics. The B.S. degree program with a combined physics-astronomy major is designed for students who plan to pursue graduate studies in astronomy or space science.

A student desiring to teach physics or astronomy in secondary schools should consult the dean of the College of Education.

Shown below are suggested curricula for complete four-year programs. Students are urged to come to the department office early in their first year to select, and consult with, an advisor from the teaching staff.

Suggested Curriculum for a B.S. in Physics with a Minor in Mathematics

FIRST YEAR

Courses	s.h.
PHYS- 2610, 2610L, 2611, 2611L	10
MATH- 1571, 1572	8
CHEM- 1515, 1516	8
ENGL- 1550, 1551	6
	32

SECOND YEAR

Courses	s.h.
PHYS- 3704, 3704L, 3705, 3705L	8
MATH- 2673, 3705	7
Electives (See note)	15
	30

THIRD YEAR

Courses	s.h.
PHYS- 3701, 3702	6
PHYS- 3741, 3742	6
PHYS- 3750	3
Electives (See note)	16
	31

FOURTH YEAR

Courses	s.h.
PHYS- 5810, 5811	6
PHYS- 4805	3
Electives (See Note)	22
	31

Note: The electives must satisfy the general University and/or STEM College requirements.

Minimum requirements for the B.A. degree in physics with a minor in mathematics—physics courses, 30 s.h.: 2610, 2610L, 2611, 2611L, 3701, 3702, 3704, 3704L, 3705, 3705L, 3741, 4805; mathematics courses, 18 s.h.: 1571, 1572, 2673, 3705, plus upper-division math elective.

Minimum requirements for the B.S. degree in physics with a minor in mathematics—physics courses, 42 s.h.: same as the B.A. above plus 3742, 3750, 5810, 5811; mathematics courses, 18 s.h.: same as B.A. degree.

Minimum requirements for the B.S. with a combined major in physics and astronomy and a minor in mathematics—physics courses, 37 s.h: 2610, 2610L, 2611, 2611L, 3701, 3702, 3704, 3704L, 3705, 3705L, 3741; 10 s.h. of upper-division physics courses and 21 s.h. of astronomy courses: 1504, 2609, 3711, 4805, 4811, 4812; mathematics courses, 18 s.h., same as for B.A. degree above.

RAYEN SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY

Accreditation

The baccalaureate degree programs in the Rayen School of Engineering and Engineering Technology accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET) are chemical engineering (jointly accredited by the American Institute of Chemical Engineers), civil engineering, electrical engineering, industrial and systems engineering, and mechanical engineering; those accredited by the Technology Accreditation Commission of ABET are civil and construction engineering technology, electrical engineering technology, and mechanical engineering technology.

Admission

For those seeking a Bachelor of Engineering (B.E.) degree, first-time-college students from high school are admitted to one of the following entry-level majors based on academic preparation.

First-Year Engineering

Minimum ACT Math score of 23

OR Minimum SAT Math score of 530

OR YSU Math Placement of MATH 1571 (Calculus I)

Note: Students deficient in high school trigonometry are required to enroll in MATH 1513 prior to MATH 1571.

International students must also present a minimum TOEFL score of 525.

Pre-Engineering & Technology

For those who do not meet the above criteria

To transfer into the first-year engineering major from another college major, a student must:

- Be qualified to enroll in MATH 1571 and ENGL 1550
- Have a GPA of at least 2.30
- Not be disqualified (See Disqualification Policy below)

To transfer into a degree-granting engineering major, a student must:

- Have earned a minimum 12 semester hours or equivalent
- Have earned "C" or better grades in MATH 1571, CHEM 1515/1515L and ENGL 1550
- Have a GPA of at least 2.30
- Not be disqualified (See Disqualification Policy below)

Associate in Applied Science Degree

Associate in Applied Science majors include: civil and construction engineering technology, computer information systems and information technology, electrical engineering technology, and mechanical engineering technology. These majors offer a 2+2 degree program design leading to the Bachelor of Science in Applied Science degree. Consult the department sections of the bulletin for specific course information.

School of Engineering Disqualification

A student who earns two grades of D, F, or NC in the same course(s) listed below will be disqualified from transferring into a degree-granting engineering major. These courses are: MATH 1513, MATH 1571, ENGL 1540, ENGL 1550, CHEM 1515/1515L, and PHYS 2610.

Enrollment in Restricted Engineering Courses

Enrollment in most engineering and engineering technology courses is restricted to those admitted to a degree-granting engineering major. A few engineering courses are not restricted. They are: ENGR 1550, 1555, 1560; CEEN 2610 and 2610L; ECEN 1521, 1521L and 1555. All others require admission to a professional engineering major unless approved by the chair of the engineering department and coordinator of the engineering program offering the course and by the STEM College dean. Students will be administratively withdrawn from restricted courses in which they are improperly enrolled.

Bachelor of Engineering degree (B.E.) Graduation Policies

All engineering programs have pre-college course requirements listed in the chart at the end of this section that should be completed in high school or in equivalent course work at the college level. YSU offers the equivalent high school courses for those not meeting these pre-college requirements. These high school deficiencies do not count toward graduation requirements and should be completed during the first two years of enrollment.

Each engineering program has minimum graduation requirements. These requirements can affect a student's enrollment in senior-level classes. If a senior-level student reaches a point where it is not possible to achieve graduation requirements, further enrollment in engineering classes will be denied. In addition to the overall recalculated C average required by the University, an unrecalculated C average in the major is required. Also, an unrecalculated C average in all engineering courses is required in all majors. **These minimum graduation requirements are referred to as a *triple C requirement*.**

Chemical Engineering

A student who is failing to meet the triple C requirement prior to the senior year will be denied enrollment in CHEN 4887.

Civil and Environmental Engineering

A student who is failing to meet the triple C requirement prior to the senior year will be denied enrollment in CEEN 4863, 5837, 5855, & 4881.

Electrical and Computer Engineering

Students who have not earned a C or better grade in ECEN 3741 and 3742 and students who are failing to meet the triple C requirement will be denied enrollment in senior level courses.

Industrial and Systems Engineering

A student who is failing to meet the triple C requirement will be denied enrollment in 4000- and 5000-level ISEN courses.

Mechanical Engineering

Students who have not earned a C or better grade in MECH 2603 and 2641 and students who are failing to meet the triple C requirement will be denied permission to register for any junior-level mechanical engineering course until remedial measures, as required by the department chair, are agreed to by the student. Students who have not earned a C or better grade in MECH 2603 and 2641 and students who are failing to meet the triple C requirement will be denied enrollment in any mechanical engineering program senior level course.

Cooperative Education/Professional Practice

Several programs leading to a baccalaureate degree offer students an optional cooperative education program. Co-op students are required to complete the same academic program for graduation as those not participating in the cooperative education experience. Credit hours awarded for the cooperative education experience are considered "add-on" hours to the degree. Professional practice opportunities include working with faculty on grants and research projects as well as internship opportunities with local industry. A professional practice coordinator is available to assist in student placement.

The table below shows the minimum pre-college requirements:

PRE-COLLEGE Subject	High School Units
English	3
Algebra 1 and 2	2
Geometry	1
Trigonometry	½
Chemistry	1
Mechanical Drawing	1
Physics	1
Other	6½

DEPARTMENT OF CIVIL/ ENVIRONMENTAL AND CHEMICAL ENGINEERING

Professors Alam, Garr, Husain, Lim, Martin (Chair); Associate Professor Price; Assistant Professors Islam, Tritico.

CHEMICAL ENGINEERING PROGRAM

Associate Professor Douglas M. Price, Program Coordinator.

The chemical engineering program—supplemented with courses in chemistry, physics, mathematics, and general engineering – provides a broad preparation for design, operation, and management in the chemical, biomedical, biological, nuclear, pharmaceutical, and energy-conversion industries, as well as graduate study leading to research positions in industry and government and to academic careers.

Educational Objectives

Graduates of the chemical engineering program at YSU

- Pursue careers as practicing chemical engineers in chemical and energy-related industries as well as in areas of materials, environmental, and biomedical engineering and biotechnology.
- Demonstrate strong, functional command of chemical engineering fundamentals and communication skills.
- Are aware of the scope of the chemical engineering profession and its global opportunities and requirements.
- Exhibit professional responsibility and a sensitivity to a broad range of societal concerns including ethical, environmental, political, regulatory, and global issues in making decisions.

Learning Outcomes

The curriculum is structured to achieve several program outcomes. Students will

- Understand how to apply the basic principles of chemical engineering in problem solving and design
- Understand how to apply math and basic sciences in solving chemical engineering problems
- Apply chemical engineering principles both in upper division classes and in the professional work arena, and know how to approach open-ended and design problems
- Use traditional chemical engineering software and general engineering software in addition to standard packages for graphing, tables, and word processing; basic programming skills
- Understand the societal, global, and ethical impact of their designs and processes
- Communicate and work effectively on a one-on-one basis, in groups of chemical engineers, and on multidisciplinary teams
- Participate in student chapter activities, now and after they enter professional work, with an emphasis on lifelong learning and attending clinics and conference sessions
- Effectively access and assess information (data from literature)

Facilities

The chemical engineering laboratories are well equipped for undergraduate instruction and student and faculty research. The equipment includes fluid flow apparatus, concentric tube and plate and frame heat exchangers, thermal conductivity apparatus, boiling heat transfer apparatus, tray dryer, double effect evaporator, computer-controlled distillation tower, gas absorption and liquid-liquid extraction columns, chemical reactors, electrostatic particle separator, centrifuges, filter presses, and other miscellaneous equipment.

Curriculum for the Bachelor of Engineering Degree with a Major in Chemical Engineering

FIRST YEAR

Courses			s.h.
ENGR	1550	Engineering Concepts	3
ENGR	1560	Engineering Computing	3
CHEM	1515	General Chemistry 1	4
CHEM	1515L	Chemistry Lab 1	0
CHEM	1516	General Chemistry 2	4
CHEM	1516L	Chemistry Lab 2	0
MATH	1571	Calculus 1	4
MATH	1572	Calculus 2	4
ENGL	1550	Writing 1	3
ENGL	1551	Writing 2	3
CMST	1545	Communication Foundations	3
GER Elective			3
			34

SECOND YEAR

Courses			s.h.
PHYS	2610	General Physics 1	4
PHYS	2611	General Physics 2	4
CHEM	3719	Organic Chemistry 1	4
CHEM	3719L	Organic Chemistry Lab 1	0
CHEM	3720	Organic Chemistry 2	4
CHEM	3720L	Organic Chemistry Lab 2	0
CHEN	2650	Comp. Meth. in Chem. Eng.	2
CHEN	2683	Chemical Engr Principles 1	3
CHEN	2684	Chemical Engr Principles 2	3
MATH	2673	Calculus 3	4
MATH	3705	Differential Equations	3
PHIL	2625	Intro. Professional Ethics	3
			34

THIRD YEAR

Courses			s.h.
CHEN	3771	Chem Engr Thermo 1	3
CHEN	3772	Chem Engr Thermo 2	3
CHEN	3785L	Transport Lab 1	1
CHEN	3786	Transport Phenomena	4
CHEN	3787	Trans 2/Unit Ops 1	3
CHEN		Chemical Engr Elective	3
CHEM	3739	Physical Chemistry 1	4
CHEM	3739L	Physical Chemistry Lab 1	0
CHEM	3740	Physical Chemistry 2	4
CHEM	3740L	Physical Chemistry Lab 2	0
Approved Engineering Elective			3
GER Elective			3
GER Elective			3
			34

FOURTH YEAR

Courses			s.h.
CHEN	3787L	Unit Ops Lab 1	1
CHEN	4815	Unit Operations 2	3
CHEN	4815L	Unit Ops Lab 2	1
CHEN	4880	Chem Reactor Design 1	3
CHEN	4881	Chem Reactor Design 2	3
CHEN	4882	Process Dynamics	3
CHEN	4882L	Process Dynamics Lab	1
CHEN	4887	Process & Plant Design 1	3
CHEN	4888	Process & Plant Design 2	3
CHEN		Chem Engr Elective	3
CHEN		Chem Engr Elective	3
GER Elective			3
GER Elective			3
GER Elective			3
			36

Total 138

Note: Transfer students from any two- or four-year academic program at other institutions or at this University who wish to pursue studies in chemical engineering should consult with the program coordinator for individual counseling to develop a program of study that fully uses their educational background and requires a minimum of time to satisfy the requirements for the degree of Bachelor of Engineering in Chemical Engineering.

CIVIL ENGINEERING PROGRAM

Professor Scott C. Martin (Program Coordinator).

Civil engineers are responsible for planning, designing, and supervising construction of the nation's infrastructure, including buildings, bridges, highways, dams, drinking water and wastewater treatment facilities, airports, etc. The civil engineering program provides an academic environment rich in opportunities for students to develop the knowledge and skills necessary for productive and rewarding careers and lives. The educational objectives of the program are to prepare graduates to:

- excel in any sector(s) of civil engineering practice, including consulting, government, construction, and industry;
- complete graduate study in civil engineering or a related field;
- communicate effectively with a variety of audiences through writing and speaking;
- apply creativity and a strong understanding of math, science, computers, and engineering to develop innovative solutions to engineering problems;
- understand and effectively incorporate the role of social, ethical, political, economic, and environmental considerations in their professional careers;
- work effectively as a member of a team or organization, and excel in a leadership role where appropriate;
- serve their profession and society through involvement in professional and service organizations;
- achieve registration as a Professional Engineer; and
- continue their intellectual and professional growth through lifelong learning.

Learning Outcomes

The undergraduate curriculum is structured to achieve the following specific program outcomes:

- Students will obtain a broad education necessary to understand the impact of civil engineering solutions in a global, societal, and environmental context.
- Students will be able to solve civil engineering problems in practice by applying fundamental knowledge of mathematics, science, and engineering, and using modern engineering techniques, tools, equipment, and computer applications.
- Students will be able to design systems, components, or processes to meet specific needs within the following realistic constraints: economic; social; political; environmental; sustainability; ethical; health and safety; and constructability.
- Students will be able to design and conduct experiments, and to analyze and interpret data within the various civil engineering specialty disciplines.
- Students will understand the fundamentals of business, management, and leadership, including organization, planning, bidding, report preparation, construction, and functioning effectively as a member of a multidisciplinary team.
- Students will be able to communicate effectively, via speaking and writing, with both technical and non-technical audiences.
- Students will have a solid understanding of professional and ethical responsibility, the importance of professional licensure, and the need for continued professional development.

Program Description

In the first two years of the program, students take coursework in the fundamentals of engineering, mathematics, and basic science in order to strengthen their technical background and develop intellectual maturity. The student then continues in a broad-based civil engineering program that develops competence in a variety of areas within the discipline. Engineering topics include environmental, geotechnical, structural, transportation, and hydraulic engineering, as well as surveying. In the last two years, students choose elective courses in the various areas of civil engineering based on their academic and career interests.

Instruction on the design process is fully integrated throughout the curriculum to foster the depth of understanding and self-confidence that students will need to think creatively and become productive engineers. The curriculum is based on the belief that students can best develop their creative skills through a series of progressively more demanding design experiences leading up to a major, comprehensive senior-level project.

Students majoring in civil engineering earn the Bachelor of Engineering (B.E.) degree. Graduates are prepared for advanced study at the master's and doctoral level in engineering or for employment in the engineering profession.

The program offers the atmosphere of a small school in maintaining close contact between students and faculty. Senior professors serve as academic advisors and are used in all phases of instruction from freshman to graduate courses. All of the program's facilities are located within the modern Moser Hall. The program maintains laboratories for environmental engineering, fluid mechanics, soil mechanics, strength of materials, surveying, and concrete testing. A wide variety of equipment is available to support both teaching and research activities.

Curriculum for the Bachelor of Engineering Degree with a Major in Civil Engineering

FIRST YEAR

Courses			s.h.
ENGL	1550	Writing 1	3
ENGL	1551	Writing 2	3
CHEM	1515	General Chemistry 1	4
CHEM	1515L	General Chemistry 1 Lab	0
ENGR	1550	Engineering Concepts	3
ENGR	1560	Engineering Computing	3
MATH	1571	Calculus 1	4
MATH	1572	Calculus 2	4
CMST	1545	Communication Fdns.	3
GER		SI Elective	3
GER		AL Elective	3
			33

SECOND YEAR

Courses			s.h.
MATH	2673	Calculus 3	4
MATH	3705	Differential Equations	3
CEEN	2601	Statics	3
CEEN	2602	Strength of Materials	3
CEEN	2602L	Strength of Materials Lab	1
CEEN	2610	Surveying	3
CEEN	2610L	Surveying Lab	1
GEOL	26111	Geology for Engineers	3
PHYS	2610	General Physics 1	4
CHEM	1516/1516L or PHYS 2611	General Chemistry 2 or General Physics 2	4
GER		PS Elective	3
			32

THIRD YEAR

Courses			s.h.
CEEN	3716	Fluid Mechanics	3
CEEN	3716L	Fluid Mechanics Lab	1
CEEN	3717	Hydraulic Design	4

CEEN	3720	Transportation Engineering	3
CEEN	3736	Fundamentals of Environmental Engineering	3
CEEN	3749	Structural Analysis 1	3
CEEN	3749L	Str. Anal. Lab	1
CEEN	4881	Geotechnical Engineering	3
CEEN	4881L	Geotechnical Engineering Lab	1
CEEN		Design Elective	3
ISEN	3724	Engineering Economy	3
GER		PS Elective	3
GER		SI Elective	3
			34

FOURTH YEAR

Courses			s.h.
CEEN	5855	Reinforced Concrete Design	3
CEEN	5856	Steel Design	3
CEEN	4812	Construction Management	3
CEEN	Elective		3
CEEN	Elective		3
CEEN	4863	Integrated Design Project	3
ISEN	3710	Engineering Statistics	3
MECH	2641	Dynamics	3
F.E. Elective		See Note Below[3]	3
GER	AL Elective		3
GER	AL Elective or SI Elective		3
			33

1 – May substitute CHEM 1516/1516L or PHYS 2611
2 – May substitute out of Dept. course with approval of CE Program Coordinator
3 – Fundamentals of Engineering Elective – Choose One:
MECH 2606 Engineering Materials; or
MECH 2603 Thermodynamics 1; or
ECEN 2632 Basic Circuit Theory 1

SUMMARY

Courses	s.h.
Mathematics	18
Natural Science	15
Writing and Speech	9
General Education Electives	21
Civil Engineering	54
Other Engineering	15
Total	**132**

Cooperative Education Option in Civil Engineering

Students who have successfully completed the sophomore year and meet the additional requirements of the program may select the cooperative education option. Students selecting this option must register for, and successfully complete at least two co-op work periods beginning after the end of the sophomore year. These work periods may be either concurrent or alternating with academic semesters. Selecting the co-op option typically adds one or two semesters to the degree program. Further information on the cooperative education option is available in the department office.

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

Professors Jalali (Chair), Munro, Pansino; Associate Professor Mossayebi; Assistant Professor Li.

The department offers coursework leading to the Bachelor of Engineering with a major in electrical engineering. Traditional, computer/digital, and pre-medical options are available. The first courses in the department major are electrical and computer engineering (ECEN) 1521 and 1521L, and are available to all University students. Visit the department office or web site for details.

Mission

The Department of Electrical and Computer Engineering is committed to academic excellence and provides educational opportunities in electrical and computer engineering. We provide students at baccalaureate and master levels with diverse and comprehensive educational experiences to meet the highly demanding standards required by industry and to further their education. We utilize the resources of the university and interact with industry to evaluate, optimize, maintain, and upgrade our teaching, research, scholarship, service and facilities to continue maintaining a high-standard educational environment. We promote students' intellectual growth to become fully developed, informed, and productive in order to serve themselves and their local and global communities effectively.

Program Educational Objectives

The Department of Electrical and Computer Engineering at Youngstown State University is committed to offering its students a high standard of engineering education. In fulfillment of its mission, as well as the missions of the College of Science, Technology, Engineering, and Mathematics and the University, the following educational objectives are established. Graduates of our program should be able to:

- Apply the latest technology and engineering tools to solve technical problems in the practice of electrical engineering or in post-graduate education.
- Function individually and in teams, professionally and socially, and communicate effectively.
- Perform responsibly and ethically in their profession.
- Understand global issues and the impact of technology and engineering solutions on society and the environment.
- Engage in life-long learning and broaden themselves and their profession.

Program Outcomes

To achieve the program educational objectives, our students are expected to attain the following outcomes by the time of their graduation. Every graduate must have:

- an ability to apply knowledge of mathematics, science, and engineering;
- an ability to design and conduct experiments, as well as to analyze and interpret data;
- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
- an ability to function on multi-disciplinary teams;
- an ability to identify, formulate, and solve engineering problems;
- an understanding of professional and ethical responsibility;
- an ability to communicate effectively;
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;
- a recognition of the need for, and an ability to engage in life-long learning;
- a knowledge of contemporary issues; and
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Laboratory Facilities

The Department of Electrical and Computer Engineering maintains modern, well-equipped laboratory facilities for circuits, electronics, communications, electromagnetics, energy conversion, control systems, and digital systems. PC computing and networking are widely available in our labs, and various licensed software packages are maintained for student use.

Cooperative Education

The Electrical and Computer Engineering Department participates in the College's Cooperative Education Program. Students who have completed the sophomore year and meet requirements approved by the department may enroll in a co-op option. Co-op students are required to complete the same program requirements for graduation as non co-op students.

Students who complete the co-op requirements may receive up to two semester credits as co-op credit to be applied toward ECEN elective courses. Students interested in receiving co-op credit must enroll in ENGR 3798 or 4898 and follow the policies written in the course syllabus. The course requirements include the submission of a work report pertaining to their co-op experience as well as a presentation. The department faculty reviews the student report to ensure the student's co-op experience qualifies him or her for credit, and then a grade is assigned. Interested students may contact the department for details.

Options

Traditional, computer/digital, and pre-medical options, the co-op program, design projects, computer simulation, and hands-on laboratory sessions are the pillars of the Bachelor of Engineering with a major in electrical engineering. These features provide students with the opportunity to prepare for a vast array of entry-level positions or advanced studies.

With faculty assistance, students tailor their programs to meet their educational objectives. This includes choices of options and elective courses, and participation in co-op, as well as semester-by-semester scheduling of courses.

The **traditional option** has 52 hours of electrical engineering, 15 hours of other engineering, 18 hours math, 16 hours science, 9 hours of writing and speech, and 21 hours general education courses for a total of 131 semester hours.

The **computer/digital option** has 40 hours of core electrical engineering courses, 15 hours of other engineering, 19 hours computer engineering/science courses, 18 hours math, 13 hours science, 9 hours of writing and speech, and 21 hours general education courses for a total of 135 semester hours.

The **pre-medical option** has 40 hours of core electrical engineering courses, 15 hours of other engineering, 18 hours mathematics, 33 hours science, 9 hours of writing and speech, and 21 hours general education courses for a total of 136 semesters hours.

Students in any of these options can participate in the co-op program. Scheduling is reasonably flexible, but there are some restrictions.

Course Scheduling

Scheduling of courses will depend upon your particular situation. Are you working part time? Will you be co-opping, either alternate or parallel? Do you wish a full- or part-time academic pursuit of the degree? Answers to these questions will affect your scheduling of courses. The Department of Electrical and Computer Engineering attempts to schedule junior and senior courses to accommodate these situations.

Students are required to meet with their department advisors to choose their semester-by-semester courses. Also, up-to-date recommended schedules and curriculum lists are available on-line and at the department.

Curricula

Traditional Option

Elect & Comp Engin (ECEN)			s.h.
1521		Basic Comp & Dig Circuits	3
1521L		Basic Comp & Dig Cir Lab	1
2611		Instr & Comp Lab 1	1
2612		Instr & Comp Lab 2	1
2632		Basic Circuit Theory 1	3
2633		Basic Circuit Theory 2	3
3710		Signals and Systems	3
3711		Intermediate Lab 1	1
3712		Intermediate Lab 2	1
3731		Digital Systems 1	3
3741		Electromagnetic Fields 1	3
3742		Electromagnetic Fields 2	3
3771		Digital & Analog Circs 1	3
3772		Digital & Analog Circs 2	3
4803		Linear Control Systems	3
4811		Senior Laboratory	1
4844		Electromag Energy Conversion	3
4899		Senior Design Project	4
		ECEN Electives	9
			52

Science Courses			s.h.
CHEM	1515	Gen Chem 1	4
PHYS	2610	Gen Physics 1	4
PHYS	2610L	Gen Physics Lab 1	1
PHYS	2611	Gen Physics 2	4
		Elective	3
			16

Summary for Traditional Option

Elec & Comp Engin	52
Science	16
Engineering *	15
Math *	18
Writing & Speech *	9
General Education *	21
Total Hours	**131**

**See end of this curriculum section for courses in these areas that are common to the three options.*

Suggested Schedule—Traditional Option

FIRST YEAR
FALL

Courses			s.h.
MATH	1571	Calculus 1	4
ENGR	1550	Engineering Concepts	3
CHEM	1515	General Chemistry 1	4
ENGL	1550	Writing 1	3
Gen Ed		Elective	3
			17

SPRING

Courses			s.h.
MATH	1572	Calculus 2	4
ENGR	1560	Engineering Computing	3
ECEN	1521	Basic Comp & Dig Circs	3
ECEN	1521L	Basic Comp & Dig Circs Lab	1
ENGL	1551	Writing 2	3
CMST	1545	Comm Thry & Prac	3
			17

SECOND YEAR
FALL

Courses			s.h.
MATH	2673	Calculus 3	4
ECEN	2632	Basic Circuit Theory 1	3
ECEN	2611	Instru and Comput Lab 1	1
PHYS	2610	General Physics 1	4
PHYS	2610L	General Physics Lab 1	1
CEEN	2601	Statics	3
			16

SPRING

Courses			s.h.
MATH	3705	Differential Equs	3
ECEN	2633	Basic Circuit Theory 2	3
ECEN	2612	Instru and Comput Lab 2	1
PHYS	2611	General Physics 2	4
MECH	2641	Dynamics	3
Gen Ed		Elective	3
			17

THIRD YEAR
FALL

Courses			s.h.
ECEN	3711	Intermediate Laboratory 1	1
ECEN	3731	Digital Systems 1	3
ECEN	3741	Electromagnetic Theory 1	3
ECEN	3771	Digital & Analog Circuits 1	3
ISEN	3710	Engineering Statistics	3
PHIL	2625	Intro to Prof Ethics	3
			16

SPRING

Courses			s.h.
ECEN	3712	Intermediate Laboratory 2	1
ECEN	3709	Communication Systems	3
ECEN	3742	Electromagnetic Theory 2	3
ECEN	3772	Digital & Analog Circuits 2	3
ECEN	4844	Electromag Energy Conversion	3
ECON	2610	Principles 1	3
			16

FOURTH YEAR
FALL

Courses			s.h.
ECEN	4811	Senior Laboratory	1
ECEN	4803	Linear Control Systems	3
ECEN		Elective	3
MATH	3715	Discrete Math	3
Gen Ed		Elective	3
Gen Ed		Elective	3
			16

SPRING

Courses			s.h.
ECEN	4899	Senior Design Project	4
ECEN		Elective	3
ECEN		Elective	3
Science		Elective	3
Gen Ed		Elective	3
			15

Computer/Digital Option

Elect & Comp Engin (ECEN)

Courses		s.h.
1521	Basic Comp & Dig Circuits	3
1521L	Basic Comp & Dig Cir Lab	1
2611	Instr & Comp Lab 1	1
2612	Instr & Comp Lab 2	1
2632	Basic Circuit Theory 1	3
2633	Basic Circuit Theory 2	3
3711	Intermediate Lab 1	1
3712	Intermediate Lab 2	1
3731	Digital Systems 1	3
3732	Digital Systems 2	3
3741	Electromagnetic Fields 1	3
3742	Electromagnetic Fields 2	3
3771	Digital & Analog Circs 1	3
4803	Linear Control Systems	3
4811	Senior Laboratory	1
4844	Electromag Energy Conversion	3
4899	Senior Design Project	4
		40

Computer Engineering/ Science

Courses			s.h.
CSIS	2610	Prog & Prob-Solving	4
CSIS	3700	Data Structures & Objects	4
CSCI/ECEN from approved electives			11
			19

Science

Courses			s.h.
CHEM	1515	Gen Chem 1	4
PHYS	2610	Gen Physics 1	4
PHYS	2610L	Gen Physics Lab 1	1
PHYS	2611	Gen Physics 2	4
			13

Summary for Computer/Digital Option

Courses	s.h.
Elect & Comp Engineering	40
Computer Engineering/Science	19
Science	13
Engineering *	15
Math *	18
Writing & Speech *	9
General Education *	21
Total Hours	**135**

**See end of this curriculum section for courses in these areas that are common to the three options.*

Suggested Schedule—Computer/Digital Option

FIRST YEAR
FALL

Courses			s.h.
MATH	1571	Calculus 1	4
ENGR	1550	Engineering Concepts	3
CHEM	1515	General Chemistry 1	4
ENGL	1550	Writing 1	3
Gen Ed		Elective	3
			17

SPRING

Courses			s.h.
MATH	1572	Calculus 2	4
ENGR	1560	Engineering Computing	3
ECEN	1521	Basic Comp & Digital Circs	3
ECEN	1521L	Basic Comp & Dig Circs Lab	1
ENGL	1551	Writing 2	3
CMST	1545	Comm Theory & Practice	3
			17

SECOND YEAR
FALL

Courses			s.h.
MATH	2673	Calculus 3	4
ECEN	2632	Basic Circuit Theory 1	3
ECEN	2611	Instru and Comput Lab 1	1
PHYS	2610	General Physics 1	4
PHYS	2610L	General Physics Lab 1	1
CEEN	2601	Statics	3
			16

SPRING

Courses			s.h.
MATH	3705	Differential Equations	3
ECEN	2633	Basic Circuit Theory 2	3
ECEN	2612	Instru and Comput Lab 2	1
PHYS	2611	General Physics 2	4
MECH	2641	Dynamics	3
Gen Ed		Elective	3
			17

THIRD YEAR
FALL

Courses			s.h.
ECEN	3711	Intermediate Laboratory 1	1
ECEN	3731	Digital Systems 1	3
ECEN	3741	Electromagnetic Theory 1	3
ECEN	3771	Digital & Analog Circuits 1	3
CSCI	2610	Prog & Prob-Solving	4
PHIL	2625	Intro to Prof Ethics	3
			17

SPRING

Courses			s.h.
ECEN	3712	Intermediate Laboratory 2	1
ECEN	3732	Digital Systems 2	3
ECEN	3742	Electromagnetic Theory 2	3
CSIS	2617	Data Structures	4
ECEN	4844	Electromag Energy Conversion	3
ECON	2610	Principles 1	3
			17

FOURTH YEAR
FALL

Courses			s.h.
ECEN	4811	Senior Laboratory	1
ECEN	4803	Linear Control Systems	3
ISEN	3710	Engineering Statistics	3
MATH	3715	Discrete Math	3
CSCI/ECEN		Elective	4
Gen Ed		Elective	3
			17

SPRING

Courses			s.h.
ECEN	4899	Senior Design Project	4
CSCI/ECEN		Elective	4
CSCI/ECEN		Elective	3
Gen Ed		Elective	3
Gen Ed		Elective	3
			17

Pre-Medical Option

Elect & Comp Engin (ECEN)

Courses		s.h.
1521	Basic Comp & Dig Circuits	3
1521L	Basic Comp & Dig Cir Lab	1
2611	Instr & Comp Lab 1	1
2612	Instr & Comp Lab 2	1
2632	Basic Circuit Theory 1	3
2633	Basic Circuit Theory 2	3
3711	Intermediate Lab 1	1
3712	Intermediate Lab 2	1
3710	Signals and Systems, or 3732 Digital Systems 2, or 3772 Digital & Analog Circs 2	3
3731	Digital Systems 1	3
3741	Electromagnetic Fields 1	3
3742	Electromagnetic Fields 2	3
3771	Digital & Analog Circs 1	3
4803	Linear Control Systems	3
4811	Senior Laboratory	1
4844	Electromag Energy Conversion	3
4899	Senior Design Project	4
		40

Science

Courses			s.h.
CHEM	1515	Gen Chem 1	4
CHEM	1516	Gen Chem 2	4
CHEM	3719	Organic Chem 1	4
CHEM	3720	Organic Chem 2	4
BIOL	2601	Gen Biol: Molec/Cells	4
BIOL	2602	Gen Biol: Org & Ecol	4
PHYS	2610	Gen Physics 1	4
PHYS	2610L	Gen Physics 2	4

The following two science courses are recommended for the pre-medical option but do not count toward degree requirements:

Courses			s.h.
CHEM	3785	Biochemistry 1	3
BIOL	3702	Microbiology	4

Summary for Pre-Medical Option

Courses	s.h.
Elect & Comp Engin	40
Science	33
Math *	18
Engineering *	15
Writing & Speech *	9
General Education *	21
Total Hours	**136**

**See end of this curriculum section for courses in these areas that are common to the three options.*

Suggested Schedule—Pre-Medical Option

FIRST YEAR
FALL

Courses			s.h.
MATH	1571	Calculus 1	4
ENGR	1550	Engineering Concepts	3
CHEM	1515	General Chemistry 1	4
ENGL	1550	Writing 1	3
CMST	1545	Comm Thry & Practice	3
			17

SPRING

Courses			s.h.
MATH	1572	Calculus 2	4
ENGR	1560	Engineering Computing	3
CHEM	1516	General Chemistry 2	4
ENGL	1551	Writing 2	3
ECEN	1521	Basic Comp & Digital Circs	3
ECEN	1521L	Basic Comp & Dig Circs Lab	1
			18

SECOND YEAR
FALL

Courses			s.h.
MATH	2673	Calculus 3	4
ECEN	2632	Basic Circuit Theory 1	3
ECEN	2611	Instru and Comput Lab 1	1
PHYS	2610	General Physics 1	4
CEEN	2601	Statics	3
Gen Ed		Elective	3
			18

SPRING

Courses			s.h.
MATH	3705	Differential Equations	3
ECEN	2633	Basic Circuit Theory 2	3
ECEN	2612	Instru and Comput Lab 2	1
PHYS	2611	General Physics 2	4
PHYS	2610L	General Physics Lab 1	1
MECH	2641	Dynamics	3
Gen Ed		Elective	3
			18

THIRD YEAR
FALL

Courses			s.h.
ECEN	3711	Intermediate Laboratory 1	1
ECEN	3731	Digital Systems 1	3
ECEN	3741	Electromagnetic Theory 1	3
ECEN	3771	Digital & Analog Circuits 1	3
BIOL	2601	Gen Biology: Molec/Cells	4
PHIL	2625	Intro to Prof Ethics	3
			17

SPRING

Courses			s.h.
ECEN	3712	Intermediate Laboratory 2	1
ECEN	3732 / 3772 / 3710		3
ECEN	3742	Electromagnetic Theory 2	3
ECEN	4844	Electromag Energy Conversion	3
BIOL	2602	Gen Biology: Orgs/Ecology	4
ECON	2610	Principles 1	3
			17

FOURTH YEAR
FALL

Courses			s.h.
ECEN	4811	Senior Laboratory	1
ECEN	4803	Linear Control Systems	3
MATH	3715	Discrete Math	3
ISEN	3710	Engineering Statistics	3
CHEM	3719	Organic Chemistry 1	4
Gen Ed	Elective		3
			17

SPRING

Courses			s.h.
ECEN	4899	Senior Design Project	4
CHEM	3720	Organic Chemistry 2	4
Gen Ed	Elective		3
Gen Ed	Elective		3
			14

*Courses Common to All Options

Engineering

Courses			s.h.
ENGR	1550	Intro to Engin 1	3
ENGR	1560	Intro to Engin 2	3
CEEN	2601	Statics	3
MECH	2641	Dynamics	3
ISEN	3710	Engin Statistics	3
			15

Mathematics

Courses			s.h.
MATH	1571	Calculus 1	4
MATH	1572	Calculus 2	4
MATH	2673	Calculus 3	4
MATH	3705	Differential Equations	3
MATH	3715	Discrete Math	3
			18

Writing & Speech

Courses			s.h.
CMST	1545	Comm Thry & Prac	3
ENGL	1550	Writing 1	3
ENGL	1551	Writing 2	3
			9

General Education (codes)			s.h.
ECON	2610	Principles 1 (SI)	3
PHIL	2625	Intro Prof Ethics (PS)	3
Elective (AL)			3
Elective (AL)			3
Elective (SI			3
Elective (AL or SI)			3
Elective (PS)			3
			21

DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING

Professors Cala, Kim, Kudav, Mehri, Shields, Suchora (Chair); Assistant Professors Marie, Panta, Wallace.

The Department of Mechanical and Industrial Engineering is dedicated to further the missions and objectives of the University and the College of Engineering and Technology by providing an opportunity for quality education in mechanical engineering and industrial and systems engineering and professional service to local and regional industry and to the public. The department is committed to providing its students with a broad, general education and an up-to-date technological curriculum in a four-year undergraduate program. It also offers an application-oriented evening Master of Science in Engineering program to practicing engineers and recent engineering graduates.

INDUSTRIAL AND SYSTEMS ENGINEERING PROGRAM

Professors Cala (Coordinator), Mehri; Assistant Professor Wallace.

The industrial and systems engineer functions as a problem-solver, innovator, coordinator, and agent of change in a wide variety of positions in manufacturing industries, service industries, and government. The industrial and systems engineer's unique background combines a study of science, mathematics, and management principles with the principles of engineering analysis and design to provide access to a wide variety of flexible technical and managerial careers.

The aim of the industrial and systems engineering program is to produce graduates who secure professional engineering positions, who practice the profession ethically and effectively, who maintain their professional competency through lifelong learning,

and who advance in one of the many technical and managerial career paths available to industrial and systems engineers. The program prepares its students for these accomplishments by providing them with a broad scientific and engineering base via courses in mathematics, physics, chemistry, and the engineering sciences. In addition, courses in the social sciences and the humanities develop sensitivity to the social context within which the profession must be ethically practiced. Finally, industrial and systems engineering courses in the areas of manufacturing systems, human-machine systems, management systems, and management science develop the technical expertise required by professional practice.

Program Educational Objectives

The industrial and systems engineering program at Youngstown State University is committed to offering its students a high standard of educational training. In fulfillment of its mission, as well as the missions of the College of STEM and the University, the program has established the following educational objectives to ensure that its graduating engineers have the educational knowledge and skills that enable them to practice industrial engineering effectively.

- Graduates shall have sufficient breadth to develop expertise within many of the specialty areas of industrial engineering.
- Graduates shall have the ability to both innovate at the detailed component level and to integrate engineered solutions into large-scale systems.
- Graduates shall have the ability to determine the optimal use of people, materials, equipment, and energy.
- Graduates shall have the ability to make the appropriate use of analytical, computational, and experimental practices to champion quality, safety, efficiency, and financial objectives.
- Graduates of the program are prepared to manage and lead people in aspects of production and service enterprise performance.

Program Outcomes

To achieve the program educational objectives, our students are expected to have attained the required professional, technical, and social experience in the program with the ability to:

1-1. Apply knowledge of mathematics, science, and engineering science to solve engineering problems.

1-2. Utilize their design knowledge, skills, and technical experience to practice engineering.

1-3. Incorporate design of experiments with engineering analysis and design.

1-4. Use design techniques to design systems, components, and processes that satisfy predetermined economic, environmental, manufacturability, ethical, social, health, and safety constraints.

1-5. Recognize technical problems, develop ideas and formulate methods to determine acceptable solutions.

2-1. Work as a member of an engineering team in industrial engineering practice.

2-2. Accept project responsibilities and use problem-solving skills.

2-3. Understand their professional roles and ethical responsibilities in the engineering profession and society.

3-1. Communicate their ideas and the application of engineering skills orally and/or in writing.

3-2. Understand the global impact of engineering solutions on societies needs.

3-3. Understand that the technology is constantly changing and industrial engineers must upgrade their knowledge in conjunction with the technological changes.

4-1. Recognize the importance of professional development through involvement and leadership in technical societies such as the IIE.

4-2. Have the broad knowledge to understand contemporary issues pertaining to the interaction between technology and society.

Industrial and Systems Engineering Laboratories

The industrial and systems engineering laboratory spaces are located in Moser Hall and are equipped with hardware, software and networks to serve experiences within the curriculum that are hands-on, team-based, and communications or computational intensive. Laboratory experiences develop capabilities to design detailed components and to integrate solutions into large scale systems. Successively more challenging assignments are taken on throughout the curriculum and culminate in comprehensive experiences in the capstone facilities design sequence.

The industrial and systems engineering program makes optimum use of the Engineering Computing Complex, which is equipped with state-of-the-art computation, design, and communication hardware and software of a multi-disciplinary nature.

The ISE Project Laboratory is focused on team-based activities throughout the curriculum and particularly serves the methods engineering, human factors engineering and facilities design areas. At its core is a network of computing stations equipped with modern industrial & systems engineering software. Data collection and processing software supports video analysis of human performance, workspace and manufacturing cell design, facility layout, flow analysis and line balancing. The goal

of this laboratory is to be able to cover any topic from the planning of initial resources for a start-up enterprise to the distribution of goods and services in global networks.

The Automation Laboratory Suite is a collection of spaces where students at all levels can learn and achieve together with an opportunity to make sustainable contributions to an initial or on-going project experience. It encompasses programmable robots, programmable logic controllers, vibratory bowl feeders, reciprocating feeders, power conveyors and numerous actuator and sensing devices.

The Manufacturing Laboratory Suite consists of several spaces containing equipment for rapid prototyping, casting processes, plastic injection molding and blow molding processes, CNC machining processes, sheet metal processing and instrumentation for inspection, measurement, and testing.

Curriculum for the Bachelor of Engineering Degree with a Major in Industrial and Systems Engineering

FIRST YEAR
FALL

Courses			s.h.
ENGL	1550	Writing 1	3
CHEM	1515	Chemistry 1	4
(Includes Chemistry 1 Lab)			0
ENGR	1550	Engineering Concepts	3
MATH	1571	Calculus 1	4
General Education Elective			3
			17

SPRING

Courses			s.h.
ENGL	1551	Writing 1	3
PHYS	2610	Physics 1	4
PHYS	2610L	Physics 1 Lab	1
ENGR	1560	Engineering Computing	3
MATH	1572	Calculus 2	4
General Education Elective			3
			18

SECOND YEAR
FALL

Courses			s.h.
MATH	2673	Calculus 3	4
ISEN	3724	Engineering Economy	3
ISEN	3710	Engineering Statistics	3
CEEN	2601	Statics	3
General Education Elective			3
			16

SPRING

Courses			s.h.
MATH Elective			3
MECH	2606	Material Properties	3
ISEN	3716	Systems Analysis & Design	3
ISEN	3736	Methods Engr.	2
ISEN	3736L	Methods Engr. Lab	1
General Education Elective			3
			15

THIRD YEAR
FALL

Courses			s.h.
ISEN	3727	Simulation IE Systems	3
ISEN	3745	Accounting for Engineers	3
ISEN	3723	Manufacturing Processes	2
ISEN	3723L	Mfg. Processes Lab	1
MECH	2641	Dynamics	3
General Education Elective			3
			15

SPRING

Courses			s.h.
PHYS	2611	Physics 2	4
PHYS	2611L	Physics 2 Lab	1
ISEN	3720	Statistical Quality Control	3
ISEN	Engineering Management Elective		3
ISEN	5801	Operations Research 1	3
CMST	1545	Comm Thry & Practice	3
			17

FOURTH YEAR
FALL

Courses			s.h.
ISEN	Operations Research Elective		3
*ISEN	4821	Facility Design I	3
ISEN	5820	Advanced Quality	3
ECEN	2632	Circuits	3
General Education Elective			3
			15

SPRING

Courses			s.h.
Engineering Elective 1			3
*ISEN	4822	Facility Design II	3
ISEN	5830	Human Factors	3
Science Elective			3
General Education Elective			3
			15

Total ..... 128 s.h.

*Capstone series consisting of two 3 sh courses

All electives must be selected with the consent of the student's departmental advisor.

Cooperative Education

The industrial and systems engineering program strongly encourages its students to actively participate in the optional cooperative education program. The parallel co-op arrangement which combines work and study each semester is recommended. However, full time employment in the summer can also be included. Students must register for a co-op course and submit a documented work report and the co-op evaluations completed by the students and their supervisor for a final letter grade. Currently a substitution of one elective course with three co-op experiences is allowed.

Advisement

The industrial and systems engineering program specifies mandatory advisement. Every student in

the program is advised every semester before his or her registration. Students cannot finalize their registration without approval of the faculty advisor or program coordinator.

MECHANICAL ENGINEERING PROGRAM

Professors Kim, Kudav, McCoy, Shields, Suchora (Coordinator); Assistant Professors Marie, Panta; Professor Emeritus McCoy.

Mechanical engineering is the branch of the engineering profession that deals with the conversion and use of energy; the design of machines and engines of all types; and the instrumentation and control of physical processes, systems and environments. The challenge of mechanical engineering is to use the principles of mathematics and the physical and thermal sciences to design and construct what people need and want. Mechanical engineers are concerned with the practical purpose and function of a machine or system, as well as its design for strength, reliability, safety, economy, and appearance.

Program Mission

The mission of the mechanical engineering program is to further the missions and objectives of the University and the College of Science, Technology, Engineering and Mathematics by providing an opportunity for a quality education in Mechanical Engineering to the people it serves, particularly those in the northeast Ohio and western Pennsylvania, and professional service to the local and regional industry and to the public. The program is committed to meeting regional and state-wide priorities in higher education by providing its students with a broad, general education and an up-to-date technological curriculum in a four-year undergraduate program, and an application-oriented evening graduate program which offers a Master of Science in Engineering degree to practicing engineers and recent engineering graduates. The program also strives to enhance quality research and scholarly activities to be integrated with teaching and to meet the needs of the region by providing the area schools, businesses, industries, and government agencies with technical expertise.

Program Educational Objectives

- The program will provide an educational environment rich in opportunities for students to obtain the knowledge and skills that will prepare its graduates for successful careers as a mechanical engineer or for advanced studies.
- The program will provide a comprehensive education for students to be able to identify, formulate, and solve engineering problems by applying fundamental knowledge of mathematics, basic and engineering sciences, and by utilizing modern techniques, methods, skills, and tools.
- The program will provide a strong technical education for students to be able to design a system, components, or process to meet the desired needs, as well as to design and conduct experiments, and to analyze the acquired data and interpret the results.
- Through the University's General Education Program, the program will provide a general education, complementary to its technical education, for students to be able to function on multidisciplinary teams, communicate effectively, understand the impact of engineering in a global and societal context, professional ethics, contemporary issues in engineering practice, and the necessity of life-long learning.

Program Outcomes

- Our students will be able to perform well as mechanical engineers and understand the impact of engineering in a global, societal, and environmental context.
- Our students will be able to identify, formulate, and solve engineering problems by applying fundamental knowledge of mathematics, basic sciences, and engineering sciences.
- Our students will be able to utilize modern engineering techniques, skills, and tools with an emphasis on the role that computers play in the process of solving engineering problems.
- Our students will be able to design and conduct experiments and to analyze and interpret data.
- Our students will be able to design mechanical engineering systems, components, or processes to meet the desired needs.
- Our students will be able to function and communicate effectively both individually and within multidisciplinary teams.
- Our students will be able to understand contemporary issues, professional and ethical responsibility, and the necessity of engaging in life long learning.

Vision Statement

Mechanical engineering and mechanical engineering education, in particular, face dramatic challenges in the future due to rapidly changing technologies and a new pattern of societal and industrial demands. The vision of the program is to meet these challenges and exceed the expectations of its constituents by focusing on the following primary strategies of the program:

- Continuous improvement of an educational environment for outstanding teaching and learning

- Development of a productive research program through a strategic focus on technology development in emerging areas such as controls, computing, and nanotechnology
- Successful co-op program that provides students with on-the-job training opportunity
- An assessment program and procedures in order to insure a high quality program in tune to the needs of the program's constituents; the students, alumni, employers, faculty, administrations, community and the general public
- Healthy enrollment that facilitates diversification of curriculum and faculty research and professional development

In order to achieve its educational objectives and to further the missions and objectives of the University and the College, the program provides an educational environment teeming with opportunities for students to learn and acquire essential knowledge and skills that are defined in the ABET Criteria 2000, through its curriculum and extra-curricular activities. The program maintains undergraduate and graduate curricula that are well balanced in engineering fundamentals, state-of-the-art technology, real-world engineering applications, and in both areas of fluid thermal and solid deformable bodies. The undergraduate curriculum also contains courses that foster critical and independent thinking; decision making; development of interpersonal communication and a life-long learning attitude; working within a team; and integration of knowledge, skills, ethics, and personal responsibility.

While the program intends to cultivate the capabilities of its students' problem solving, fundamental and advanced engineering analyses, design, research, and development, it also intends to provide the students with maximum exposure to hands-on, experimental skills to insure the high quality of its graduates. Through courses like stress analysis, control, and finite element analysis, students will acquire strong tools for design and pertinent knowledge to solve real-world engineering problems. Our emphasis on engineering applications, computer simulation, and hands-on experience are complementary to each other and encourage students to apply analytical methods to engineering problems. This approach enhances the effectiveness of teaching and also facilitates the students' understanding of abstract and difficult subjects. The ultimate goal of the program is to provide the society and industry with "whole person" mechanical engineers with superior technical capability.

Mechanical Engineering Laboratories

The mechanical engineering program maintains six physical experimental laboratories in Moser Hall. A wide array of modern equipment, instrumentation devices, and department-owned computers are housed in spacious rooms and support academic instruction and research activities in applied thermodynamics, heating and air conditioning, fluid mechanics, heat transfer, stress analysis, vibrations, and acoustics. Other mechanical engineering laboratories are simulation and computing-related laboratories that include computer-aided design and drafting, machine design, kinematic and dynamic systems, and finite-element analysis. The College and the mechanical engineering program maintain modern computing facilities in Moser Hall and constantly upgrade hardware and software. The students and faculty also use the university computing facilities in Meshel Hall and Kilcawley Center.

Curriculum for the Bachelor of Engineering Degree with a Major in Mechanical Engineering

FIRST YEAR

Courses			s.h.
ENGL	1550, 1551	Writing 1,2	6
MATH	1571, 1572	Calculus 1,2	8
CHEM	1515	Chemistry 1	4
PHYS	2610	Physics 1	4
ENGR	1550,	Engr Concepts	3
ENGR	1560	Engr Computing	3
CMST	1545	Comm Thry & Prtce	3
GER Electives			3
			34

SECOND YEAR

Courses			s.h.
MATH	2673	Calculus 3	4
MATH	3705	Differential Equations	3
PHYS	2611	Physics 2	4
CEEN	2601	Statics	3
CEEN	2602L	Str of Material	3
CEEN	2603	Str of Material Lab	1
MECH	2603	Thermodynamics 1	3
MECH	2604	Thermodynamics 2	3
MECH	2641	Dynamics	3
ECON	2610	Principles 1	3
MECH	2606	Materials	3
			33

THIRD YEAR

Courses			s.h.
MECH	3708	Engr Analysis	3
MECH	3720	Fluid Dynamic	3
MECH	3720L	Fluid Lab	1
MECH	3725	Heat Transfer	3
MECH	3742	Kinematics	3
MECH	3751	Stress 1	3
MECH	3751L	Stress 1 Lab	1
MECH	3762	Machine Design	3
MECH	3762L	Machine Design Lab	1
ECEN	2632	Circuit 1	3
STAT	3743 or ISEN 3710	Engr Statistics	3
PHIL	2625	Prof Ethics	3
GER Electives			3
			33

FOURTH YEAR

Courses			s.h.
MECH	4808	Mechanical System Design	2
MECH	4808L	Mechanical System Design Lab	1
MECH	4809	Mech Sys Design 2	3
MECH	4835	Thermal Fluid Applications	3
MECH	4835L	Thermal Fluid Applications Lab	1
MECH	5892	Control Mech Systems	3
MECH	5892L	Vibration & Control Lab	1
MECH	Electives		6
MECH	4881	Dynamics Sys + Vibrations	3
GER Electives			9
			32

MECHANICAL ENGINEERING ELECTIVES

Courses			s.h.
MECH	4800	Special Topics	3
MECH	4823	HVAC	3
MECH	5811	Solar Engineering	3
MECH	5825	Heat Transfer 2	3
MECH	5836	Fluid Power and Control	3
MECH	5852	Stress 2	3
MECH	5872	Acoustics	3
MECH	5884	Finite Element Analysis	3

Summary

Courses	s.h.
Writing and Speech (3 courses)	9
Art & Literature (2 courses)	6
Soc & Institution (3 courses)	9
Pers & Soc Responsibility (2 courses)	6
Nat Science (3 courses)	12
Mathematics (5 courses)	18
ENGR & Other Engr Programs (6 courses)	16
Mechanical Engineering (23 courses)	56
Total	**132 s.h.**

Cooperative Education

The mechanical engineering program strongly encourages its students to actively participate in the optional cooperative education program. The program includes an alternating and a parallel co-op arrangement. Co-op students are required to complete the same academic program for graduation as non-co-op students and will be considered full-time by the University in the semester which the students are off campus to do the co-op work. Students must register for a co-op course and submit a documented work report and the co-op evaluations completed by the students and their supervisor for a final letter grade.

Advisement

The mechanical engineering program specifies mandatory advisement. Every student in the program is advised every semester before his or her registration. Students cannot finalize their registration without approval of the faculty advisor or chair.

DEPARTMENT OF ENGINEERING TECHNOLOGY

Professors Bosela, Kurtanich (Director), Messuri; Associate Professors, Laird; Assistant Professors Costarell, George, Lamb, Moy, Vuksanovich; Instructors Coyne, Hrinko; Faculty Emeriti Krygowski, Slanina, Zupanic.

The Department of Engineering Technology offers "two-plus-two" programs in engineering technology. Students in these programs may work toward a two-year associate degree and then continue to earn a four-year bachelor's degree. The programs include both classroom and laboratory experiences which stress the application of established engineering and computer knowledge and methods to the solution of problems. They include study of the sciences and mathematics necessary to support a technology, as well as study of the methods, processes, skills, and materials used in that technology. The programs are designed to prepare graduates for job opportunities in industry and the public sector. Demands developed by an expanding technology place graduates of these programs in one of the fastest-growing occupational groups in the country.

Associate of Technical Study Degree

The Department of Engineering Technology offers Associate of Technical Study (A.T.S.) degrees in:

Electrical Utility Technology
Power Plant Technology

Students in these programs are awarded academic credit for skills-related experience and training to compliment the academic coursework at YSU.

Associate in Applied Science Degree

The department offers two-year programs in:

Civil and Construction Engineering Technology
Drafting and Design Technology
Electrical Engineering Technology
Mechanical Engineering Technology

Graduates of these programs are awarded the Associate in Applied Science degree and may serve as engineering technicians.

Engineering technicians function as aides or professional associates in support of scientists and engineers. Their work is in the design, drafting (CAD), development, testing, and production phases of engineering projects. Their tasks include laboratory testing, data gathering, evaluation, and instrument calibration. They may perform quality-control tests, serve as technical sales representatives, or serve as technical writers in the formulation of specifications or trade manuals.

Drafting and design graduates work with engineers, architects, and technicians in converting

ideas, designs, and sketches into workable plans and specifications using 2D and 3D solid modeling CAD techniques.

Degrees in these programs may be earned in four semesters if students average 17-18 hours per semester.

Bachelor of Science in Applied Science Degree

The civil and construction engineering technology, electrical engineering technology, and mechanical engineering technology programs are based on the "two-plus-two" educational system which provides the student with the flexibility of earning an associate degree and a bachelor's degree according to his or her needs. After completing the requirements of the associate degree, the student may elect to either enter industry or, through an added two years of full-time study (averaging 17 hours per semester) or equivalent part-time study, earn the Bachelor of Science in Applied Science (B.S.A.S.).

Graduates of the BSAS degree program obtain employment as engineering technologists or engineering designers for government agencies, consulting engineers and architects, industry and manufacturing, and contractors. Because their education is more extensive, they are prepared for more responsibility and more-rapid advancement. BSAS engineering technologists and designers plan, design, inspect, and direct construction, production, and maintenance activities.

Based on an evaluation of their work, transfer students who have a related associate degree from a regionally accredited institution may be admitted to the bachelor's degree program at the junior level.

Accreditation and Registration

The civil and construction, electrical, and mechanical engineering technology associate and bachelor programs are accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC-ABET). Graduates are qualified to apply to the National Institute for Certification in Engineering Technologies (NICET) for certification procedures in various specialty areas, depending on academic major and employment area. In many states, including Ohio, West Virginia and Pennsylvania, bachelor's degree graduates are qualified to take the Fundamentals of Engineering (FE) exam, and, with sufficient work experience, the Professional Engineers (PE) exam.

Cooperative Education

The School of Engineering Technology offers an optional cooperative education program for qualified students enrolled in the civil & construction engineering technology, electrical engineering technology, and mechanical engineering technology bachelor's degree programs. Engineering technology students typically participate in a parallel co-op which includes full-time employment and part-time academic study. Details about the co-op program may be obtained from the director of the School of Engineering Technology.

Admission Requirements

Admission to all School of Engineering Technology programs requires at least one year of high school algebra and one year of high school geometry with grades of C or better. Transfer students must be in good standing at their previous institution. All freshmen must take the Mathematics Placement Test prior to admission into the School of Engineering Technology.

Students not meeting the admission requirements are enrolled as pre-majors in the College of Science, Technology, Engineering, and Mathematics. While advising is provided by professional advisors within the college, these students are also encouraged to see the coordinator of the program in which they are interested for further orientation.

Qualified engineering technology students are urged to enroll in the ENTC 1505 course. It is designed to acquaint students with the nature of this career area, and therefore assist prospective students in determining the level of their interest. ENTC 1505 is required of all engineering technology majors.

CIVIL AND CONSTRUCTION ENGINEERING TECHNOLOGY

Assistant Professor Lamb, Program Coordinator

Students in the civil and construction engineering technology (CCET) program may choose to complete two years of study and earn an Associate in Applied Science (A.A.S.) degree. The A.A.S. degree provides early access to employment in engineering support positions. Upon completion of the A.A.S. degree, the student may continue on for the Bachelor of Science in Applied Science (B.S.A.S.) degree. This program provides additional coursework, continuing the student's growth to that of an engineering technologist or designer. Exceptional students may be eligible for enrollment in a Master of Engineering or Master of Business Administration program. Students interested in construction may choose a certificate program in construction management or the Associate of Technical Study degree in construction technology.

Program Educational Objectives

Educational objectives for the civil and construction engineering technology programs have been developed by faculty and the program industrial advisory committee to support the university, college, and School of Engineering Technology missions. Graduates of the CCET associate degree program are prepared to support civil engineers in structural design, public works, construction, inspec-

tion, transportation, and environmental engineering. Bachelor's degree graduates are prepared to assist with planning, design, inspection, and direction of the construction of projects involving buildings, roads, dams, bridges, airports, and wastewater treatment facilities.

During their first few years after earning of the civil and construction engineering technology degree at YSU, graduates will have demonstrated the ability to:

- Secure employment in a technical career related to their civil and construction engineering technology degree.
- Communicate effectively in a professional environment.
- Continue growth in professional knowledge and skills.
- Achieve recognition consistent with their educational achievements.

Program Outcomes

CCET students will demonstrate by the time of graduation:

- mastery of knowledge, skills, and tools of the discipline
- ability to apply knowledge to solve problems
- ability to conduct, analyze, and interpret experiments
- ability to be creative in design
- ability to work effectively in teams
- ability to identify, analyze, and solve technical problems
- ability to communicate effectively
- recognition of the need to engage in lifelong learning
- ability to understand professional, ethical, and social responsibilities
- respect for diversity, professional, societal, and global issues
- commitment to quality, timeliness, and continuous improvement

Associate Degree Program

The associate degree program prepares technicians to support civil engineers in structural design, public works, construction, transportation, and environmental engineering. Most graduates are hired by government agencies, consulting engineers, architects, and contractors.

Bachelor's Degree Program

The bachelor's program in civil and construction engineering technology prepares students for employment as engineering technologists or engineering designers. The student can concentrate in structures, construction, or transportation as interests dictate. A co-op program with the Ohio Department of Transportation or with other technical firms enables CCET students to gain experience and income during their junior and senior years. Many students work full or part time while completing the B.S.A.S. degree by taking evening classes. Students are encouraged to take the Fundamentals of Engineering (FE) exam as the first step toward professional registration.

Certificate Program—Construction Management Technology

The certificate program in construction management technology provides an in-depth, focused study of the fundamental concepts of construction materials, specifications, and construction management. It also provides technical fundamentals for more advanced study in the field. The certificate program consists of the equivalent of one year of full time study. Contact the CCET program coordinator for more information.

Individualized Curriculum Program (ICP)

Drawing heavily from the civil and construction engineering technology program, students may develop an ICP in construction management that includes coursework from the Williamson College of Business Administration.

Associate in Applied Science

FIRST YEAR
Fall Semester

ENTC	1505	Engr. Tech. Concepts	3
ENTC	1505L	Engr. Tech. Concepts Lab	1
MATH	1513	Algebraic & Transc. Fens	5
DDT	1503	AUTOCAD 1	2
DDT	1504	DRF and Plan 2	2
ENGL	1550	Writing 1	3
			16

Spring Semester

MET	1515	Mechanics 1	3
CCET	2604	Prop./Strength of Mat'ls	3
CCET	2614	Materials Lab 1	1
ENGL	1551	Writing 2	3
PHYS	1500	Conceptual Physics	3
GER		Elective	3
			18

SECOND YEAR
Fall Semester

CEEN	2610	Surveying 1	3
CEEN	2610L	Surveying 1 Lab	1
MET	2616	Mechanics 2	3
CCET	3709	Structural Analysis (2610)	3
CCET	2617	Constr. Methods & Material	3
GER		Elective	3
			16

Spring Semester

MATH	1570	Applied Calculus 1	4
CCET	3724	Hydr. & Land Dev.	3
CCET	3706	Structural Dsgn. 1	4
CCET	3711	Specs. & Estimating	3
CMST	1545	Communication Theory/Pract.	3
			17

Semester Hours for Associate Degree..... 67

Bachelor of Science in Applied Science

THIRD YEAR
Fall Semester

CCET	4812	Concrete Design	3
CCET	3705	Computing for Tech	3
MATH	2670	Applied Calculus 2	5
PHYS	1502	Physics 2	3
PHYS	1502L	Physics 2 Lab	1
GER	Elective		3
			18

Spring Semester

CCET	4813	Steel Design	3
CCET	3730	Transportation Tech	3
CCET	3740	Construction Mgmt.	3
Natural Sci.		Elective	4
GER		Elective	3
			16

FOURTH YEAR
Fall Semester

CCET	4815 or 4816 or 3712		3
CCET	3714	Soil Mechanics	3
CCET	3714L	Soil Mechanics Lab	1
CCET	4807	Project Planning & Scheduling	3
CCET	Technical Elective 1*		3
GER	Elective		3
			16

Spring Semester

CCET	4884	Civil/Struct. Facilities Design	3
EET	4880	Elect./Mech. Facilities Design	3
*CCET	Technical Elective 2*		3
GER	Elective		3
GER	Elective		3
			15

Semester Hours for BSAS..... 132

***Technical Electives**

CCET	4809	Structural Analysis 2	3
CCET	4810	Construction Surveying	3
CCET	4824	Environmental Technology	3
CCET	4814	Foundations	3
MET	4870	Appl. Finite Element	3
CEEN	4835	Highway Design	3
CEEN	5820	Pavement Material & Dsgn.	3
ENTC	4895	Indep. Engr. Tech Project	

DRAFTING AND DESIGN TECHNOLOGY

Assistant Professor Lamb, Program Coordinator

YSU's drafting and design technology (DDT) program prepares students to function as design drafters in either the mechanical or civil field. They study various design aspects, such as determination of size, form, and clearance and CAD drafting where they convert ideas, sketches, and specifications into working drawings and plans. Graduates earn the associate degree and are employable in industries relating to manufacturing, quality control, materials, and the fabrication and production of building structures and metal products. Graduates interested in further technical education should consider the "two-plus-two" bachelor's degree program in civil and construction engineering technology or mechanical engineering technology.

During their first few years after earning of the drafting and design technology degree at YSU, graduates will have demonstrated the ability to:

- Secure employment in a technical career related to their drafting and design technology degree.
- Communicate effectively in a professional environment.
- Continue growth in professional knowledge and skills.
- Achieve recognition consistent with their educational achievements.

Program Outcomes

Drafting and design technology students will demonstrate by the time of graduation:

- mastery of knowledge, skills, and tools of the discipline
- ability to apply knowledge to solve problems
- ability to conduct, analyze and interpret experiments
- ability to be creative in design
- ability to work effectively in teams
- ability to identify, analyze, and solve technical problems
- ability to communicate effectively
- recognition of the need to engage in lifelong learning
- ability to understand professional, ethical, and social responsibilities
- respect for diversity, professional, societal, and global issues
- commitment to quality, timeliness, and continuous improvement

Associate Degree Program

FIRST YEAR
FALL

Courses			s.h.
MATH	1513	Algebra and Trans Functions	5
ENTC	1505	Engr. Tech Concepts	3
ENCT	1505L	Engr. Tech Concepts Lab	1
DDT	1503	AUTOCAD 1	2
DDT	1504	DRF and Plan 2	2
ENGL	1550	Writing 1	3
			16

SPRING

Courses			s.h.
GER Elective*			3
MET	1515	Mechanics 1	3
DDT	2606	CAD Tech 2	4
CCET	2604	Properties + Str. of Mat'ls	3
CCET	2614	Materials Lab	1
MET	2630	Manuf. Techniques + Lab	2 + 1
			17

SECOND YEAR
FALL

Courses			s.h.
PHYS	1501/L	Physics 1 + Lab	4 + 1
DDT	2607	CAD Tech 3	2
DDT	2609	Industrial Tech	3
ENGL	1551	Writing 2	3
Technical Elective			3
			16

SPRING

Courses			s.h.
GER Elective*			3
CMST	1545	Comm Theory + Practice	3
DDT	2608	Machine Elements	3
Science Elective			3
Technical Elective			3
			15

Semester Hours for Associate Degree 64

* GER Elective must not be science

ELECTRICAL ENGINEERING TECHNOLOGY

Professor Messuri, Program Coordinator

Students in the electrical engineering technology (EET) program may choose to complete two years of study and earn an Associate in Applied Science (A.A.S.) degree. The A.A.S. provides early access to employment in engineering support positions. Upon completion of the A.A.S. degree, the student may continue on for the Bachelor of Science in Applied Science (B.S.A.S.) degree. This program provides additional coursework, continuing the student's growth to that of an engineering technologist or designer. Exceptional students may be eligible for enrollment in a Master of Engineering or Master of Business Administration program.

Educational Objectives

Educational objectives for the electrical engineering technology programs have been developed by faculty and the program industrial advisory committee to support the University, College, and Rayen School of Engineering and Engineering Technology missions. Graduates of the EET associate degree program generally function as assistants to electrical engineers in the design, analysis, and laboratory testing of electrical and electronic systems and of rotating machinery. Bachelor degree graduates are prepared to assist in the design and testing of electrical systems and may function independently in some areas.

During their first few years after earning of the electrical engineering technology degree at YSU, graduates will have demonstrated the ability to:

- Secure employment in a technical career related to their Electrical Engineering Technology degree.
- Communicate effectively in a professional environment.
- Continue growth in professional knowledge and skills.
- Achieve recognition consistent with their educational achievements.

Program Outcomes:

EET students will demonstrate by the time of graduation:

- mastery of knowledge, skills & tools of the discipline
- ability to apply knowledge to solve problems
- ability to conduct, analyze & interpret experiments
- ability to be creative in design
- ability to work effectively in teams
- ability to identify, analyze & solve technical problems
- ability to communicate effectively
- recognition of the need to engage in lifelong learning
- ability to understand professional, ethical & social responsibilities
- respect for diversity, professional, societal & global issues
- commitment to quality, timeliness & continuous improvement

Associate Degree Program

Graduates of the two-year electrical engineering technology program generally function as assistants to electrical engineers in the design, analysis, and laboratory testing of electrical and electronic systems and of rotating machinery. Most graduates are employed by electrical and electronic equipment manufacturers, utility companies, the aerospace industry, and manufacturing companies in general.

Several options are available for the associate degree in EET. Most students opt for the **traditional** or the **computer** option.

Bachelor's Degree Program

The bachelor's degree program in electrical engineering technology prepares students for employment as engineering technologists or engineering designers. The students focus on analog and digital electronics communication systems, and computer networking systems. Co-op programs with various local companies enable EET students to gain experience and income during their junior and senior years. Many students work full or part-time while completing the BSAS degree taking evening classes. Students are encouraged to take the Fundamentals of Engineering (FE) exam as the first step toward professional registration.

Associate Degree Program

TRADITIONAL OPTION
FIRST YEAR
FALL

Courses			s.h.
MATH	1513	Algebra/Trans functions	5
ENTC	1505	Engr. Tech Concepts	3
ENTC	1505L	Engr. Tech Concepts Lab	1
EET	1501L	Circuit Theory 1 + Lab	3+1
DDT	1503	AUTOCAD 1	2
DDT	1504	DRF and Plan 2	2
			17

SPRING

Courses			s.h.
MATH	1570	Applied Calculus 1	4
PHYS	1501/L	Physics 1 + Lab	4+1
EET	1502/L	Circuit Theory 2 + Lab	3+1
ENGL	1550	Writing 1	3
EET	2620/L	Digital Electronics + Lab	2+3
			19

SECOND YEAR
FALL

Courses			s.h.
EET	2605/L	Electronics 1 + Lab	3+1
EET	3710/L	Electrical Machines + Lab	3+1
ENGL	1551	Writing 2	3
GER Elective			3
GER Elective			3
			17

SPRING

Courses			s.h.
EET	3735/L	Microprocessor Arch. + Lab	3
EET	3706/L	Electronics 2 + Lab	3+1
EET	3712/L	PLC's + Lab	3+1
CMST	1545	Comm Theory & Practice	3
CHEM	1515/L	Chemistry 1 & Lab	4
			18

Semester Hours for AAS - Traditional Opt. 71

COMPUTER OPTION
FIRST YEAR
FALL

Courses			s.h.
MATH	1513	Algebra/Transc. Functions	5
ENTC	1505	Engr. Tech Concepts	3
ENTC	1505L	Engr. Tech Concepts Lab	1
EET	150/L	Circuit Theory 1 + Lab.	3+1
EET	2650	PC Hardware	3
GER Elective			3
			19

SPRING

Courses			s.h.
MATH	1570	Applied Calculus 1	4
EET	1502/L	Circuit Theory 2 + Lab.	3+1
EET	2620/L	Digital Electronics + Lab	2+1
ENGL	1550	Writing 1	3
CSIS	2610	Prog. & Prob. Solving	4
			18

SECOND YEAR
FALL

Courses			s.h.
EET	2605/L	Electronics 1 + Lab	3+1
ENGL	1551	Writing 2	3
EET	2651	Digital Comm. Systems 1	3
CSIS	3782	Cisco Networking Academy 2	4
GER Elective			3
			17

SPRING

Courses			s.h.
EET	3735/L	Microproc Arch. & Lab	3
EET	2653	Fiber Optics	3
CSIS	3783	Cisco Networking Academy 2	4
CMST	1545	Comm. Theory & Practice	3
PHYS	1501/L	Physics 1 & Lab	4+1
			18

Semester Hours for AAS - Computer Opt. 72

Bachelor's Degree Program

THIRD YEAR
FALL

Courses			s.h.
MATH	2670	Applied Calculus 2	5
EET	3730/L	Logic Systems & Lab	3
EET	3780/L	Communication Systems.	3
ENGL	3743	Prof. + Tech. Comm.	3
GER Elective			3
			17

SPRING

Courses			s.h.
EET Elective			3
MET	3700	Physical Measurements	3
MET	2630/L	Mfg. Techniques + Lab	2+1
CCET	3705	Computing for Technologists	3
GER Elective			3
			15

FOURTH YEAR
FALL

Courses			s.h.
EET	3745/L	Microprocessor 2 & Lab	3
EET Elective			3
Natural Science		GER Elective	3
GER Elective			3
GER Elective			3
			15

SPRING

Courses			s.h.
EET	3760/L	Variable Speed Drives & Lab	3
EET	4870	Process Control Technology	4
EET	4880	Elec & Mech Facilities Design	3
CCET	4884	Civil & Struct Facilities Design	3
GER Elective			3
			16

Semester Hours for BSAS..... 134

MECHANICAL ENGINEERING TECHNOLOGY

Assistant Professor Costarell, Program Coordinator

The mechanical engineering technology (MET) program is designed as a "two-plus-two" program. Students may earn an Associate in Applied Science degree after two years of full-time study. With this degree, they may begin a career in industry. The associate degree graduate can continue for two more years of full-time study to earn the bachelor's degree.

Educational Objectives

Educational objectives for the MET programs have been developed by faculty and the program industrial advisory committee to support the University, the College, and the Rayen School of Engineering and Engineering Technology missions. Graduates of the MET associate degree program function as assistants in the design, drafting and testing of mechanical products, equipment and processes. Bachelor's degree graduates assume greater responsibility in the design and testing of mechanical products, processes, and equipment.

During their first few years after completion of the mechanical engineering technology program at YSU, graduates will have demonstrated the ability to:

- Work competently in technical and professional careers related to the field of mechanical engineering technology.
- Communicate effectively in a professional environment.
- Continue growth in professional knowledge and skills.
- Achieve recognition and/or compensation consistent with their educational achievements.

Program Outcomes

MET students will demonstrate by the time of graduation:

- mastery of knowledge, skills, and tools of the discipline
- ability to apply knowledge to solve problems
- ability to conduct, analyze, and interpret experiments
- ability to be creative in design
- ability to work effectively in teams
- ability to identify, analyze, and solve technical problems
- ability to communicate effectively
- recognition of the need to engage in lifelong learning
- ability to understand professional, ethical, and social responsibilities
- respect for diversity, professional, societal, and global issues
- commitment to quality, timeliness, and continuous improvement

Associate Degree Program

The associate degree program introduces the student to the principles and practices of machine design, manufacturing processes, testing, and energy conversion. Students are also given a firm foundation in communications, mathematics and science. Upon completion of the associate degree, graduates may find employment as engineering technicians in a wide variety of industries. They assist engineers in the design, drafting, testing, and support of mechanical products, or of the industrial equipment and processes used to manufacture consumer products.

Bachelor's Degree Program

Students who have earned the associate degree may elect to complete the bachelor's degree on either a full- or part-time basis. Courses in the bachelor's degree program further develop technical, communication, and managerial skills. Upon successful completion of the coursework, graduates are awarded the

Bachelor of Science in Applied Science degree, and are prepared for greater levels of responsibility and greater career advancement.

Curriculum

FIRST YEAR
FALL

Courses			s.h.
MATH	1513	Algebra/Trans Functions	5
ENTC	1505	Engr. Tech Concepts	3
ENTC	1505L	Engr. Tech Concepts Lab	1
DDT	1503	AUTOCAD 1	2
DDT	1504	DRF and Plan 2	2
ENGL	1550	Writing 1	3
GER Elective			3
			19

SPRING

Courses			s.h.
PHYS	1501/L	Physics 1 + Lab	4+1
MET	1515	Mechanics 1	3
CCET	2604	Properties & Str of Mat'ls	3
CCET	2614	Materials Lab 1	1
ENGL	1551	Writing 2	3
			15

SECOND YEAR
FALL

Courses			s.h.
MATH	1570	Applied Calculus 1	4
PHYS	1502/L	Physics 2 + Lab	3+1
MET	3714/L	Fluid Mechanics + Lab	2+1
MET	2616	Mechanics 2	3
MET	3706	Machine Design 1	3
			17

SPRING

Courses			s.h.
MET	3705	Thermodynamics	3
MET	2630/L	Mfg Techniques + Lab	2+1
MET	3707	Machine Design 2	3
CMST	1545	Comm Theory & Practice	3
DDT	2606	CAD Tech 2	4
GER Elective		3	
			19

Semester hours for Associate Degree.....70

Bachelor's Degree Program

THIRD YEAR
FALL

Courses			s.h.
MATH	2670	Applied Calculus 2	5
MET	3711	Heat & Power Cycles	3
EET	3725	Electromechanical Systems	4
MET Elective*			3
ISEN/MGT Elective			3
			18

SPRING

Courses			s.h.
MET	3720	Mechanisms	3
MET	3715	Fluid Power Systems	3
MET	3700	Physical Measurements	3
CCET	3705	Computing for Technologists	3
GER Elective			3
			15

FOURTH YEAR
FALL

Courses			s.h.
MET Elective*			3
MET	4820	Machine Systems	3
MET	4810	Mfg Systems Analysis	3
CHEM 1505/L or 1515/L			3 or 4
GER Elective			3
			16

SPRING

Courses			s.h.
MET	4870	Applied Finite Elmnt	3
MET	4860/L	Robotics Technology + Lab	2+1
GER Elective			3
GER Elective			3
GER Elective			3
			15

Semester hours for BSAS 134

*** MET Electives**

MET	3710	Tool Design
MET	4812	Numerical Control
MET	4890	Special Topics in MET
EET	4880	Elec & Mech Facilities Design
ENTC	4895	Independent ET Project

ELECTRIC UTILITY TECHNOLOGY

Professor Bosela, Program Coordinator

This program is offered in partnership with First Energy Corporation. It prepares students to perform basic overhead and underground line work for electric utility and other related industries. Students gain knowledge in electrical theory and other areas, including college writing, oral communications, and general education. In addition to classroom instruction, students also participate in skills-related lab experiences at a local electric utility company facility. Upon successful completion of the program, students are prepared for entry-level employment in the utility industry. Enrollment in the program is restricted.

Please note that FirstEnergy is not accepting any additional applications for the lineworker program for Fall 2009. Please contact LaMinda Nichols at FirstEnergy at 440-604-9803 for possible consideration for Fall 2010 admission.

Associate of Technical Study Degree Program

FIRST YEAR
FALL

Courses			s.h.
MATH	1501	Elementary Algebraic Models	5*
ENTC	1500	Technical Skills Development	4
EUT	2690	Electric Utility Lab 1	6
			10

SPRING

Courses			s.h.
MATH	2623	Survey of Math	3
EUT	1500/L	Electrical Fundamentals + Lab	3+1
ENGL	1550	College Writing 1	3
GER	Societies and Institutions (ECON 1501)		3
EUT	2691	Electric Utility Lab 2	6
			19

FIRST YEAR
SUMMER

Course			s.h.
EUT	2699	Electric Utility Co-op	2

SECOND YEAR
FALL

Courses			s.h.
EUT	2600	Electric Utility Dist. Systems	4
ENGL	1551	College Writing 2	3
CMST	1545	Comm Theory and Practice	3
EUT	2692	Electric Utility Lab 3	6
			16

SPRING

Courses			s.h.
EUT	2601	Electrical Codes and Standards	4
GER-PS	Personal + Social Resp. (PHIL 2609 or HSC 1568)		3
PHYS	1500/L	Conceptual Physics and Lab	4
EUT	2693	Electric Utility Lab 4	6
			17

Total semester hours for degree 64

*Note: MATH 1501 may be required based on the results of the Math Placement Test. However, the 5 sh credit for MATH 1501 cannot be counted toward the degree and is therefore not included in the total for Semester 1 or in the total required for the degree.

POWER PLANT TECHNOLOGY

Professor Bosela, Program Coordinator

This program prepares graduates to perform basic operating functions required in electric utility power plants and other related industries. Students gain knowledge in electrical theory, electrical machinery and controls, power plant operations, boiler, turbine, and generator operations, power plant instrumentation, and pollution control equipment. In addition, college writing, oral communications, and general education form an integral part of the program. Upon successful completion of the program, students are prepared for entry-level employment in the utility industry as power plant operators.

Associate of Technical Study Degree Program

FIRST YEAR
FALL

Courses			s.h.
GER - PS	Personal & Social Responsibility		3
ENGL	1550	College Writing 1	3
ENTC	1500	Technical Skills Development	4
EUT	1502/L	Power Plant Fundamentals + Lab*	4+2
			16

SPRING

Courses			s.h.
EUT	1500/L	Electrical Fundamentals + Lab	3+1
EUT	1503/L	Power Plant Mechanical Equipment + Lab	3+1
MATH	2623	Survey of Math	3
ENGL	1551	College Writing 2	3
GER - SI	Societies & Institutions		3
			17

SUMMER

Course			s.h.
EUT	2699	Electric Utility Co-op (Optional)	2

SECOND YEAR
FALL

Courses			s.h.
EUT	2604/L	Power Plant Elec. Equip. + Lab	3+1
EUT	2605/L	Intermediate Power Plant Systems + Lab	3+1
EUT	2606/L	Power Plant Operator Practice + Lab	3+1
CMST	1545	Communication Theory and Practice	3
			15

SPRING

Courses			s.h.
EUT	2607/L	Power Plant Inst and Control + Lab	3+1
EUT	2608/L	Advanced Power Plant Systems	3+1
EUT	2609/L	Power Plant Supervision + Lab	3+1
GER - NS		Nat. Sci. Elect and Lab	3+1
			16

Semester Hours for degree 64-66

*Note: MATH 1501 or level 3 on the MPT and eligibility to take ENGL 1550 (i.e., completion of R&SK and ENGL 1540 or test out) are prerequisites. ENTC 1500 is a pre- or co-requisite.