ENGINEERING

ASSOCIATE OF SCIENCE (AS) – 60 CREDITS

About this program

The Associate of Science in Engineering consists of sequential math, physics and other science courses that will transfer to either a BS in physics or to diverse engineering programs at many four-year colleges and universities. An AS in Engineering will also create options for technical jobs in the upcoming new energy sector. In general, a degree in engineering has been and will continue to be an excellent platform for success across a wide range of careers in the private sector and in government, schools, colleges and universities.

Program outcomes

1. Demonstrate an understanding of scientific theories and the scientific method.
2. Demonstrate the ability to formulate and test hypotheses or scientific principle by performing laboratory or field experiments.
3. Demonstrate the ability to collect, organize, analyze and interpret experimental data, perform statistical and graphic analyses by employing appropriate mathematical treatment, recognize and determine sources of error, and evaluate numerically experimental uncertainty.
4. Communicate experimental findings, analyses, and interpretation and results both orally and in writing.
5. Demonstrate significant proficiency with the use of algebra, trigonometry and calculus to analyze equations of physics and chemistry and solve problems.
6. Demonstrate capacity to analyze different physics word problems, translate them to mathematical forms, solve them and effectively communicate the results in writing.
7. Demonstrate the ability to use dimensional analysis for problem solving.
8. Demonstrate the capacity to set up laboratory apparatus to perform experiments using schematic drawings and with minimal instruction.
9. Demonstrate knowledge about mathematical and logical modes of thinking and appreciate the breadth of applications of mathematics, logic and statistics to make decisions.
10. Analyze the logical connections among the facts, goals and implicit assumptions relevant to a problem or claim; generate and evaluate implications that follow from them.
11. Gather factual information and apply it to a given problem in a manner that is relevant, clear, comprehensive and conscious of possible bias in the information selected.

Curriculum overview

Crds	Requirement type
48	Required courses
3	Restricted electives in courses
9	Restricted electives in special requirements
60	**Total**

Developmental courses note: A student may be required to enroll in developmental courses in reading, writing and math. A student's scores on the Accuplacer assessment will determine enrollment in developmental courses. The purpose of developmental courses is to prepare students for the demands of a college-level curriculum. *Credits may vary.*

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Accreditation: Minnesota State Community and Technical College is accredited by the Higher Learning Commission, a regional accreditation agency recognized by the U.S. Department of Education. The Higher Learning Commission 230 South LaSalle Street, Suite 7-500 Chicago, IL 60604-1411 http://www.ncahigherlearningcommission.org Phone: 312.263.0456 / 800.621.7440

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Curriculum requirement details

Required courses

Course	Crds
CHEM1111 - General Chemistry I	5
CHEM1112 - General Chemistry II	5
COMM1120 - Introduction to Public Speaking	3
ENGL1101 - College Writing	3
ENGR2210 - Engineering Mechanics I	3
ENGR2220 - Engineering Mechanics II	3
ENGR2230 - Mechanics of Materials	3
MATH1134 - Calculus I	5
MATH1135 - Calculus II	5
MATH2231 - Calculus III	4
MATH2259 - Differential Equations	4
PHYS1412 - University Physics II	5

Other requirements or restricted electives

3 credits from one or more of these Courses:

Course title	Credits
ENGL1205 - Writing About Literature	3
ENGL1210 - Writing About Current Issues	3
ENGL1215 - Writing for the Workplace	3

Special Requirement: 3 credits

- General Education w/MnTC Goals. A minimum of 2 additional goal areas must be met through elective general education courses.

Special Requirement: 6 credits

- General Education w/MnTC goals OR ENGR2970 OR CADD1000 OR CADD2120

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Course summaries

CHEM1111 - General Chemistry I ..... ***(5 credits)***
Meets MnTC Goal Areas 2 and 3. This course is the first of a two-course series (CHEM1111 and CHEM1112) intended for science majors. Students will learn the general chemistry principles: problem solving, nomenclature, atomic structure, electronic structure, stoichiometry, titration, reaction types, molecular structure, thermochemistry, electronic structure, and properties and laws of gases. The course includes a lab. Students completing the two-semester sequence will be competent in all areas listed in General Chemistry I & II of the Minnesota State Chemistry Transfer Pathway.

Prerequisites:

- MATH1020

CHEM1112 - General Chemistry II ..... ***(5 credits)***
Meets MnTC Goal Areas 2 and 3. This course is the second of a two-course series (CHEM1111 and CHEM1112) intended for science majors. Students will learn the general chemistry principles: intermolecular forces, properties of solids and liquids, solution chemistry, kinetics, chemical equilibrium, acid-base equilibrium, solubility equilibrium, thermodynamics, electrochemistry, nuclear chemistry, and possibly coordination chemistry and an introduction to environmental chemistry. The course includes a lab. Students completing the two-semester sequence will be competent in all the areas listed in General Chemistry I & II of the Minnesota State Chemistry Transfer Pathway.

Prerequisites:

- CHEM1111
- MATH1114

COMM1120 - Introduction to Public Speaking ..... ***(3 credits)***
Meets MnTC Goal Area 1. This course clarifies the process of oral communication, clarifies the basic principles of public speaking and allows the student to increase the application of these principles while both speaking and listening.

Prerequisites:

- Assessment into ENGL 1101

ENGL1101 - College Writing ..... ***(3 credits)***
Meets MnTC Goal Area 1. This is an introductory course designed to prepare students for later college and career writing through a process approach with particular emphasis on revision. Students consider purpose and audience as they read, discuss and refine their work to develop confidence in their writing and communication skills.

Prerequisites:

- ELL1085
- ENGL0097
- or placement in College Level English.

ENGR2210 - Engineering Mechanics I ..... ***(3 credits)***
This course provides an introduction to the principles of mechanics, including equilibrium of particles and rigid bodies; distributed forces, centroids and centers of gravity; moments of inertia of areas; analysis of simple structures and machines; and various types of friction.

Prerequisites:

- MATH1134

ENGR2220 - Engineering Mechanics II ..... ***(3 credits)***
This course introduces the theory and application of dynamics of particles and rigid bodies. Topics include the kinematics and kinetics of particles and rigid bodies (translational and rotational), principles of work and energy, and principles of impulse and momentum.

Prerequisites:

- ENGR2210
- MATH1135

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ENGR2230 - Mechanics of Materials ..... ***(3 credits)***
This course provides an introduction to the study of stress, strain, deformation and failure of elastic bodies subjected to external forces. Topics include the relationships between the applied loads and the resulting stresses and deformations in an elastic body, stress-strain relations and the design of structural members subjected to known loads.

Prerequisites:

- ENGR2210

MATH1134 - Calculus I ..... ***(5 credits)***
Meets MnTC Goal Areas 2 and 4. This course includes limits and continuity, derivatives, definite and indefinite integrals of algebraic, trigonometric, exponential and logarithmic functions, and applications of the derivative and definite integral.

Prerequisites:

- MATH1116

OR

- MATH1118

OR

- MATH1115
- or by placement exam

MATH1135 - Calculus II ..... ***(5 credits)***
Meets MnTC Goal Areas 2 and 4. This course includes integration of logarithmic, exponential, trigonometric and hyperbolic functions and their inverses. Students will apply techniques of integration. Polar coordinates, conic sections, indeterminate forms, improper integrals and infinite series are also included.

Prerequisites:

- MATH1134

MATH2231 - Calculus III ..... ***(4 credits)***
Meets MnTC Goal Areas 2 and 4. The course content includes a study of vectors in the plane and space, differentiation and integration of vector-valued functions, and partial differentiation, multiple integrals, including line and surface, in rectangular, polar, cylindrical, spherical and other systems, and a study of Stokes' Theorem, Green's Theorem, and the Divergence Theorem.

Prerequisites:

- MATH1135

MATH2259 - Differential Equations ..... ***(4 credits)***
This course includes first and second order differential equations with applications in physics, electrical engineering and chemistry. It also includes Laplace transforms, matrices, series solutions and systems of differential equations.

Prerequisites:

- MATH2231

PHYS1412 - University Physics II ..... ***(5 credits)***
Meets MnTC Goal Area 3. This course is open to all students but is especially suited for engineering students. The course is a continuation of Physics 1411, University Physics I. However, it may be taken without having taken Physics 1411. Topics include thermodynamics, selected topics in electricity and magnetism, DC and AC circuit theory, optics, light and electromagnetic radiation, atomic physics, spectroscopy, lasers, photonics and nuclear physics. Lab equipment is used to illustrate these concepts. A mastery of college algebra as well as knowledge of calculus and trigonometry is essential for success in this course. Lab is required.

Prerequisites:

- MATH1134

ENGL1205 - Writing About Literature ..... ***(3 credits)***
Meets MnTC Goal Area 1. This course builds on the foundations of College Writing and provides students with additional opportunities to develop fluency in their writing through a process approach. Students read critically from a variety of literary genres, explore meaning through academic research and responding through discussion and writing. Coursework includes an introduction to argumentative writing and writing from academic sources.

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ENGL1210 - Writing About Current Issues ..... ***(3 credits)***
Meets MnTC Goal Area 1. This course builds on the foundations of College Writing and provides students with additional opportunities to develop and refine their writing through a process approach. Students explore current issues by critically reading a variety of texts, conducting academic research and responding through discussion and writing.

ENGL1215 - Writing for the Workplace ..... ***(3 credits)***
Meets MnTC Goal Area 1. This composition course focuses on writing and designing professional and technical documents, including print and non-print correspondence, descriptions, instructions, reports and proposals, along with promotional material. Analysis, critical thinking and synthesis of sources will be covered, along with the development of presentation skills. Coursework also includes a formally documented, multi-source professional project. This course builds on the foundations of College Writing and provides students with additional opportunities to develop and refine their writing through a process approach.

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Program Plan — "Primary"

Locations: Moorhead

1st Fall Term (16 credits)

Courses

Course	Crds
CHEM1111 - General Chemistry I	5
ENGL1101 - College Writing	3
MATH1134 - Calculus I	5

3 credits in one or more of the following:

General Education w/MnTC Goals. A minimum of 2 additional goal areas must be met through elective general education courses.

1st Spring Term (16 credits)

Courses

Course	Crds
CHEM1112 - General Chemistry II	5
ENGR2210 - Engineering Mechanics I	3
MATH1135 - Calculus II	5

3 credits in one or more of the following:

ENGL1205 - Writing About Literature 3
ENGL1210 - Writing About Current Issues 3
ENGL1215 - Writing for the Workplace 3

2nd Fall Term (13 credits)

Courses

Course	Crds
COMM1120 - Introduction to Public Speaking	3
ENGR2220 - Engineering Mechanics II	3
MATH2231 - Calculus III	4

3 credits in one or more of the following:

General Education w/MnTC goals OR ENGR2970 OR CADD1000 OR CADD2120

2nd Spring Term (15 credits)

Courses

Course	Crds
ENGR2230 - Mechanics of Materials	3
MATH2259 - Differential Equations	4
PHYS1412 - University Physics II	5

3 credits in one or more of the following:

General Education w/MnTC goals OR ENGR2970 OR CADD1000 OR CADD2120

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