

Addendum to Transfer Articulation Agreement

Between

Minnesota State Colleges and Universities System Colleges

And

Minnesota State Colleges and Universities System Universities in
Engineering Broad Field Transfer Agreement

The Engineering Broad Field Transfer Agreement will remain in effect until June 30, 2019. A review of the agreement began January, 2018.

MINNESOTA STATE COLLEGES AND UNIVERSITIES¹ ENGINEERING BROAD FIELD AGREEMENT

This Agreement is entered into between Minnesota State University, Mankato; St. Cloud State University; Winona State University; University of Minnesota, and any system college approved to offer the Associate in Science Engineering Broad Field degree program. Any system college that offers the Associate in Science Engineering Broad Field program is a party to this agreement. This Agreement and any amendments and supplements, shall be interpreted pursuant to the laws of the State of Minnesota.

This agreement is applicable to university engineering degree programs listed in Table 2 and System colleges approved to offer the Associate in Science Engineering Broad Field degree program as outlined in Table 1. This agreement will facilitate credit transfer and provide a smooth transition from one related program to another. It is mutually agreed that:

Admission and Graduation Requirements

- A. System university admission and program admission requirements apply equally to both direct entry students and to students who transfer under this agreement.
- B. Baccalaureate engineering degree programs may have limited enrollment capacity with seats available on a competitive basis.
- C. Completion of the Associate in Science Engineering Broad Field degree program does not guarantee admission to a baccalaureate degree program.
- D. Students accepted into a system university must fulfill the baccalaureate program graduation requirements.

Transfer of Credits

- A. Engineering Broad Field degree program required courses are listed in Table 1. MnSCU colleges and universities will provide advising to students on the selection of elective courses most suited to the student's intended engineering baccalaureate major.
- B. All general education courses named in Table 1. transfer and count toward the university engineering baccalaureate degree program requirements. MnTC Goal Areas are determined by the sending college.
- C. All engineering specialty courses labeled Required (Req) within the chosen specialty area in Table 1. transfer and count toward the university baccalaureate degree program requirements. Students must consult with an advisor or transfer specialist to determine whether courses labeled As Advised (Adv) will transfer to a particular university engineering program. Specific advising information, including the name of the college and the specific university engineering program should be retained by students for reference in the case of an appeal.
- D. Students must meet at least six of the ten Minnesota Transfer curriculum goal areas to receive the Associate of Science in Engineering Broad Field degree. Students who want to meet more than six goal areas should consult with an advisor or transfer specialist regarding goal area requirements that fit best with the selected engineering program.

¹ The Board of Trustees of the Minnesota State Colleges and Universities is authorized by Minnesota Statutes, Chapter 136F to enter into Agreements and has delegated this authority to colleges and universities.

Table 1: Engineering Broad Field Course Requirements								
General Education*								Minimum Credits**
English Composition								3
Humanities, History, Behavioral or Social Sciences. Two courses that satisfy Goals 5 and 6. One of these courses must also satisfy at least one of goals 7, 8, 9, or 10.								6
Calculus I								4
Calculus II								4
Multivariable Calculus								4
Differential Equations								3
Physics I (calculus-based, with lab)								4
Physics II (calculus-based, with lab)								4
Chemistry I (Computer Engineering students substitute MnTC course as advised)								4
* MnTC Goal Area is determined by the sending college. **Course credits may vary by college								36
Minimum MnTC Subtotal								
Engineering Specialties: Programs must offer all required courses for at least three of the seven engineering specialties.								
Select a <u>minimum</u> of 4 courses and 12 credits from a single engineering specialty (e.g. civil, computer, general, mechanical, etc.).								
Key: "Req" = required university program course; "Adv" = see advisor/transfer specialist to confirm transfer to university program								
Civil	Computer	Electrical	General	Mech	Manuf	Composite		Minimum Credits**
Adv	Adv	Adv	Req	Req	Adv	Req	Intro to Engineering	2
	Req	Req	Req	Req	Adv	Req	Comp Programming	3
Req		Adv	Req	Req	Req	Req	Statics	3
Req		Adv	Req	Req	Req	Req	Dynamics	3
Req			Req	Req	Req	Req	Deformable Body Mechanics	3
Req UMN-Adv		Adv	Adv	Req	Adv	Adv	Thermodynamics	3
	Req	Req	Req	Req	Req	Req	Circuits I (with lab)	4
	Req	Req					Circuits II	3
	Req	Req		Adv			Digital logic	3
UMN-Adv	Adv			Adv	Adv	Adv	Probability & Statistics	3
Adv	Adv	Adv	Adv	Adv	Adv	Req	Chemistry II	3
						Req	Organic Chemistry I & II	6
A total of 60 credits is required to complete the degree program. If necessary, complete additional general education or engineering specialty courses. See an advisor or transfer specialist for guidance on courses that will best transfer to the selected university engineering program.								60

APPLICABLE PROGRAMS. To complete an engineering baccalaureate degree program, courses from the Associate in Science Engineering Broad Field degree program will transfer to university programs listed in Table 2 according to the terms of this agreement.

Table 2. Engineering Broad Field, AS, articulates to the following related university programs²
Minnesota State University, Mankato (limited seats available on a competitive basis) <ul style="list-style-type: none"> ▪ Civil Engineering ▪ Computer Engineering ▪ Electrical Engineering ▪ General Engineering ▪ Mechanical Engineering
St. Cloud State University (limited seats available on a competitive basis) <ul style="list-style-type: none"> ▪ Computer Engineering ▪ Electrical Engineering ▪ Manufacturing ▪ Mechanical Engineering
Winona State University (limited seats available on a competitive basis) <ul style="list-style-type: none"> ▪ Composite Materials Engineering

Terms of Agreement

- A. This Articulation Agreement is effective on January 1, 2013, and shall remain in effect until the end date of January 1, 2018, or five years, whichever occurs first. This Articulation Agreement will be reviewed by all parties within five years of the effective date, on or before August 1, 2017 (within six months of the end date).
- B. The Chief Academic Officers or designees of the parties to this agreement will implement the terms of this agreement, including identifying and incorporating any changes into subsequent agreements, assuring compliance with system policy, procedure and guidelines, and conducting a periodic review of this agreement.
- C. Program curriculum and requirements may change as agreed by all parties.

By my signature below, I support the terms of this "MINNESOTA STATE COLLEGES AND UNIVERSITIES ENGINEERING BROAD FIELD ARTICULATION AGREEMENT"

Linda Baer, Interim Vice President for Academic and Student Affairs

Minnesota State University, Mankato

Electronic signature on file.

Date: 12/19/2012

² See advisor or transfer specialist for guidance or questions regarding the selected baccalaureate program.

Devinder Malhotra, Provost and Vice President for Academic Affairs
St. Cloud State University

Electronic signature on file.

Date: 12/19/2012

Nancy Jannik, Interim Provost and Vice President for Academic Affairs
Winona State University

Electronic signature on file.

Date: 12/21/2012

Engineering Core & Elective Course Descriptions

Introduction to Engineering. Overview of engineering fundamentals and various engineering disciplines (mechanical, electrical, civil, chemical, manufacturing and/or composite materials engineering). Extensive exposure to visual, written and oral communication forms and to computer-based design tools.

Calculus I. This course is a thorough treatment of differentiation and an introduction to integration. Topics include the definition of derivative, limits and continuity, differentiation, applications of the derivative, definite and indefinite integrals, the Fundamental Theorem of Calculus, techniques of integration and applications of integration. (NH)

Calculus II. This course continues the study of the definite and indefinite integrals and leads to a study of improper integrals and infinite series. Topics include advanced techniques of anti-differentiation, numerical integration techniques and error bounding, applications of the integral, improper integrals, an introduction to differential equations, infinite series, parametric equations, and polar coordinates. (NH)

Multivariable Calculus. Multivariable functions and vector functions are studied as the concepts of differential and integral calculus are generalized to surfaces and higher dimensions. Topics include vectors, parametric equations, cylindrical and spherical coordinates, partial and directional derivatives, multiple integrals, line and surface integrals, and the theorems of Green, Gauss, and Stokes.

Differential Equations. Solution techniques for ordinary differential equations including boundary/initial value problems and systems of first-order equations. Topics include linear homogeneous and non-homogeneous differential equations and the Laplace transform. Methods of linear algebra are studied as they apply to the solution of differential equations.

Physics I (calculus-based, with lab). Designed for science and engineering students. Calculus-based physics. Covers elementary mechanics including kinematics, statics, equilibrium and dynamics of particles, work and energy, rotational motion, gravitation, and oscillation. Lecture and laboratory.

Physics II (calculus-based, with lab). A continuation of Physics I. Principles of thermodynamics, electricity and magnetism, light and modern physics. Lecture and laboratory.

Chemistry I. Introduction to the basic principles of chemistry including atomic and molecular structure, bonding, chemical reactions, stoichiometry, thermodynamics and states of matter. Laboratory will reinforce lecture concepts.

Computer Programming. A lecture-laboratory course. Formulate an overall solution algorithm and solve engineering and scientific problems utilizing spreadsheets, programming language(s), and mathematical software. Topics include engineering and scientific problems that employ statistics, algebra, calculus, linear algebra, optimization, and image processing in their solutions. Use of computers as a mean for technical communication is stressed.

Statics. Application of equilibrium equations to analyze simple engineering structures and machines, including the nature and influence of friction. Elementary theory of statically determinate framed structures.

Mechanical systems and rigid body model. Equilibrium, kinematics, and dynamics of plane systems. Designed to develop the ability to analyze and solve engineering problems.

Dynamics. Kinematics: translation, rotational, plane motion and relative motion of particles and rigid bodies. Planar kinematics of rigid bodies. Kinetics of particles and rigid bodies by methods of force-mass-acceleration, work energy, impulse and momentum, introduction to vibrations.

Deformable Body Mechanics. This course is an introduction to the linear stress-strain behavior of engineering materials. Topics will include stresses due to uniaxial loading, bending and torsion; stress transformations, beam deflections, indeterminate structures and column buckling.

Thermodynamics. Basic concepts, First and Second Law of Thermodynamics, properties and phase changes of pure substances, ideal gases, energy analysis of closed and open systems, enthalpy, entropy, reversibility, and Carnot and gas power cycles.

Circuits I (with lab). Physical principles underlying circuit element models. Resistive circuits, Kirchhoff's laws, independent and dependent sources, node-voltage and mesh-current methods, op-amps, inductors, and capacitors. First- and second-order circuits. Diodes, BJTs, FETs, and elementary amplifiers. Experiments with simple circuits and electronics. Familiarization with measurement tools and equipment.

Circuits II. Elements of signal and linear system analysis. Sinusoidal steady state analysis, Laplace transforms, two-port circuits, frequency selective circuits, active filter circuits, single stage transistor amplifier frequency response of BJT and FET amplifiers.

Digital Logic. This is the first half of an introduction to digital logic. It is recommended for mechanical, aerospace, computer and electrical engineering students. Topics include Boolean algebra, logic gates, Karnaugh mapping and analysis of combinational circuits.

Probability & Statistics. Introduction to basic ideas and fundamental laws of probability. Topics include an introduction to combinatorics, probability axioms, conditional probability, discrete random variables, common discrete distributions, expectation, generating functions, limit theorems, and continuous random variables.

Chemistry II. An in-depth study of the principles of chemistry including atomic structure, the chemical bond, solutions, thermodynamics, kinetics, acid-base theory, oxidation-reduction, complex ion equilibrium, and electrochemistry. Organic and inorganic examples are used when appropriate throughout the courses, and a short unit on organic chemistry is included. Laboratory and lecture are coordinated.

Organic Chemistry I & II. A thorough study of the chemistry of organic compounds, with emphasis on structure, properties, synthesis, purification, principles and mechanisms of reactions, instrumental methods, compound identification, and important biological and economic applications.