STEM: Science, Technology, Engineering & Mathematics Programs & Courses

Science & Mathematics

Science

Mathematics

Science, Technology and Engineering

Science

Nanoscience

Engineering

Computer Graphics and Visualization

Computer Science

Data Science

STEM: Science, Technology, Engineering & Mathematics Courses

Course delivery methods change on a semester basis. Please check the current course schedule for the most up-to-date information at saintpaul.edu/CourseSchedule.

Science

Biochemistry

Biochemistry is the study of the chemical reactions in living organisms, and it contains aspects of organic and inorganic chemistry as well as biology. Topics covered in biochemistry include protein structure and function, as well as cell metabolic processes that include lipids, carbohydrates, proteins, and nucleic acids. Biochemistry includes fundamental concepts that can be applied to molecular biology, immunochemistry, neurochemistry, and biophysical chemistry. It has a wide range of applications which can be applied to fields such as medicine, agriculture, toxicology, and engineering to name a few. Biochemists often work in modern research laboratories and participate in stimulating, creative work. They interact with scientists from other fields because their research is intertwined. The application of biochemistry to other fields focuses on improving the quality of life. Opportunities for employment in this field are expected to grow in industry, medicine, and genetic research.

Course			Cr
BIOC	1730	Biochemical Laboratory Exploration	4
BIOC	1790	Special Topics in Biochemistry	1-6
BIOC	2700	Biochemistry	4
BIOC	2790	Biochemistry Internship/Research Project	1-4

Biology

The Biology department provides high quality educational experiences in the biological sciences including: environmental science, general biology for majors and non-majors, nutrition, medical terminology, forensic science, biology of women, human anatomy and physiology for majors and non-majors, and microbiology. The faculty believe biology occupies a central position in the physical sciences and that an understanding of fundamental biological principles enables students to make better-informed decisions for work and life roles. The biology faculty promote active learning in lecture and lab activities, interacting closely with students at various levels of academic development. Biology courses serve the College and students by providing offerings that satisfy requirements for general education, allied health and pre-professional transfer programs. Biology faculty are committed to excellence in teaching and scholarship providing a variety of lab/field experiences and online applications.

Course			Cr
BIOL	1471	Medical Terminology	2
BIOL	1725	Environmental Science	4
BIOL	1730	Human Body Systems	3
BIOL	1735	Understanding Biology	4
BIOL	1740	General Biology 1: The Living Cell	5
BIOL	1745	General Biology 2: The Living World	5
BIOL	1760	Nutrition	3
BIOL	1782	Introduction to Forensic Science	4
BIOL	1785	Biology of Women	3
BIOL	1790	Special Topics in Biology	1-6
BIOL	2721	Human Anatomy and Physiology 1	4
BIOL	2722	Human Anatomy and Physiology 2	4
BIOL	2750	General Microbiology	4
BIOL	2755	Genetics	4
BIOL	2760	Cell and Molecular Biology	5
BIOL	2770	Biology Internship	1-4

Chemistry

The Chemistry department offers courses that provide an understanding of chemical principles across the discipline. The chemistry faculty believe that an understanding of fundamental chemical principles enables students to make better- informed decisions on a wide variety of issues related to work and life roles. The faculty interact closely with students, a diverse population at various levels of academic development, to help them develop capabilities in science and become lifelong learners. Chemistry courses fulfill requirements for general education and various graduation requirements.

Course		Cr
CHEM 1700	Chemistry Concepts	4
CHEM 1711	Principles of Chemistry 1	4
CHEM 1712	Principles of Chemistry 2	4
CHEM 2720	Organic Chemistry 1	5
CHEM 2721	Organic Chemistry 2	5
CHEM 2730	Instrumental Analysis	4
CHEM 2790	Science Technician Laboratory Research Project	1-4
CHEM 2791	Cleanroom Lab Research Project	1-4
CHEM 2795	Special Topics in Chemistry	1-6

Natural Sciences

The Natural Sciences department offers courses in the areas of earth science, geology, oceanography, and meteorology. Natural Science courses fulfill Goals 3, 9 & 10 of the Minnesota Transfer Curriculum, as well as various graduation requirements.

Course			Cr
NSCI	1710	Earth Science	4
NSCI	1721	Introduction to Geology	4
NSCI	1730	Introduction to Oceanography	3
NSCI	1740	Introduction to Meteorology	3
NSCI	1750	Natural Disasters	3
NSCI	1770	Introduction to Energy and the Environment	3
NSCI	1780	Contemporary Issues in Science	3
NSCI	1782	Minnesota Geology	3
NSCI	1790	Special Topics in Natural Science	1-6
NSCI	2770	Natural Sciences Internship	1-4

Physics

The study of Physics involves the study of matter and motion, energy and forces. The Physics department offers Principles of Physics 1 and 2 as well as General Physics 1 and 2 with a calculus base. Students enroll in physics courses to fulfill the Minnesota Transfer Curriculum requirements and various graduation requirements.

Course		Cr
PHYS 1720	Principles of Physics 1	4
PHYS 1722	Principles of Physics 2	4
PHYS 1760	Descriptive Astronomy (no lab)	3
PHYS 2700	General Physics 1 (with Calculus)	5
PHYS 2710	General Physics 2 (with Calculus)	5
PHYS 2760	Introductory Astronomy (with lab)	4
PHYS 2790	Special Topics in Physics	1-6

Mathematics

Mathematics

The study of mathematics provides foundational knowledge for understanding other disciplines, as well as logical reasoning and problem solving skills for work and life roles. The department offers a full curriculum to meet the educational needs of our students such as developmental offerings, mathematics courses specific to majors and a range of general education courses including Statistics, College Algebra, Calculus, and Ordinary Differential Equations. Courses fulfill Minnesota Transfer Curriculum requirements and graduation requirements.

Course		Cr
MATH 0910*	Introductory Algebra	3
MATH 0920*	Intermediate Algebra	3
MATH 1411*	Applied Mathematics	3
MATH 1420*	Trade Algebra and Trigonometry	3
MATH 1710	Liberal Arts Mathematics	3
MATH 1730	College Algebra	3
MATH 1740	Introduction to Statistics	4
MATH 1750	Trigonometry	3
MATH 1762	Pre-Calculus	5
MATH 1790	Special Topics in Mathematics	1-6
MATH 2100	Intermediate Statistics	4
MATH 2749	Calculus 1	4
MATH 2750	Calculus 2	4
MATH 2753	Multivariable Calculus	4
MATH 2760	Differential Equations and Linear Algebra	4

* Does not meet Minnesota Transfer Curriculum (MnTC) Distribution Requirements

Biology Transfer Pathway AS DEGREE

Program Overview

The Biology Transfer Pathway AS degree is awarded for successful completion of 60 credits in science and liberal arts. It is designed to constitute the first two years of a bachelor's degree in Biology.

Career Opportunities

A biology major is a good choice for students who are intrigued by living things. Upon completion of the Biology Transfer Pathway AS degree, students will have learned to apply the scientific method, set up experiments, and use laboratory equipment. Students will develop laboratory skills, techniques, and procedures allowing them to gather, organize, and analyze data. As graduates in Biology, students can choose a number of career options from technical scientific laboratory careers to education. Salaries will vary depending on the chosen career path.

Program Outcomes

1. Apply knowledge of the important concepts and principles of the natural science, mathematics, history, social and behavioral sciences, arts, and humanities.
2. Develop skills necessary for life roles, including skills in thinking, communication, and methods of inquiry and applications of knowledge.
3. Critically examine and develop an appreciation for diverse people, cultures, and life roles.
4. Develop oral and written communication skills to communicate with a wide range of diverse populations.
5. Demonstrate an understanding of the fields of physical science and apply scientific theory to contemporary problems and issues.

Transfer Opportunities

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below.

For more information please go to saintpaul.edu/Transfer.

Biology Transfer Pathway AS

BS Biology – General Biology
BS Biology – Ecology, Biodiversity, and Evolutionary Biology

BS Biology – Environmental Science
Bemidji State University

BA Biology
Metropolitan State University

BA Biology
BS Biology
Minnesota State University, Mankato

BA Biology
BA Ecology
Minnesota State University, Moorhead

BA Biology Concentration
Southwest Minnesota State University

BA Biology
St. Cloud State University

BA Biology
Winona State University

Program Faculty

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Kirstin Purcell	kirstin.purcell@saintpaul.edu
Mary Stueve	mary.stueve@saintpaul.edu

Program Requirements

☑ Check off when completed

Course	Cr
☐ BIOL 1740 General Biology 1	5
☐ BIOL 1745 General Biology 2	5
☐ BIOL 2755 Genetics	4
☐ CHEM 1711 Principles of Chemistry 1	4
☐ CHEM 1712 Principles of Chemistry 2	4
☐ Program Electives (select 1 of the following)	4-5
BIOL 2750 General Microbiology – 4 cr	
These courses can be taken at partner institutions	
BIOL 17XX Cell and Molecular Biology – 5 cr	
BIOL 17XX General Ecology – 5 cr	
Century College	
Inver Hills Community College	
Minneapolis Community & Technical College	
Normandale Community College	
Subtotal	**26-27**

General Education/MnTC Requirements	Cr
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication	9
ENGL 1711 Composition 1 – 4 cr	
ENGL 1712 Composition 2 – 2 cr	
COMM 17XX – 3cr	
☐ Goal 3: Natural Sciences	4
Goal 3 met with courses above.	
☐ Goal 4: Mathematical/Logical Reasoning	3
MATH 1730 College Algebra (or higher) – 3 cr	
☐ Goal 5: History, Social Science and Behavioral Sciences	9
Minimum of three courses from two different disciplines	
☐ Goal 6: Humanities and Fine Arts.	9
Minimum of three courses from two different disciplines	
☐ Goals 1-10 of the Minnesota Transfer Curriculum	3-4
Select a minimum of 3 additional credits	
General Education Requirements	**33-34**

Total Program Credits 60

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Start Dates

Fall, Spring, Summer

Course Sequence

This course sequence is recommended for a full-time student; however, this sequence is not required.

Not all courses are offered each semester; a selection of courses is offered summer term.

Students should consult with the Program Faculty each semester.

First Semester
Goal 1: ENGL 1711 Composition 1 4
Goal 1: COMM 17XX 3
Goal 3: BIOL 1740 General Biology 1 5
Goal 4: MATH 1730 College Algebra 3
Total Semester Credits 15

Second Semester
Goal 1: ENGL 1712 Composition 2 2
Goal 3: BIOL 1745 General Biology 2 5
Goal 3: CHEM 1711 Principles of Chemistry 1 4
Goal 5: History, Social Science and Behavioral Sciences 3
Total Semester Credits 14

Third Semester
Goal 3: CHEM 1712 Principles of Chemistry 2 4
Goal 3: BIOL 2755 Genetics 4
Goal 5: History, Social Science and Behavioral Sciences 3
Goal 6: Humanities and Fine Arts 3
Total Semester Credits 14

Fourth Semester
Goal 5: History, Social Science and Behavioral Sciences 3
Goal 6: Humanities and Fine Arts 6
Goals 1-10 MnTC Elective 3-4
Program Electives 4-5
Total Semester Credits 17

Total Program Credits 60

Minimum Program Entry Requirements
Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ on Reading Comprehension or grade of "C" or better in ENGL 0922

College Level Mathematics: Score of 50+ or grade of "C" or better in MATH 0920

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

TPBI

Chemistry AS DEGREE

Program Overview

The Associate of Science (AS) degree in Chemistry is awarded for successful completion of 60 credits in science and liberal arts. It is designed to constitute the first two years of a bachelor's degree in Chemistry.

Career Opportunities

Chemistry majors are curious, analytical and self-starting leaders. Upon completion of the Chemistry AS degree, students will have developed strong communication skills and grown in their scientific and mathematical reasoning skills as well as developed their ability to perform experiments in a hands-on environment. As graduates in Chemistry, students can choose a number of career options from technical scientific laboratory careers to education. Salaries will vary based on the chosen career path.

Program Outcomes

1. Design and conduct experiments as well as analyze and interpret the results.
2. Identify, formulate, and solve chemical and other science related problems.
3. Understand professional and ethical responsibility.
4. Apply knowledge of mathematics, science, and technology in the solution of chemical technology problems.
5. Solve science technology problems within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

Transfer Opportunities

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below.

For more information please go to saintpaul.edu/Transfer.

Chemistry AS

BS Chemistry
Metropolitan State University

Program Faculty

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Travis Mills travis.mills@saintpaul.edu
Zubah Kpanaku zubah.kpanaku@saintpaul.edu

Program Requirements

☑ Check off when completed

Course	Cr
☐ BIOC 2700 Biochemistry	4
☐ CHEM 1711 Principles of Chemistry 1	4
☐ CHEM 1712 Principles of Chemistry 2	4
☐ CHEM 2720 Organic Chemistry 1	5
☐ CHEM 2721 Organic Chemistry 2	5
☐ PHYS 2700 General Physics 1 (w/Calc)	5
☐ MnTC Goal 3 elective	3
Subtotal	**30**

General Education/MnTC Requirements	Cr
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication ENGL 1711 Composition 1 – 4 cr COMM 17XX – 3 cr	7
☐ Goal 3: Natural Science BIOL 1740 General Biology 1: The Living Cell	5
☐ Goal 4: Mathematical/Logical Reasoning MATH 2749 Calculus 1 – 4 cr	4
☐ Goal 5: History, Social Science, and Behavioral Sciences	3
☐ Goal 6: Humanities & Fine Arts	3
☐ Goals 1-10 of the MnTC Students must select a minimum of 8 additional credits such that courses from at least six (6) goal areas of the Minnesota Transfer Curriculum are met.	8
General Education Requirements	**30**

Total Program Credits 60

Information is subject to change.
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Program Start Dates

Fall, Spring, Summer

Course Sequence

This course sequence is recommended for a full-time student; however, this sequence is not required.

Not all courses are offered each semester; a selection of courses is offered summer term.

Students should consult with the Program Faculty each semester.

First Semester

Goal 1: ENGL 1711 Composition	4
Goal 1: COMM 17XX	3
Goal 3: CHEM 1711 Principles of Chemistry 1	4
Goal 4: MATH 2749 Calculus 1	4
Total Semester Credits	**15**

Second Semester

Goal 3: CHEM 1712 Principles of Chemistry 2	4
Goal 3: PHYS 2700 General Physics 1 (w/Calc)	5
Goal 5: History, Social Science, and Behavioral Sciences	3
MnTC elective	3
Total Semester Credits	**15**

Third Semester

Goal 3: BIOL 1740 General Biology 1: The Living Cell	5
Goal 3: CHEM 2720 Organic Chemistry 1	5
Goal 6: Humanities & Fine Arts	3
MnTC elective (Goal 3)	3
Total Semester Credits	**16**

Fourth Semester

Goal 3: BIOC 2700 Biochemistry	4
Goal 3: CHEM 2721 Organic Chemistry 2	5
MnTC elective	5
Total Semester Credits	**14**

Total Program Credits 60

Minimum Program Entry Requirements

Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ on Reading Comprehension or grade of "C" or better in ENGL 0922

College Level Mathematics: Score of 50+ or grade of "C" or better in MATH 0920

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

381S (7167)

Science Technician AS DEGREE

Program Overview

The Science Technician degree is designed for students who are seeking employment in a science laboratory and/or who are seeking to transfer to a four-year program.

Career Opportunities

Science technicians can work in many aspects of the laboratory process industry from basic research to clean room facility skills. Technicians operate many kinds of equipment and instrumentation, prepare samples for processing, monitor commercial production, test for product quality and collect and analyze samples. Technicians will conduct a variety of laboratory procedures, from routine process of laboratory procedures to complex research projects. A solid background in science and math along with the skills in using advanced equipment is vital for success as a Science Technician.

Program Outcomes

1. Design and conduct experiments as well as analyze and interpret the results.
2. Identify, formulate, and solve science technology problems.
3. Understand professional and ethical responsibility.
4. Apply knowledge of mathematics, science, and technology in the solution of chemical technology problems.
5. Solve science technology problems within realistic constraints such as economic, environmental, social, political, ethical, and health and safety, manufacturability, and sustainability.

Transfer Opportunities

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below.

For more information please go to saintpaul.edu/Transfer.

Science Technician AS

BA Individualized Studies
Metropolitan State University

BS Chemistry
Metropolitan State University

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Faculty

Travis Mills travis.mills@saintpaul.edu
Penny Starkey penny.starkey@saintpaul.edu

Program Requirements

☑ Check off when completed
Science and Engineering Core: Required

Course	Cr
☐ BIOC 1730 Biochemical Laboratory Exploration	4
☐ CHEM 1712 Principles of Chemistry 2	4
☐ CHEM 2730 Instrumental Analysis	4
☐ CHEM 2790 Science Technician Laboratory Research Project	3
☐ ENGR 1706 Principles of Engineering	2
Subtotal	**17**

Science and Engineering Focus (Select one focus area)

Chemistry

☐ CHEM 2721 Organic Chemistry 2	5
☐ Science or Engineering Electives	8

Biochemistry

☐ BIOC 2700 Biochemistry	4
☐ Science or Engineering Electives	9

Physics

☐ PHYS 2710 General Physics 2	5
☐ Science or Engineering Electives	8

Engineering

☐ ENGR 2700 Intro to Problem Solving and Engineering Design	2
☐ Science or Engineering Electives	11
Focus Subtotal	**13**

Note: Science/engineering electives must be taken from: BIOC, BIOL, CHEM, CSCI, ENGR, NSCI, PHYS. Consult with your advisor for information about 2, 3, and 4 credit course options.

General Education/MnTC Requirements	Cr
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication ENGL 1711 Composition 1 – 4 cr COMM 17XX – 3 cr	7
☐ Goal 3: Natural Science CHEM 1711 Principles of Chemistry 1 – 4 cr	4
☐ Goal 4: Mathematical/Logical Reasoning MATH 2749 Calculus 1 – 4 cr MATH 2750 Calculus 2 – 4 cr	8
☐ Goal 5: History, Social Science and Behavioral Sciences	3
☐ Goal 6: Humanities and Fine Arts	3
☐ Goals 1-10 of the Minnesota Transfer Curriculum Students must select a minimum of 5 additional credits such that courses from at least six (6) goal areas of the Minnesota Transfer Curriculum are met.	5
General Education Requirements	**30**

Total Program Credits 60

Program Start Dates

Fall, Spring, Summer

Course Sequence

This sample course sequence is recommended for a full-time student; however, this sequence is not required.

Not all courses are offered each semester; a selection of courses is offered summer term.

Students should consult with the Program Faculty each semester.

First Semester

ENGR 1706 Principles of Engineering	2
Goal 1: ENGL 1711 Composition 1	4
Goal 3: CHEM 1711 Principles of Chemistry 1	4
Goal 5: History, Social Science and Behavioral Sciences	3
Goal 6: Humanities and Fine Arts	3
Total Semester Credits	**16**

Second Semester

Goal 1: COMM 17XX	3
Goal 3: CHEM 1712 Principles of Chemistry 2	4
Goal 3: BIOC 1730 Biochemical Lab Exploration	4
Goal 4: MATH 2749 Calculus 1	4
Total Semester Credits	**15**

Third Semester

Goal 3: CHEM 2730 Instrumental Analysis	4
Goal 4: MATH 2750 Calculus 2	4
MnTC Elective	3
Focus Area Course(s)	5
Total Semester Credits	**16**

Fourth Semester

Goal 3: CHEM 2790 Science Tech Lab Research Project	3
MnTC Elective: ENGL 1712 Composition 2 Recommended	2
Focus Area Course(s)	8
Total Semester Credits	**13**

Total Program Credits 60

Minimum Program Entry Requirements
Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ on Reading Comprehension or grade of "C" or better in ENGL 0922

College Level Mathematics: Score of 50+ or grade of "C" or better in MATH 0920

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

377S (7210)

Nanoscience Technology AAS DEGREE

Program Overview

This program prepares students for careers in nanobiotech, nanomaterials and nanoelectronics industries. The program also provides a strong foundation applicable to environmental, energy and agricultural industries. The curriculum is a combination of classroom and laboratory experiences, with hands on use of nanoscale equipment in all 4 semesters. Students have several opportunities for individual research and exploration of nanoscale concepts. Offered in partnership with the University of Minnesota, the program provides skills and knowledge required for employment in a large number of companies. The DCTC program also provides a starting point to four year degrees at multiple institutions in many degree programs. Processes of scientific inquiry, experiment and research design, critical thinking, and communication are aspects that are woven into each course.

Career Opportunities

Nanoscience technologists work in multiple business environments including research, production, testing, training and marketing. Often this role is a bridge between scientists, engineers and other technicians. Program graduates may work independently in some aspects but most often are part of a team. Your job will include some desk work but most of your time will be spent in a laboratory environment preparing test samples, microscope operation and testing, documentation and analysis and communication of your results. These technologists do not usually do the same thing for many months at a time. Finally, although nanoelectronics related jobs may occur in a clean room, most of these jobs are in traditional company research environments and labs. The options and work environments are varied and expanding with the United States nanotech market expected to reach $1 trillion by 2015.

Program Outcomes

1. Solve nanoscience technology problems within economic, environmental, social, political, ethical, and manufacturability constraints.
2. Explain the potential of nanoscience in multiple biological applications including nanopore, nanoparticle and nanochannel structures, diagnostics and treatment.
3. Relate nanoscale principles to imprint lithography, etching, nanotransistors, quantum computing, magnetic and electron spin memory, and holographic memory devices.
4. Fabricate structures such as nanowires, cantilevers and nanochannels.
5. Create nanomaterials, particles and crystals by various processes including colloidal suspensions, deposition, evaporation and plating

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Faculty

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Program Start Dates

Fall, Spring, Summer

Program Requirements

☑ Check off when completed

Course	Cr
☐ NANO 1100 Fundamentals of Nanotechnology 1	3
☐ NANO 1110 Student Lab Experience and Research	3
☐ NANO 1200 Fundamentals of Nanotechnology 2	3
☐ NANO 1210 Computer Simulation	1
☐ NANO 2101 Nanoelectronics	3
☐ NANO 2111 Nanobiotechnology/Agriculture	3
☐ NANO 2121 Nanomaterials	3
☐ NANO 2131 Manufacturing Quality Assurance	2
☐ NANO 2140 Interdisciplinary Lab	3
☐ NANO 2151 Career Planning and Industry Tours	1
☐ NANO 2970 Industry Internship	1
Subtotal	**26**

Second Year – Second Semester
At the University of Minnesota

☐ MT 3111 Elements of Micro Manufacturing	3
☐ MT 3112 Elements of Micro & Nano Man Lab	1
☐ MT 3121 Thin Films Deposition	3
☐ MT 3131 Introduction to Materials Characterization	3
☐ MT 3132 Materials Characterization Lab	1
☐ MT 3141 Prin & Apps of Bionanotech	3
☐ MT 3142 Nanoparticles & Biotech Lab	1
Subtotal	**15**

General Education/MnTC Requirements	Cr
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication	7
ENGL 1711 Composition 1 – 4 cr	
COMM 1720 Interpersonal Communications – 3 cr	
☐ Goal 3: Natural Sciences	17
BIOL 1740 General Biology 1 – 5 cr	
CHEM 1700 Chemistry Concepts – 4 cr	
PHYS 1720 Principles of Physics 1 – 4 cr	
PHYS 1722 Principles of Physics 2 – 4 cr	
☐ Goal 4: Mathematics/Logical Reasoning	7
MATH 1730 College Algebra – 3 cr	
MATH 1740 Introduction to Statistics – 4 cr	
General Education Requirements	**31**

Total Program Credits 72

NANO courses may be offered at Saint Paul College or Dakota County Technical College

Transfer Opportunities

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below. For more information please go to saintpaul.edu/Transfer.

Nanoscience Technology AAS

BA Individualized Studies
Metropolitan State University

Course Sequence

This course sequence is recommended for a full-time student; however, this sequence is not required.

Not all courses are offered each semester; a selection of courses is offered summer term. Students should consult with the Program Faculty each semester.

First Semester

NANO 1100 Fundamentals of Nanotechnology 1	3
Goal 1: ENGL 1711 Composition 1	4
Goal 3: PHYS 1720 Principles of Physics 1	4
Goal 3: BIOL 1740 General Biology 1	5
Goal 4: MATH 1730 College Algebra	3
Total Semester Credits	**19**

Second Semester

NANO 1110 Student Lab Experience and Research	3
NANO 1200 Fundamentals of Nanotechnology 2	3
NANO 1210 Computer Simulation	1
Goal 1: COMM 1720 Interpersonal Communication	3
Goal 3: CHEM 1700 Chemistry Concepts	4
Goal 3: PHYS 1722 Principles of Physics 2	4
Goal 4: MATH 1740 Introduction to Statistics	4
Total Semester Credits	**22**

Third Semester

NANO 2101 Nanoelectronics	3
NANO 2111 Nanobiotechnology/Agriculture	3
NANO 2121 Nanomaterials	3
NANO 2131 Manufacturing Quality Assurance	2
NANO 2140 Interdisciplinary Lab	3
NANO 2151 Career Planning and Industry Tours	1
Total Semester Credits	**15**

Fourth Semester – At the University of Minn.

MT 3111 Elements of Microelectronic Manufacturing	3
MT 3112 Elements of Micro & Nano Manufacturing Lab	1
MT 3121 Thin Films Deposition	3
MT 3131 Introduction to Materials Characterization	3
MT 3132 Materials Characterization Lab	1
MT 3141 Principles & Applications of Bionanotech	3
MT 3142 Nanoparticles & Biotech Lab	1
NANO 2970 Industry Internship & Observation	1
Total Semester Credits	**16**

Total Program Credits 72

Minimum Program Entry Requirements

Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ on Reading Comprehension or grade of "C" or better in ENGL 0922

College Level Mathematics: Score of 50+ or grade of "C" or better in MATH 0920

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain courses in the program have additional prerequisites.

380A

Engineering Broad Field AS DEGREE

Program Overview

Engineering is a profession that uses basic knowledge from the mathematical and natural sciences and utilizes the materials and forces of nature to develop systems that will perform optimally and economically for the benefit of mankind. The Engineering Broad Field program is designed to provide for a student's first two years of a four-year Engineering degree. The curriculum is designed to meet the needs of those students who have not yet decided on a specific engineering field. The program focuses on developing a fundamental knowledge of physics, chemistry, and mathematics.

Career Opportunities

Engineering occupations are expected to grow by more than 10% through 2020 according to the Bureau of Labor Statistics. Engineering includes careers with branches in civil, agricultural, chemical, electrical, mechanical, and aerospace sciences to name a few. This degree is part of a state-wide articulation program and designed to transfer easily.

Program Outcomes

1. Apply knowledge of mathematics, science, and engineering in the solution of engineering problems.
2. Design and conduct experiments as well as analyze and interpret results.
3. Design and engineering system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. Understand professional and ethical responsibility.
5. Recognize the need for and develop an ability to engage in life-long professional development and learning.
6. Utilize techniques, skills, and modern engineering tools necessary for engineering practice.

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Program Requirements

☑ Check off when completed

Course	Cr
☐ ENGR 1707 Introduction to Engineering	3
Choose a focus:	
Electrical	
☐ CHEM 1712 Principles of Chemistry 2	4
☐ ENGR 1709 Digital Electronics	3
☐ ENGR 1717 Circuit Analysis 1	4
☐ ENGR 2705 Statics	3
☐ ENGR 2710 Dynamics	3
Mechanical or Manufacturing or Composite	
☐ CHEM 1712 Principles of Chemistry 2	4
☐ ENGR 1717 Circuit Analysis 1	4
☐ ENGR 2705 Statics	3
☐ ENGR 2710 Dynamics	3
☐ ENGR 2712 Deformable Body Mechanics	3
Civil	
☐ CHEM 1712 Principles of Chemistry 2	4
☐ ENGR 2705 Statics	3
☐ ENGR 2710 Dynamics	3
☐ ENGR 2712 Deformable Body Mechanics	3
☐ ENGR 2715 Thermodynamics	3
☐ ENGR Elective	1
Computer	
☐ CSCI 1410 Comp. Science & Info Systems	4
☐ CSCI Electives	6
☐ ENGR 1709 Digital Electronics	3
☐ ENGR 1717 Circuit Analysis 1	4
Integrated	
☐ CHEM 1712 Principles of Chemistry 2	4
☐ ENGR 1717 Circuit Analysis 1	4
☐ ENGR 2705 Statics	3
☐ ENGR 2710 Dynamics	3
☐ ENGR Elective	3
Subtotal	**20**

General Education/MnTC Requirements	Cr
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication ENGL 1711 Composition 1 – 4cr	4
☐ Goal 3: Natural Sciences CHEM 1711 Principles of Chemistry 1 – 4 cr PHYS 2700 General Physics 1 – 5 cr PHYS 2710 General Physics 2 – 5 cr	14
☐ Goal 4: Mathematical/Logical Reasoning MATH 2749 Calculus 1 – 4 cr MATH 2750 Calculus 2 – 4 cr MATH 2753 Multivariable Calculus – 4 cr MATH 2760 Differential Equations & Linear Algebra – 4 cr	16
☐ Goal 5: History, Social Science and Behavioral Sciences	3
☐ Goal 6: Humanities and Fine Arts. *The course selected for goal area 5 or 6 must also satisfy goal 7, 8, 9, or 10.	3
General Education Requirements	**40**

Total Program Credits **60**

Program Faculty

Pam Schumacher pam.schumacher@saintpaul.edu

Part-Time/Full-Time Options

This program can be completed by using a combination of day, evening, Saturday, hybrid, and online courses. Part-time and full-time options are available.

Course Sequence

The course sequence listed on the back of this guide is recommended for a full-time student. Not all courses are offered every semester. Students should consult with the Program Faculty each semester.

See back of this guide for Course Sequence and Transfer Opportunities

Minimum Program Entry Requirements

Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

College Level Mathematics: Score of 50+ or grade of "C" or better in MATH 0920

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain courses in the program have additional prerequisites.

382S (7211)

Engineering Broad Field AS DEGREE *(continued)*

Program Start Dates

Fall, Spring, Summer

Course Sequence

This course sequence is recommended for a full-time student. Not all courses are offered every semester. Students should consult with the Program Faculty each semester.

First Semester

ENGR 1707 Introduction to Engineering 3
Goal 1: ENGL 1711 Composition 1. 4
Goal 3: CHEM 1711 Principles of Chemistry 1 4
Goal 4: MATH 2749 Calculus 1 4
Total Semester Credits. 15

Second Semester

Goal 3: CHEM 1712 Principles of Chemistry 2 4
Goal 3: PHYS 2700 General Physics 1. 5
Goal 4: MATH 2750 Calculus 2 4
Goal 5: History, Social Science and Behavioral Sciences 3
Total Semester Credits. 16

Third Semester

ENGR 2705 Statics 3
Goal 3: PHYS 2710 General Physics 2. 5
Goal 4: MATH 2753 Multivariable Calculus 4
Goal 6: Humanities and Fine Arts 3
Total Semester Credits. 15

Fourth Semester

ENGR 1717 Circuit Analysis 4
ENGR 2710 Dynamics 3
ENGR 2712 Deformable Body Mechanics 3
Goal 4: MATH 2760 Differential Equations & Linear Algebra. 4
Total Semester Credits. 14

Total Program Credits 60

Transfer Opportunities

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below.

For more information please go to saintpaul.edu/Transfer.

Engineering Broad Field AS

BS Composite Materials Engineering
Winona State University

BS Computer Engineering
Saint Cloud State University

BS Electrical Engineering
Saint Cloud State University

BS Manufacturing Engineering
Saint Cloud State University

BS Mechanical Engineering
Saint Cloud State University

BSCE Civil Engineering
Minnesota State University-Mankato

BSE General Engineering
Minnesota State University-Mankato

BSE Integrated Engineering
Minnesota State University-Mankato
*offered at Normandale location

BSEE Electrical Engineering
Minnesota State University-Mankato

BSEC Computer Engineering
Minnesota State University-Mankato

BSME Mechanical Engineering
Minnesota State University-Mankato

Computer Graphics and Visualization AS DEGREE

Program Overview

This program prepares students for jobs in the exciting computer graphics and animation field. Students will learn how to take an idea from concept through production including computer graphics, computer animation, sound and video.

Computer Graphics Specialists can work in a wide variety of creative jobs including web design, film and animation production, CD ROM production and any organization that can benefit from these special talents. With more and more animation moving to the desktop, the computer graphics specialist is becoming a high demand career.

The student should be creative and have excellent communication skills. Students should exhibit qualities of patience, and preciseness, and should enjoy working independently and on team projects.

Career Opportunities

The computer graphics field relates to many jobs in the multimedia area including but not limited to:

- Web Designer
- Computer Animator
- Computer Game Designer and Developer
- Multimedia Developer

Program Outcomes

1. Graduates will have knowledge and skills in web design.
2. Graduates will have knowledge and skills in computer animation.
3. Graduates will have knowledge and skills in digital sound and video production.
4. Graduates will have knowledge and skills in digital photography.
5. Graduates of this program may choose to continue their education at a four-year institution in computer graphics, technical communication or a related field.

Transfer Opportunities

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below.

For more information please go to saintpaul.edu/Transfer.

Computer Graphics and Visualization AS

BA Individualized Studies
Metropolitan State University

BA Technical Communication and Professional Writing
Metropolitan State University

BS Information Technology
Saint Mary's University-Twin Cities Campus

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Faculty

Darren Pearson darren.pearson@saintpaul.edu

Recommended Equipment
Digital Camera, USB Drive, Adobe Software

Estimated Book Cost
$50 - $75 per class

Program Requirements

☑ Check off when completed

Course	Cr
☐ CSCI 1450 Web Fundamentals/HTML	4
☐ DGIM 1400 Introduction to Computer Graphics	4
☐ DGIM 1443 Graphical Web Design 1	2
☐ DGIM 1448 Flash 1	2
☐ DGIM 1483 Photoshop 1	2
☐ DGIM 1484 Photoshop 2	2
☐ DGIM 1540 Blogging Applications	2
☐ DGIM 2586 Digital Sound	2
☐ DGIM 2587 Digital Video 1	2
☐ Technical Electives	8
Any 8 credits in DGIM or CSCI	
Subtotal	**30**

General Education/MnTC Requirements	Cr
Students must select courses from at least six (6) different Goal Areas of the MnTC.	
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication	7
ENGL 1711 Composition 1 – 4 cr	
COMM 17XX – 3 cr	
☐ Goal 4: Mathematical/Logical Reasoning	3
☐ Goal 5: History, Social Science and Behavioral Sciences	4
☐ Goal 6: Humanities and Fine Arts	7
ARTS 1713 Photography 1 – 3 cr (recommended)	
☐ Goals 1-10 of the Minnesota Transfer Curriculum	9
Select a minimum of 9 additional credits	
General Education Requirements	**30**

Total Program Credits 60

Program Start Dates

Fall, Spring, Summer

Course Sequence

The following sequence is recommended for a full-time student; however, this sequence is not required. Contact the Program Faculty with questions.

First Semester

CSCI 1450 Web Fundamentals/HTML	4
DGIM 1400 Introduction to Computer Graphics	4
DGIM 1443 Graphical Web Design 1	2
Goal 1: ENGL 1711 Composition I	4
Goal 1: COMM 17XX	3
Total Semester Credits	**17**

Second Semester

DGIM 1448 Flash 1	2
DGIM 1483 Photoshop 1	2
DGIM 1540 Blogging Applications	2
Goal 5: History, Social Science and Behavioral Sciences	4
Goal 6: Humanities and Fine Arts	3
Total Semester Credits	**13**

Third Semester

DGIM 1484 Photoshop 2	2
DGIM 2586 Digital Sound	2
Goal 4: Mathematical/Logical Reasoning	3
Goal 6: Humanities and Fine Arts	4
Technical Electives	4
Total Semester Credits	**15**

Fourth Semester

DGIM 2587 Digital Video 1	2
MnTC Electives	9
Technical Electives	4
Total Semester Credits	**15**

Total Program Credits 60

Minimum Program Entry Requirements
Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

College Level Mathematics: Score of 50+ or grade of "C" or better in MATH 0920

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

255S (7116)

Visualization Technology AAS DEGREE

Program Overview

This program prepares students for jobs in the exciting computer graphics and animation field. Students will learn how to take an idea from concept through production, including computer graphics, computer animation, sound and video.

Computer Graphics Specialists can work in a wide variety of creative jobs including web design, film and animation production, CD ROM production and any organization that can benefit from these special talents. With more and more animation moving to the desktop, the computer graphics specialist is becoming a high demand career.

The student should be creative and have excellent communication skills. Students should exhibit qualities of patience and precision and enjoy working both independently and on team projects.

Career Opportunities

The computer graphics field relates to many jobs in the multimedia area including but not limited to:

- Web Designer
- Computer Animator
- Computer Game Designer and Developer
- Multimedia Developer

Program Outcomes

1. Graduates will have knowledge and skills in web design.
2. Graduates will have knowledge and skills in digital photography.
3. Graduates will have knowledge and skills in digital sound and video production.
4. Graduates will have developed an online portfolio of work
5. Graduates will have knowledge of freelancing and self-employment business practices

Transfer Opportunities

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below.

For more information please go to saintpaul.edu/Transfer.

Visualization Technology AAS

BA Individualized Studies
Metropolitan State University

BS Information Technology
Saint Mary's University-Twin Cities Campus

BS Marketing
Saint Mary's University-Twin Cities Campus

BS Operations Management
Minnesota State University-Moorhead

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Faculty

Darren Pearson darren.pearson@saintpaul.edu

Part-Time/Full-time Options
This program can be completed by using a combination of day, evening, and Saturday courses. Part-time and full-time options are available.

Recommended Equipment
USB Drive, Digital Camera, Adobe Software

Estimated Book Cost
$50 - $75 per class

Program Requirements

☑ Check off when completed

Course	Cr
☐ CSCI 1450 Web Fundamentals/HTML	4
☐ DGIM 1400 Introduction to Computer Graphics	4
☐ DGIM 1448 Flash 1	2
☐ DGIM 1449 Flash 2	2
☐ DGIM 2560 Illustrator	4
☐ DGIM 2569 Digital Portfolio Development	2
☐ DGIM 2587 Digital Video 1	2
☐ DGIM 2588 Digital Video 2	2
☐ Technical Electives Any 6 credits in DGIM or CSCI; ensure technical elective is not part of selected emphasis	6
Subtotal	**28**

Select one of the emphases listed below

Web Emphasis

☐ CSCI 1470 Web Design	4
☐ DGIM 1443 Graphical Web Design 1	2
☐ DGIM 1444 Graphical Web Design 2	2
☐ DGIM 1483 Photoshop 1	2
☐ DGIM 1484 Photoshop 2	2
Total Emphasis Credits	**12**

Animation Emphasis

☐ DGIM 1490 3D Animation Fundamentals	4
☐ DGIM 2520 3D Character Animation	4
☐ DGIM 2704 3D Animation Capstone	4
Total Emphasis Credits	**12**

General Education/MnTC Requirements	Cr
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication ENGL 1711 Composition 1 – 4 cr COMM 17XX – 3 cr	7
☐ Goal 4: Mathematics/Logical Reasoning MATH 1730 College Algebra – 3 cr OR PHIL 1710 Logic – 3 cr	3
☐ Goal 5: History, Social Science and Behavioral Sciences	3
☐ Goal 6: Humanities and Fine Arts	3
☐ Goals 1-10 of the Minnesota Transfer Curriculum Select a minimum of 4 additional credits	4
General Education Requirements	**20**

Total Program Credits 60

Program Start Dates

Fall, Spring

Course Sequence

The following course sequence is recommended; however, this sequence is not required. Contact the Program Faculty with questions.

First Semester

CSCI 1450 Web Fundamentals/HTML	4
DGIM 1400 Introduction to Computer Graphics	4
DGIM 1448 Flash 1	2
Goal 1: ENGL 1711 Composition I	4
Total Semester Credits	**14**

Second Semester

DGIM 1449 Flash 2	2
DGIM 2560 Illustrator	4
Goal 1: COMM 17XX	3
Goal 5: History, Social and Behavioral Sciences	3
Emphasis Course	4
Total Semester Credits	**16**

Third Semester

DGIM 2569 Digital Portfolio Development	2
DGIM 2587 Digital Video 1	2
Goal 4: MATH 1730 College Algebra OR PHIL 1710 Logic	3
Emphasis Course	4
Technical Elective(s)	4
Total Semester Credits	**15**

Fourth Semester

DGIM 2588 Digital Video 2	2
Goal 6: Humanities and Fine Arts	3
MnTC Electives	4
Technical Elective	2
Emphasis Course	4
Total Semester Credits	**15**

Total Program Credits 60

Minimum Program Entry Requirements
Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

College Level Mathematics: Score of 50+ or grade of "C" or better in MATH 0920

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

215A (7093)

Visualization Technology CERTIFICATE

Program Overview

This certificate program is a series of entry level courses that are part of the Visualization Technology AAS degree at Saint Paul College.

This certificate option is available for students who may choose not to complete the entire AAS degree and gain some experience with courses used in computer graphics, particularly courses in the Adobe software suite.

Career Opportunities

The computer graphics field relates to many jobs in the multimedia area including but not limited to:

- Web Designer
- Computer Animator
- Computer Game Designer and Developer
- Multimedia Developer

Program Outcomes

1. Graduates will have basic skills to create documents with Adobe Illustrator.
2. Graduates will have basic skills to create websites using Adobe Dreamweaver.
3. Graduates will have basic skills for using Adobe Photoshop as a creative media.
4. Graduates will have the basic skills to create basic animations.
5. Graduates of this certificate may choose to continue with the AA or AAS degree in Visualization or a 4-year transfer opportunity is available.

Program Faculty

Darren Pearson darren.pearson@saintpaul.edu

Course Offering Options
This program can be completed by using a combination of day, evening, and Saturday courses. Part-time and full-time options are available.

Recommended Equipment
Digital Camera, USB Drive, Adobe Software

Estimated Book Cost
$50 - $75 per class

Program Requirements

☑ Check off when completed

Course	Cr
☐ DGIM 1400 Introduction to Computer Graphics	4
☐ DGIM 1443 Graphical Web Design 1	2
☐ DGIM 1448 Flash 1	2
☐ DGIM 1483 Photoshop 1	2
☐ DGIM 2560 Illustrator	4
Subtotal	**14**
☐ **Technical Electives**	**4**
Any DGIM or CSCI	
☐ **General Education Requirements**	**3**
General Education Requirements –3 cr	
Goal 6: Humanities and Fine Arts	
ARTS 17XX (recommended)	
Total Program Credits	**21**

Program Start Dates

Fall, Spring

Course Sequence

The following sequence is recommended; however, this sequence is not required. Contact the Program Faculty with questions.

First Semester

DGIM 1400 Introduction to Computer Graphics	4
DGIM 1443 Graphical Web Design 1	2
DGIM 1448 Flash 1	2
DGIM 1483 Photoshop 1	2
Total Semester Credits	**10**

Second Semester

DGIM 2560 Illustrator	4
Technical Electives	4
Goal 6: ARTS 17XX recommended	3
Total Semester Credits	**11**

Total Program Credits 21

Minimum Program Entry Requirements
Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 38+

Arithmetic: Score of 20+

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

289C (7153)

Information is subject to change.
This Program Requirements Guide is not a contract.

Computer Animation CERTIFICATE

Program Overview

The Computer Animation Certificate is intended to give students the skills needed to work as a digital animator. The classes required for this certificate will have students learning the

most up-to-date animation and video software packages including Blender, Flash, Premiere Pro, After Effects and other applications. Intensive hands-on participation will be stressed in creating 3D models, animations, and scenes. Emphasis is placed on practical, real-world application of their skills. Upon certificate completion, students will have multiple short animation projects suitable for a portfolio or demo reel.

Career Opportunities

Many career opportunities exist in the computer animation field, particularly for individuals with extensive portfolios. Jobs exist in the video game industry, web design and advertising focused on emerging technologies. Many computer animators begin their career as self-employed, freelancers, in order to expand their personal portfolio.

Program Outcomes

1. Graduates will have extensive knowledge and skills in computer animation using Blender.
2. Graduates will have knowledge and skills in computer animation using other various 3D animation tools.
3. Graduates will have knowledge and skills in basic video production.

Program Faculty

Darren Pearson darren.pearson@saintpaul.edu

Course Offering Options
This program can be completed by using a combination of day, evening, and Saturday courses. Part-time and full-time options are available.

Recommended Equipment
Digital Camera, USB Drive, Adobe Software

Program Requirements

☑ Check off when completed

Course	Cr
☐ DGIM 1490 3D Animation Fundamentals	4
☐ DGIM 2520 3D Character Animation	4
☐ DGIM 2587 Digital Video 1	2
☐ DGIM 2588 Digital Video 2	2
☐ DGIM 2704 3D Animation Capstone	4
☐ DGIM XXXX (Select any 2 credits in DGIM not already required for this program)	2
Total Program Credits	**18**

Program Start Dates

Fall, Spring

Course Sequence

The following course sequence is recommended; however, this sequence is not required. Contact the Program Faculty with questions.

First Semester

DGIM 1490 3D Animation Fundamentals	4
DGIM XXXX (Select any 2 credits in DGIM not already required for this program)	2
Total Semester Credits	**6**

Second Semester

DGIM 2520 3D Character Animation	4
DGIM 2587 Digital Video 1	2
DGIM 2588 Digital Video 2	2
Total Semester Credits	**8**

Third Semester

DGIM 2704 3D Animation Capstone	4
Total Semester Credits	**4**

Total Program Credits 18

Minimum Program Entry Requirements
Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 38+

Arithmetic: Score of 20+

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

336C (7191)

Information is subject to change.
This Program Requirements Guide is not a contract.

Web Design CERTIFICATE

Program Overview

This program prepares students for jobs in the exciting computer graphics field. Students will learn how to take an idea from concept through production including computer graphics and computer animation.

The student should be creative and have excellent communications skills. Students should exhibit qualities of patience and precision and should enjoy working both independently and on team projects.

Career Opportunities

The computer graphics field relates to many jobs in the multimedia area including but not limited to:

- Web Designer
- Web Developer

Program Outcomes

1. Graduates will have knowledge of front-end, web design software packages.
2. Graduates will have knowledge of back-end, web development software languages.
3. Graduates will have knowledge of usability, accessibility and search engine optimization practices.

Program Faculty

Darren Pearson darren.pearson@saintpaul.edu

Recommended Equipment
USB Drive, Digital Camera, Adobe Software

Program Requirements

☑ Check off when completed

Course	Cr
☐ CSCI 1450 Web Fundamentals/HTML	4
☐ CSCI 1470 Web Design	4
☐ CSCI 2440 Client Side Programming 1	4
☐ DGIM 1443 Graphical Web Design 1	2
☐ DGIM 1448 Flash 1	2
☐ DGIM 2521 2D Web Animation	2
Total Program Credits	**18**

Program Start Dates

Fall, Spring

Course Sequence

The following course sequence is recommended; however, this sequence is not required. Contact the Program Faculty with questions.

First Semester
CSCI 1450 Web Fundamentals/HTML 4
DGIM 2521 2D Web Animation 2
Total Semester Credits. 6

Second Semester
CSCI 1470 Web Design. 4
DGIM 1443 Graphical Web Design 1 2
DGIM 1448 Flash 1 2
Total Semester Credits. 8

Third Semester
CSCI 2440 Client Side Programming 1. 4
Total Semester Credits. 4

Total Program Credits 18

Information is subject to change.
This Program Requirements Guide is not a contract.

Minimum Program Entry Requirements
Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

Elementary Algebra: Score of 76+ or grade of "C" or better in MATH 0910

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

Degree option may have a greater requirement than this certificate.

178C (7113)

CyberSecurity AAS DEGREE

Program Overview

CyberSecurity professionals work in a wide variety of information technology positions, but have a focus on information assurance, cyber ethics, and incident detection, investigation and response. Students completing this degree will be able to investigate and defend computer systems against cyber-attacks, unauthorized use or modification, and exploitation.

Students entering into this program of study should have excellent communication, reading and math skills. Throughout the program students will experience coursework that will help them develop skills such as critical thinking, performance monitoring, decision making and evaluating systems and organizations.

The CyberSecurity program at Saint Paul College is 60 credits in length. The program provides 16 credits specifically related to CyberSecurity which will aid students in the field and in potential certifications.

Career Opportunities

CyberSecurity professionals will find a growing need in both public and private employment sectors. Graduates will find excellent opportunities as systems administrators, network engineers, system programmers, and systems specialists.

Program Outcomes

1. Graduates will have knowledge and skills in system design, analysis and maintenance.
2. Graduates will have the skills to gather, monitor, and analyze multiple sources of data to identify changes in circumstances or events.
3. Graduates will have the skills to evaluate information to determine compliance with security standards.
4. Graduates of the CyberSecurity program will be prepared for employment as information Security Analysts or Computer Systems Analysts.

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below.

For more information please go to saintpaul.edu/Transfer.

CyberSecurity AAS

BA Individualized Studies
Metropolitan State University

BS Information Technology
Saint Mary's University-Twin Cities Campus

BS Operations Management
Minnesota State University-Moorhead

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Faculty

Mark Rawlings mark.rawlings@saintpaul.edu
James Woodcock james.woodcock@saintpaul.edu

Program Requirements

☑ Check off when completed

Course	Cr
☐ CSCI 1410 Computer Science & Information Systems	4
☐ CSCI 1423 Computer Networking 1 – Client	4
☐ CSCI 1440 Networking Fundamentals	4
☐ CSCI 1523 Intro to Computing and Programming Concepts	4
☐ CSCI 2420 Computer Security	4
☐ CSCI 2451 Computer Networking 2 – Serve	4
☐ CSCI 2461 Computer Networking 3 – Linux	4
☐ CSCI 2465 Computer Networking 4 – Infrastructure	4
☐ CSCI 2480 Network Security and Penetration Prevention	4
☐ CSCI 2482 Security Incident Handling, Response and Disaster Recovery	4
☐ CSCI 2484 Ethical Hacking & Countermeasures	4
Subtotal	**44**

General Education/MnTC Requirements	Cr
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication ENGL 1711 Composition 1 – 4 cr COMM 17XX – 3 cr	7
☐ Goal 3 or Goal 4 Goal 3: Natural Sciences OR Goal 4: Mathematical /Logical Reasoning	3
☐ Goal 5: History, Social Science and Behavioral Sciences	3
☐ Goal 6: Humanities and Fine Arts	3
General Education Requirements	**16**

Total Program Credits 60

Minimum Program Entry Requirements
Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ on Reading Comprehension or grade of "C" or better in ENGL 0922

Elementary Algebra: Score of 76+ or grade of "C" or better in MATH 0910

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

352A (7203)

Program Start Dates

Fall, Spring, Summer

Course Sequence

This course sequence is recommended for a full-time student; however, this sequence is not required.

Not all courses are offered each semester; a selection of courses is offered summer term.

Students should consult with the Program Faculty each semester.

First Semester

CSCI 1410 Computer Science & Information Systems	4
CSCI 1423 Computer Networking 1 – Client	4
CSCI 1440 Networking Fundamentals	4
Goal 1: ENGL 1711 Composition 1	4
Total Semester Credits	**16**

Second Semester

CSCI 1523 Intro to Computing and Programming Concepts	4
CSCI 2451 Computer Networking 2 – Server	4
CSCI 2461 Computer Networking 3 – Linux	4
Goal 6: Humanities and Fine Arts	3
Total Semester Credits	**15**

Third Semester

CSCI 2420 Computer Security	4
CSCI 2465 Computer Networking 4 – Infrastructure	4
Goal 1: COMM 17XX	3
Goal 3: Natural Sciences OR Goal 4: Mathematical /Logical Reasoning	3
Total Semester Credits	**14**

Fourth Semester

CSCI 2480 Network Security and Penetration Prevention	4
CSCI 2482 Security and Incident Handling Response and Disaster Recovery	4
CSCI 2484 Ethical Hacking & Countermeasures	4
Goal 5: History, Social Science and Behavioral Sciences	3
Total Semester Credits	**15**

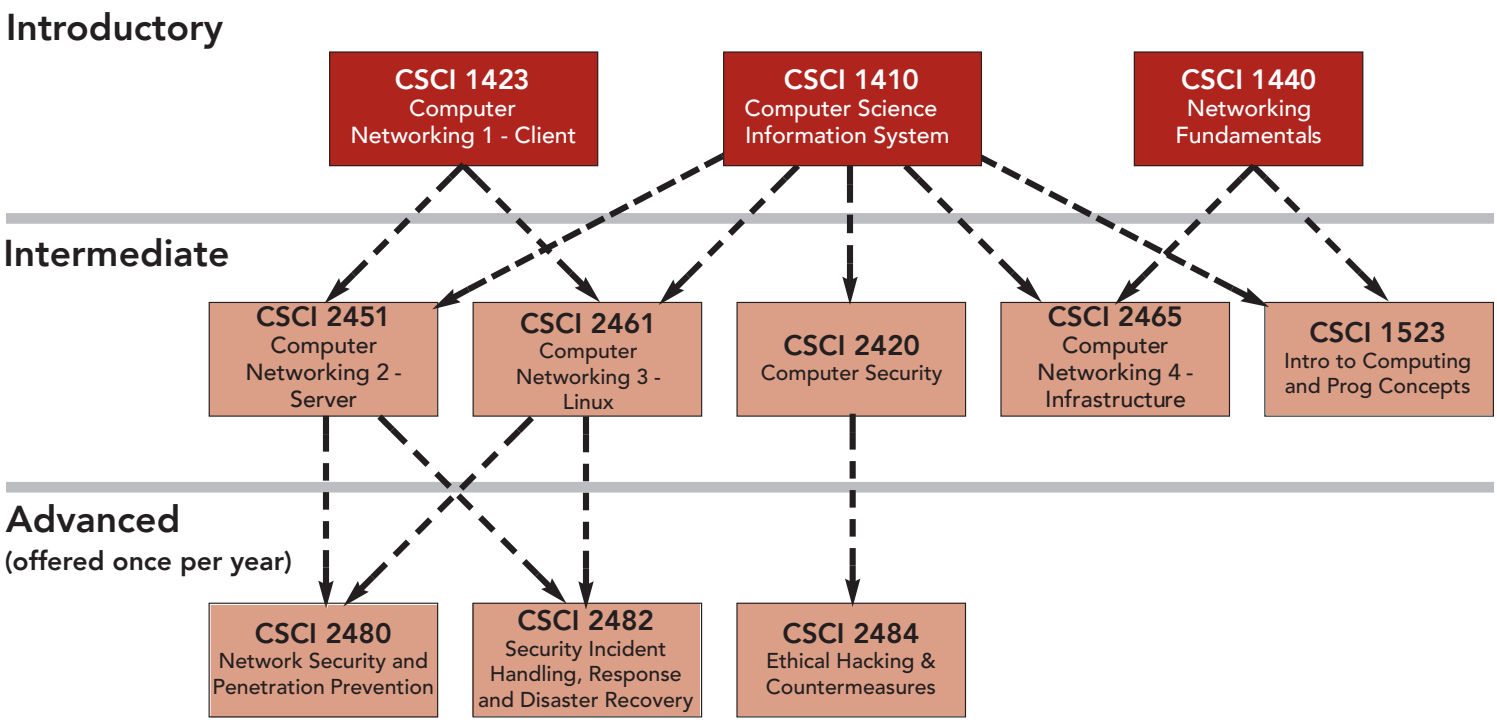
Total Program Credits 60

See back of this guide for Course Chart

CyberSecurity AAS DEGREE *(continued)*

(44 credits + 16 GenEd credits)

The below chart illustrates the courses required for completion of this degree.



CyberSecurity CERTIFICATE

Program Overview

Note: Students must have completed the Computer Network Engineering AAS degree or have instructor approval.

CyberSecurity professionals work in a wide variety of information technology positions, but have a focus on information assurance, cyber ethics, and incident detection, investigation and response. Students completing this degree will be able to investigate and defend computer systems against cyber-attacks, unauthorized use or modification, and exploitation.

Students entering into this program of study should have excellent communication, reading and math skills. Throughout the program students will experience coursework that will help them develop critical skills such as critical thinking, performance monitoring, decision making and evaluating systems and organizations

The CyberSecurity certificate program at Saint Paul College is 24 credits in length. The program provides 16 credits specifically related to CyberSecurity which will aid students in the field and in potential certifications.

Career Opportunities

CyberSecurity professionals will find a growing need in both the public and private employment sectors. Graduates will find excellent opportunities as systems administrators, network engineers, system programmers, and systems specialists.

Program Outcomes

1. Graduates will have knowledge and skills in system design, analysis and maintenance.
2. Graduates will have the skills to gather, monitor, and analyze multiple sources of data to identify changes in circumstances or events.
3. Graduates will have the skills to evaluate information to determine compliance with security standards.
4. Graduates of the CyberSecurity program will be prepared for employment as Information Security Analyst or Computer Systems Analysts.

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Faculty

Mark Rawlings mark.rawlings@saintpaul.edu
James Woodcock james.woodcock@saintpaul.edu

Program Requirements

☑ Check off when completed

Course	Cr
☐ CSCI 1440 Networking Fundamentals	4
☐ CSCI 2420 Computer Security	4
☐ CSCI 2451 Computer Networking 2 - Server	4
☐ CSCI 2480 Network Security and Penetration Prevention	4
☐ CSCI 2482 Security Incident Handling, Response and Disaster Recovery	4
☐ CSCI 2484 Ethical Hacking & Countermeasures	4
Subtotal	**24**
Total Program Credits	**24**

Program Start Dates

Fall, Spring

Course Sequence

This course sequence is recommended for a full-time student; however, this sequence is not required.

Not all courses are offered each semester; a selection of courses is offered summer term.

Students should consult with the Program Faculty each semester.

First Semester

CSCI 1440 Networking Fundamentals	4
CSCI 2420 Computer Security	4
CSCI 2451 Computer Networking 2 - Server	4
Total Semester Credits	**12**

Second Semester

CSCI 2480 Network Security and Penetration Prevention	4
CSCI 2482 Security and Incident Handling Response and Disaster Recovery	4
CSCI 2484 Ethical Hacking & Countermeasures	4
Total Semester Credits	**12**

Total Program Credits **24**

Minimum Program Entry Requirements
Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ on Reading Comprehension or grade of "C" or better in ENGL 0922

Elementary Algebra: Score of 76+ or grade of "C" or better in MATH 0910

Students enrolling in the Certificate should have previous networking experience or consider taking additional networking courses as identified by the instructor/advisors.

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

352C

Computer Science Transfer Pathway AS DEGREE

Program Overview

The Computer Science Transfer Pathway AS Degree is designed to provide students with opportunities for immediate employment or for transfer to four-year institutions. The College has developed articulation agreements with four-year institutions to assist students with their transfer goals. See a Pathway Advisor for further information.

Students planning a career in this area should have above average mathematic reasoning and communication skills. Students should exhibit qualities of patience, and preciseness and enjoy working in a team environment.

Career Opportunities

Graduates of this program may choose to continue their education at a four-year institution in a Computer Science or related field. Others may elect to enter the workforce following graduation. Graduates will find opportunities in the computer science field in the areas of programming or database management in business, manufacturing, government and education. With additional education and experience, students may advance to positions such as Database Analyst, Systems Analyst, Software Developer or Programmer-Analyst.

Program Outcomes

1. Graduates will be able to develop complex algorithms which underlie common programming tasks.
2. Graduates will be able to construct and analyze the performance of complex data structures and use them to develop efficient computer programs.
3. Graduates will have a sound understanding of the mathematics that underlies Computer Science and be able to develop and deploy computer programs which utilize it.
4. Graduates of the program will have mastered the general education requirements for work and life roles.

Transfer Opportunities

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below.

For more information please go to saintpaul.edu/Transfer.

Computer Science AS

BA Individualized Studies
Metropolitan State University

BS Information Technology
Saint Mary's University-Twin Cities Campus

BS Computer Information Systems
College of St. Scholastica

Program Faculty

Warren Sheaffer warren.sheaffer@saintpaul.edu

Part-time/Full-time Options
Some day and evening class availability. Students may attend full-time or part-time.

Program Requirements

☑ Check off when completed

Course	Cr
☐ CSCI 1410 Computer Science & Information Systems	4
☐ CSCI 1523 Intro to Computing and Programming Concepts	4
☐ CSCI 1524 Intro to Algorithms and Data Structures	4
☐ CSCI 1533 ANSI C Language Programming	2
☐ CSCI 1541 Java Programming 1	4
☐ CSCI 2460 Discrete Structures of Computer Science	4
☐ CSCI 2469 Advanced Programming Principles	4
☐ CSCI 2570 Machine Architecture & Organization	4
Subtotal	**30**

General Education/MnTC Requirements	Cr
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication ENGL 1711 Composition 1 – 4 cr ENGL 1712 Composition 2 -- 2 cr COMM 17XX – 3 cr	9
☐ Goal 3: Natural Sciences PHYS 2700 General Physics 1 – 5 cr	5
☐ Goal 4: Mathematical/Logical Reasoning MATH 2749 Calculus 1 - 4 cr MATH 2750 Calculus 2 OR MATH 1740 Introduction to Statistics - 4 cr	8
☐ Goal 5: History, Social Science and Behavioral Sciences	3
☐ Goal 6: Humanities and Fine Arts	3
☐ Goals 1-10 of the Minnesota Transfer Curriculum Select a minimum of 2 additional credits. Students must select courses from at least six (6) Goal Areas of the Minnesota Transfer Curriculum.	2
General Education Requirements	**30**

Total Program Credits 60

* Please refer to specific articulation agreements to determine the best mathematics option.

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Start Dates

Fall, Spring, Summer

Course Sequence

The following sequence is recommended for a full-time student. Not all courses are offered each semester.

First Semester

CSCI 1410 Computer Science & Information Systems	4
Goal 1: ENGL 1711 Composition 1	4
Goal 4: MATH 2749 Calculus 1	4
Goals 1-10 of the Minnesota Transfer Curriculum	2
Total Semester Credits	**14**

Second Semester

CSCI 1523 Intro to Computing and Programming Concepts	4
Goal 3: PHYS 2700 General Physics 1	5
Goal 4: MATH 2750 Calculus 2 OR MATH 1740 Intro to Statistics	4
Goal 5: History, Social Sciences, Behavioral	3
Total Semester Credits	**16**

Third Semester

CSCI 1533 ANSI C Language Programming	2
CSCI 1541 Java Programming 1	4
CSCI 2570 Machine Architecture & Organization	4
Goal 1: ENGL 1712 Composition 2	2
Goal 1: COMM 17XX	3
Total Semester Credits	**15**

Fourth Semester

CSCI 1524 Intro to Algorithms and Data Structures	4
CSCI 2460 Discrete Structures of Comp Science	4
CSCI 2469 Advanced Programming Principles	4
Goal 6: Humanities and Fine Arts	3
Total Semester Credits	**15**

Total Program Credits 60

See back of this guide for Course Chart

Minimum Program Entry Requirements
Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

Elementary Algebra: Score of 76+ or grade of "C" or better in MATH 0910

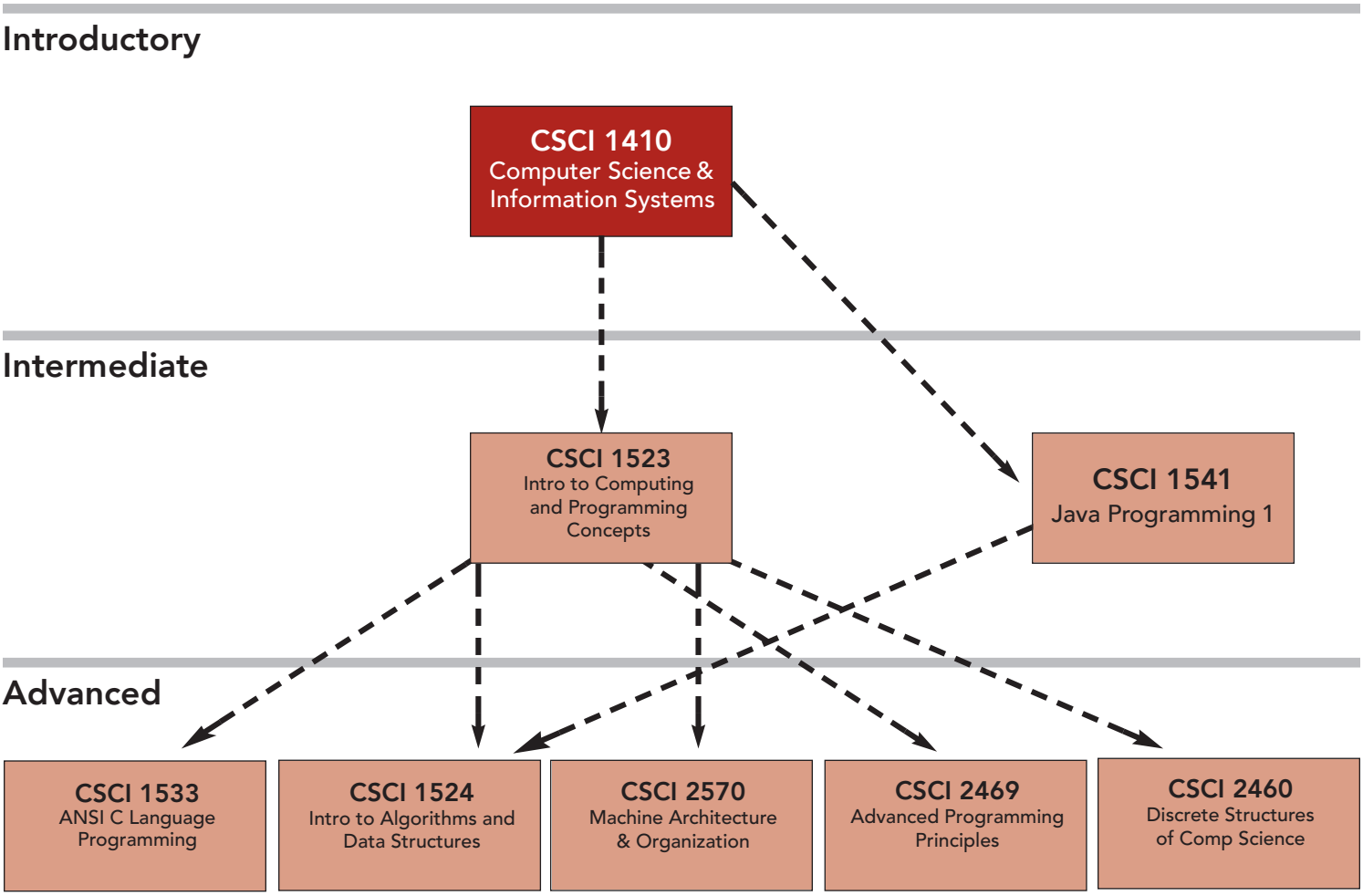
Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

TPCS

Computer Science Transfer Pathway AS DEGREE *(continued)*

(30 credits + 30 GenEd credits)

The below chart illustrates the courses required for completion of this degree.



Management Information Systems AS DEGREE

Program Overview

The Associate of Science Degree in Management Information Systems is designed to provide students with opportunities for immediate employment or for transfer to four-year institutions. The College has developed articulation agreements with four-year institutions to assist students with their transfer goals. See a Transfer Specialist for further information.

Students planning a career in this area should have above average mathematic reasoning and communication skills. Students should exhibit qualities of patience, perseverance, and preciseness, and should enjoy working in a team environment.

Career Opportunities

A management information system degree prepares the student for a career that combines business techniques and computer systems capability. Students study how to provide reporting and analysis using best practices in information technology.

Graduates will find opportunities in the information systems field in business, manufacturing, government and education.

With additional education and experience, students may advance to positions such as Systems Analyst, Software Architect and Business Analyst. Graduates of this program may choose to continue their education at a four-year institution in Management Information Systems or a related field. Others may elect to enter the workforce following graduation.

Program Outcomes

1. Graduates will be able to analyze complex business processes and develop process improvements and comprehensive information system requirements specifications to support them.
2. Graduates will be able to help build and test information systems in an organization.
3. Graduates will be able to utilize accounting and business systems information to develop recommendations for operating cost reduction and improved use of capital investment.
4. Graduates will have a sound understanding of business systems, current technologies, organizational structures, communication tools and critical thinking skills to help guide Management Information Systems success.

Program Faculty

Warren Sheaffer warren.sheaffer@saintpaul.edu

Part-time and Full-time Options

This program can be completed by using a combination of day, evening, and Saturday courses. Part-time and full-time options are available.

Program Requirements

☑ Check off when completed

Course	Cr
☐ ACCT 2410 Financial Accounting	4
☐ BUSN 2110 Principles of Marketing	3
☐ BUSN 2450 Management Fundamentals	3
☐ CSCI 1410 Computer Science & Information Systems	4
☐ CSCI 1450 Web Fundamentals/HTML	4
☐ CSCI 1523 Intro to Computing and Programming Concepts	4
☐ CSCI 1550 Database Management Fundamentals	4
☐ CSCI 2410 Management Information Systems	3
Subtotal	**29**

General Education/MnTC Requirements	Cr
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication ENGL 1711 Composition 1 – 4 cr COMM 17XX – 3 cr	7
☐ Goal 4: Mathematical/Logical Reasoning MATH 1740 Introduction to Statistics – 4 cr MATH 1730 College Algebra – 3 cr OR MATH 2749 Calculus 1 – 4 cr	7-8
☐ Goal 5: History, Social Science and Behavioral Sciences ECON 1720 Macroeconomics – 3 cr ECON 1730 Microeconomics – 3 cr	6
☐ Goals 1-10 of the Minnesota Transfer Curriculum. Select a minimum of 10-11 additional credits Students must select courses from at least six (6) Goal Areas of the Minnesota Transfer Curriculum.	10-11
General Education Requirements	**31**

Total Program Credits 60

Transfer Opportunities

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below.

For more information please go to saintpaul.edu/Transfer.

Management Information Systems AS

BA Individualized Studies
Metropolitan State University

BS Computer Information Systems
College of St. Scholastica

BS Information Technology
Saint Mary's University-Twin Cities Campus

BS Management Information Systems
Metropolitan State University

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Start Dates

Fall, Spring, Summer

Course Sequence

The following sequence is recommended for a full-time student. Not all courses are offered each semester.

First Semester

BUSN 2450 Management Fundamentals	3
CSCI 1410 Computer Science & Info Systems	4
Goal 1: ENGL 1711 Composition 1	4
Goal 4: MATH 1730 College Algebra OR MATH 2749 Calculus 1	3-4
Total Semester Credits	**14-15**

Second Semester

ACCT 2410 Financial Accounting	4
BUSN 2110 Principles of Marketing	3
CSCI 1523 Introduction to Computing and Programming Concepts	4
Goal 4: MATH 1740 Introduction to Statistics	4
Total Semester Credits	**15**

Third Semester

CSCI 1450 Web Fundamentals/HTML	4
CSCI 1550 Database Management Fundamentals	4
Goal 1: COMM 17XX	3
Goal 5: ECON 1720 Macroeconomics	3
MnTC Electives	3
Total Semester Credits	**17**

Fourth Semester

CSCI 2410 Management Information Systems	3
Goal 5: ECON 1730 Microeconomics	3
MnTC Electives	7-8
Total Semester Credits	**13-14**

Total Program Credits 60

See back of this guide for Course Chart

Minimum Program Entry Requirements

Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

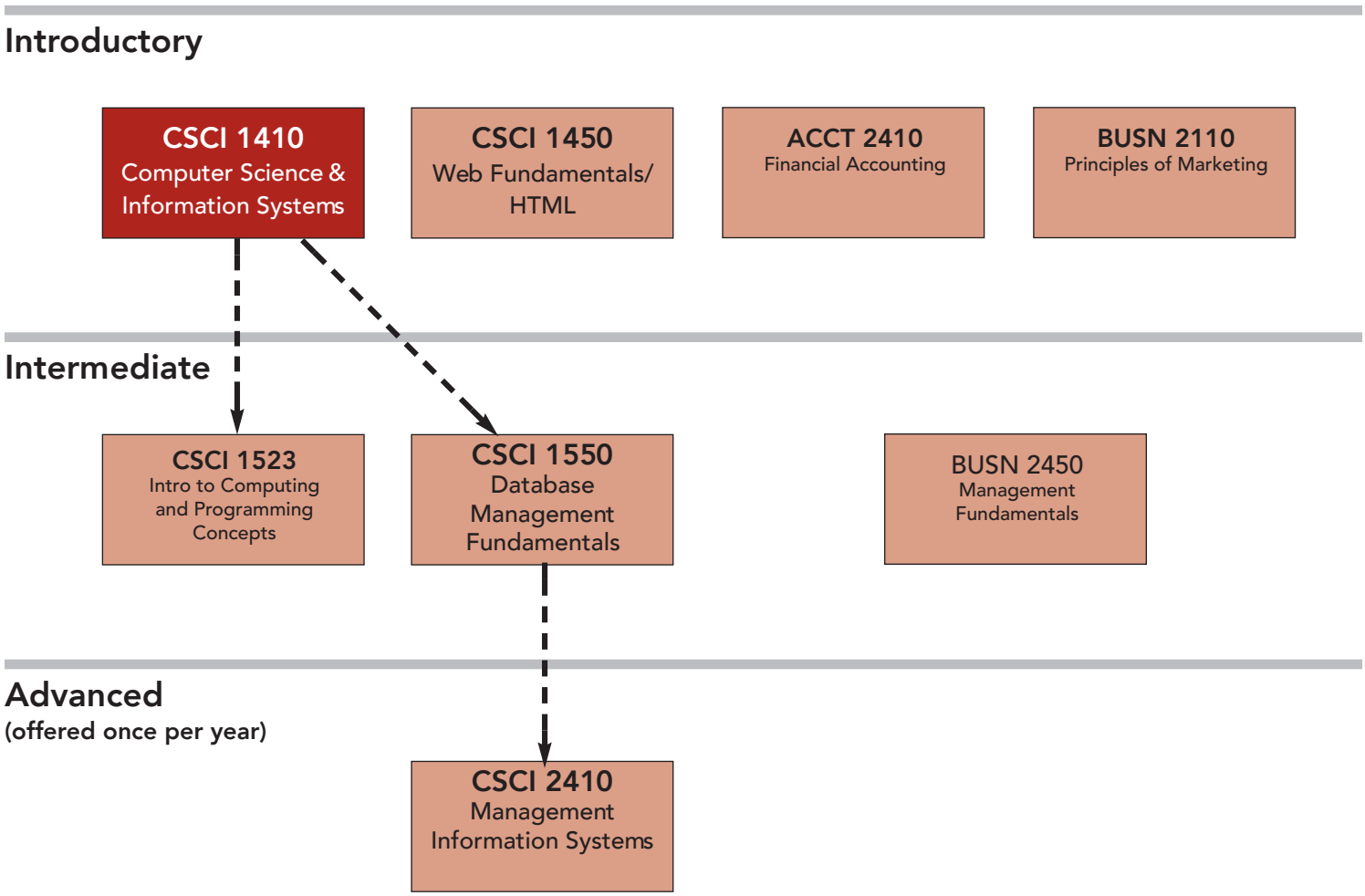
Elementary Algebra: Score of 76+ or grade of "C" or better in MATH 0910

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

232S (7102)

Management Information Systems AS DEGREE *(continued)*
(29 credits + 31 GenEd credits)

The below chart illustrates the courses required for completion of this degree.



Computer Network Engineering AAS DEGREE

Program Overview

Networking Specialists can work in a wide variety of jobs. The work could include purchasing, installing, configuring, administrating and/or supporting. Some jobs in networking could include computer network support, user training, installing and maintaining local and/or wide area networks.

The student should have excellent communication and math skills. For the certificate programs, the student is expected to have prior microcomputer and/or networking experience. He/she should exhibit qualities of patience, perseverance and preciseness and be a logical thinker. The student should enjoy working in a team environment and be able to work independently.

Career Opportunities

With almost every size company connected to some type of network, the jobs in networking have become the fastest growing jobs in the computer field. With companies networking to share resources and reduce expenses the networking specialist is an invaluable part of the new company structure. There is a wide variety of jobs in networking including installation, maintenance, training, managing and user support.

Graduates find excellent opportunities as Network Administrators, Network Support, and Certified Network Engineers in business, manufacturing, government and education. Jobs for Networking Specialists for all types of installations are found throughout the country with opportunities for excellent earnings and rapid advancement. Jobs include the following:

- Networking Engineer
- Network Help Desk Support
- Datacommunications Specialist
- PC Network Administrator
- Information Specialist
- WAN Manager Network Administrator
- LAN Specialist
- Telecommunications Specialist
- Certified Network Engineer
- LAN Manager

Program Outcomes

1. Graduates will have knowledge and skills in computer network engineering.
2. Graduates will have knowledge and experience in system design, analysis and maintenance.
3. Graduates of the Computer Network programs will be prepared for employment as computer network engineers.
4. Graduates will be prepared to take industry certification exams.

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Faculty

Warren Sheaffer warren.sheaffer@saintpaul.edu

Part-Time/Full-Time Options
Some day and evening class availability. Students may attend full time or part time.

Program Requirements

☑ Check off when completed

Course	Cr
☐ CSCI 1410 Computer Science & Information Systems	4
☐ CSCI 1423 Computer Networking 1 – Client	4
☐ CSCI 1440 Networking Fundamentals	4
☐ CSCI 1523 Intro to Computing and Programming Concepts	4
☐ CSCI 2420 Computer Security	4
☐ CSCI 2451 Computer Networking 2 – Server	4
☐ CSCI 2453 Computer Virtualization	4
☐ CSCI 2461 Computer Networking 3 – Linux	4
☐ CSCI 2465 Computer Networking 4 – Infrastructure	4
☐ CSCI 2475 A+ Hardware/Operating System Prep	4
☐ CSCI 2570 Machine Architecture and Organization	4
Subtotal	**44**

General Education Requirements	Cr
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication ENGL 1711 Composition 1 – 4 cr COMM 17XX – 3 cr	7
☐ Goal 3 or Goal 4 Goal 3: Natural Sciences OR Goal 4: Mathematical/Logical Reasoning	3
☐ Goal 5: History, Social Science and Behavioral Sciences	3
☐ Goal 6: Humanities and Fine Arts	3
General Education Requirements	**16**

Total Program Credits 60

Transfer Opportunities

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below.

For more information please go to saintpaul.edu/Transfer.

Computer Network Engineering AAS

BA Individualized Studies
Metropolitan State University

BS Computer Information Systems
College of St. Scholastica

BS Information Technology
Saint Mary's University-Twin Cities Campus

BS Operations Management
Minnesota State University-Moorhead

Program Start Dates

Fall, Spring, Summer

Course Sequence

The following sequence is recommended for a full-time student. Not all courses are offered each semester.

First Semester
CSCI 1410 Computer Science & Information Systems . . 4
CSCI 1423 Computer Networking 1 – Client 4
CSCI 1440 Networking Fundamentals 4
Goal 1: ENGL 1711 Composition 1. 4
Total Semester Credits. 16

Second Semester
CSCI 1523 Intro to Computing and Programming Concepts 4
CSCI 2451 Computer Networking 2 – Server 4
CSCI 2461 Computer Networking 3 – Linux. 4
CSCI 2475 A+ Hardware/Operating System Prep 4
Total Semester Credits. 16

Third Semester
CSCI 2453 Computer Virtualization 4
Goal 1: COMM 17XX 3
Goal 3: Natural Science OR
Goal 4: Mathematical/Logical Reasoning 3
Goal 5: History, Social and Behavioral Sciences 3
Goal 6: Humanities and Fine Arts 3
Total Semester Credits. 16

Fourth Semester
CSCI 2420 Computer Security 4
CSCI 2465 Computer Networking 4 – Infrastructure . . 4
CSCI 2570 Machine Architecture and Organization . . . 4
Total Semester Credits. 12

Total Program Credits 60

See back of this guide for Course Chart

Minimum Program Entry Requirements
Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

Elementary Algebra: Score of 76+ or grade of "C" or better in MATH 0910

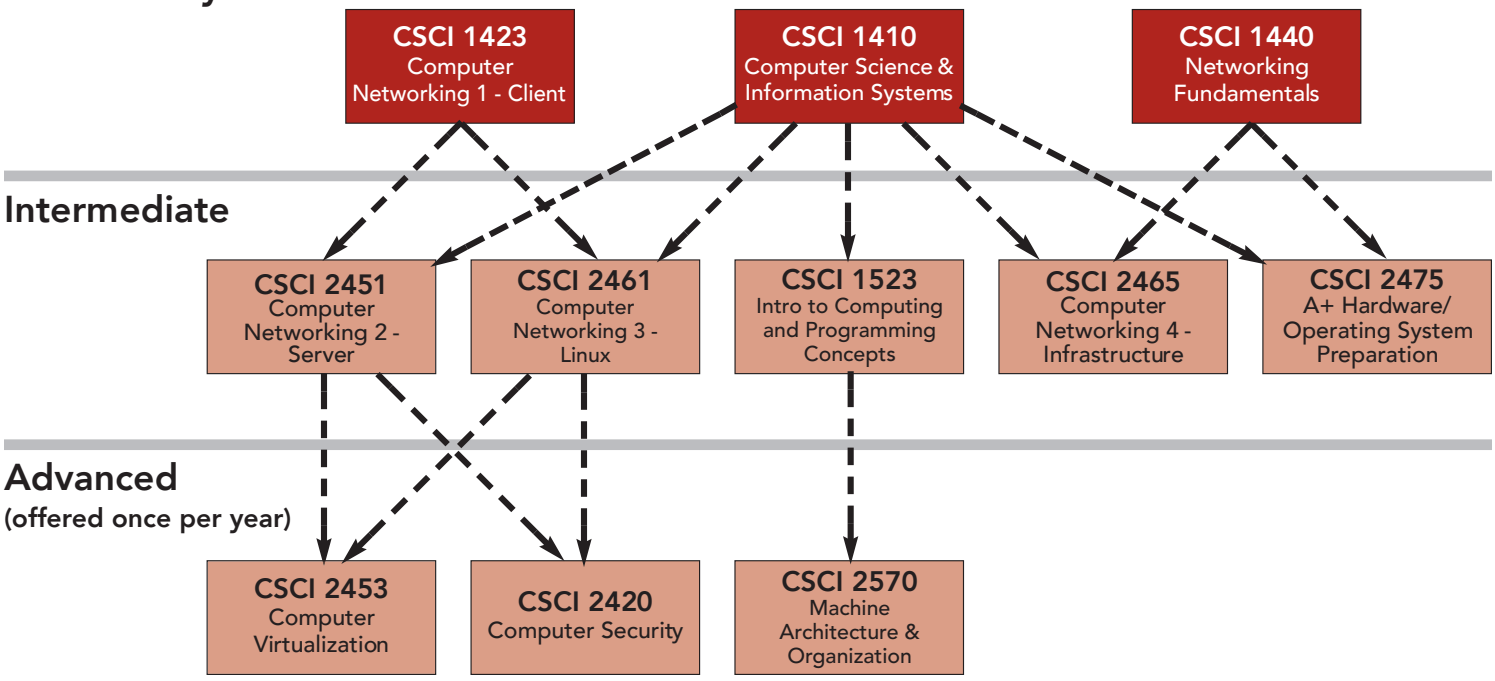
Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

037A (7035)

Computer Network Engineering AAS DEGREE *(continued)*

(44 credits + 16 GenEd credits)

The below chart illustrates the courses required for completion of this degree.



Computer Programming AAS DEGREE

Program Overview

The job of the applications programmer is to (1) review job specifications provided by the system analyst and end user and (2) plan, code, test, and document a programming solution which takes the available data input and produces the desired output in the form of a printed report or a screen display. The programming language(s) used depends on the nature of the problem and the languages available to the programmer at his/her installation.

The student should have above average communications and math skills. He/she should exhibit qualities of patience, perseverance and preciseness and should enjoy working in a team environment and also be able to work independently.

Career Opportunities

Graduates find excellent opportunities as computer programmers in business, manufacturing, government and education. Jobs for computer programmers for all types of computer systems are found throughout the country with opportunities for good earning and rapid advancement. Jobs include: Programmer, Database Project Specialist, Applications Programmer, Technical Programmer, Systems Analyst, MIS Coordinator, Software Developer, Junior Programmer-Analyst, and Senior Programmer-Analyst.

Program Outcomes

1. Graduates will be able to design and code production software applications.
2. Graduates will be able to analyze complex organizational problems and create design specifications to address these problems.
3. Graduates will be able to use industry standard database management systems to support their applications
4. Graduates of the degree programs will have mastered the general education requirements for work and life roles.
5. Graduates will be prepared to take certification exams in their area of specialization.

Program Faculty

Warren Sheaffer warren.sheaffer@saintpaul.edu

Program Requirements

☑ Check off when completed

Course	Cr
☐ CSCI 1410 Computer Science & Information Systems	4
☐ CSCI 1423 Computer Networking – Client	4
☐ CSCI 1450 Web Fundamentals/HTML	4
☐ CSCI 1523 Intro to Computing and Programming Concepts	4
☐ CSCI 1524 Intro to Algorithms and Data Structures	4
☐ CSCI 2570 Machine Architecture and Organization	4
☐ **Technical Electives**	**4**
Select one of the courses listed below. Ensure that your elective is not part of your chosen emphasis:	
☐ CSCI 1541 Java Programming 1	4
☐ CSCI 1531 Objective-C Programming	4
☐ CSCI 1550 Database Management Fundamentals	4
☐ CSCI 2440 Client Side Programming 1 (required for the Web Based 2D Game Development Emphasis)	4
☐ CSCI 2442 Server Side Programming	4
☐ CSCI 2560 Introduction to Computer Games	4
Subtotal	**28**

Complete one of the Emphases listed below 16

Java Program Emphasis	Cr
☐ CSCI 1541 Java Programming 1	4
☐ CSCI 1542 Java Programming 2	4
☐ CSCI 1550 Database Management Fundamentals	4
☐ CSCI 2466 J2EE-JSP and Servlets	4
Total Emphasis Credits	**16**

Web Development Emphasis	Cr
☐ CSCI 2440 Client Side Programming 1	4
☐ CSCI 2442 Server Side Programming	4
☐ CSCI Technical Electives	8
☐ CSCI 2466 J2EE-JSP and Servlets	4
☐ CSCI 2621 Ruby on Rails	4
☐ CSCI 2622 Client Side Programming 2	4
Total Emphasis Credits	**16**

Mobile Development Emphasis	Cr
☐ CSCI 1531 Objective-C Programming	4
☐ CSCI 1541 Java Programming 1	4
☐ CSCI 2628 Programming iOS Devices	4
☐ CSCI 2629 Programming Android Devices	4
Total Emphasis Credits	**16**

Web Based 2D Game Development Emphasis	Cr
☐ DGIM 2521 2D Web Animation	2
☐ DGIM 2530 Web Based Game Design 1	4
☐ DGIM 2531 Web Based Game Design 2	4
☐ DGIM 2586 Digital Sound	2
☐ DGIM Technical Electives	4
☐ DGIM 1490 3D Animation Fundamentals	4
☐ DGIM 2560 Illustrator	4
☐ DGIM 1483 Photoshop 1	2
☐ DGIM 1484 Photoshop 2	2
Total Emphasis Credits	**16**

Enterprise Emphasis	Cr
☐ CSCI 1544 Enterprise Operating Systems	4
☐ CSCI 1546 COBOL Programming 1	4
☐ CSCI 1547 COBOL Programming 2	4
☐ CSCI 2470 Enterprise Database Systems	4
☐ CSCI 2472 Enterprise Transaction Processing (CICS)	4
Total Emphasis Credits	**16**

General Education Requirements	Cr
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication ENGL 1711 Composition 1 – 4 cr COMM 17XX – 3 cr	7
☐ Goal 3 or Goal 4 Goal 3: Natural Sciences OR Goal 4: Mathematical/Logical Reasoning	3
☐ Goal 5: History, Social Science and Behavioral Sciences	3
☐ Goal 6: Humanities and Fine Arts	3
General Education Requirements	**16**

Total Program Credits 60

See back of this guide for Course Sequence, Transfer Opportunties and Chart

Information is subject to change.
This Program Requirements Guide is not a contract.

Minimum Program Entry Requirements

Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

Elementary Algebra: Score of 76+ or grade of "C" or better in MATH 0910

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

009A (7011)

Computer Programming AAS DEGREE *(continued)*

Program Start Dates

Fall, Spring, Summer

Course Sequence

The following sequence is recommended for a full-time student; however, this sequence is not required. Not all courses are offered each semester.

First Semester
CSCI 1410 Computer Science & Information Systems. . 4
CSCI 1423 Computer Networking – Client. 4
CSCI 1450 Web Fundamentals/HTML 4
Goal 1: COMM 17XX 3
Total Semester Credits. 15

Second Semester
CSCI 1523 Intro to Computing and Programming Concepts 4
Goal 3: Natural Sciences OR Goal 4: Mathematical/Logical Reasoning 3
Emphasis Course. 4
Technical Elective 4
Total Semester Credits. 15

Third Semester
CSCI 1524 Intro to Algorithms and Data Structures. . . 4
Goal 1: ENGL 1711 Composition 1. 4
Emphasis Course(s) 8
Total Semester Credits. 16

Fourth Semester
CSCI 2570 Machine Architecture and Organization . . . 4
Goal 5: History, Social and Behavioral Sciences 3
Goal 6: Humanities and Fine Arts 3
Emphasis Course(s) 4
Total Semester Credits. 14

Total Program Credits 60

Transfer Opportunities

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below.

For more information please go to saintpaul.edu/Transfer.

Computer Programming AAS

BA Individualized Studies
Metropolitan State University

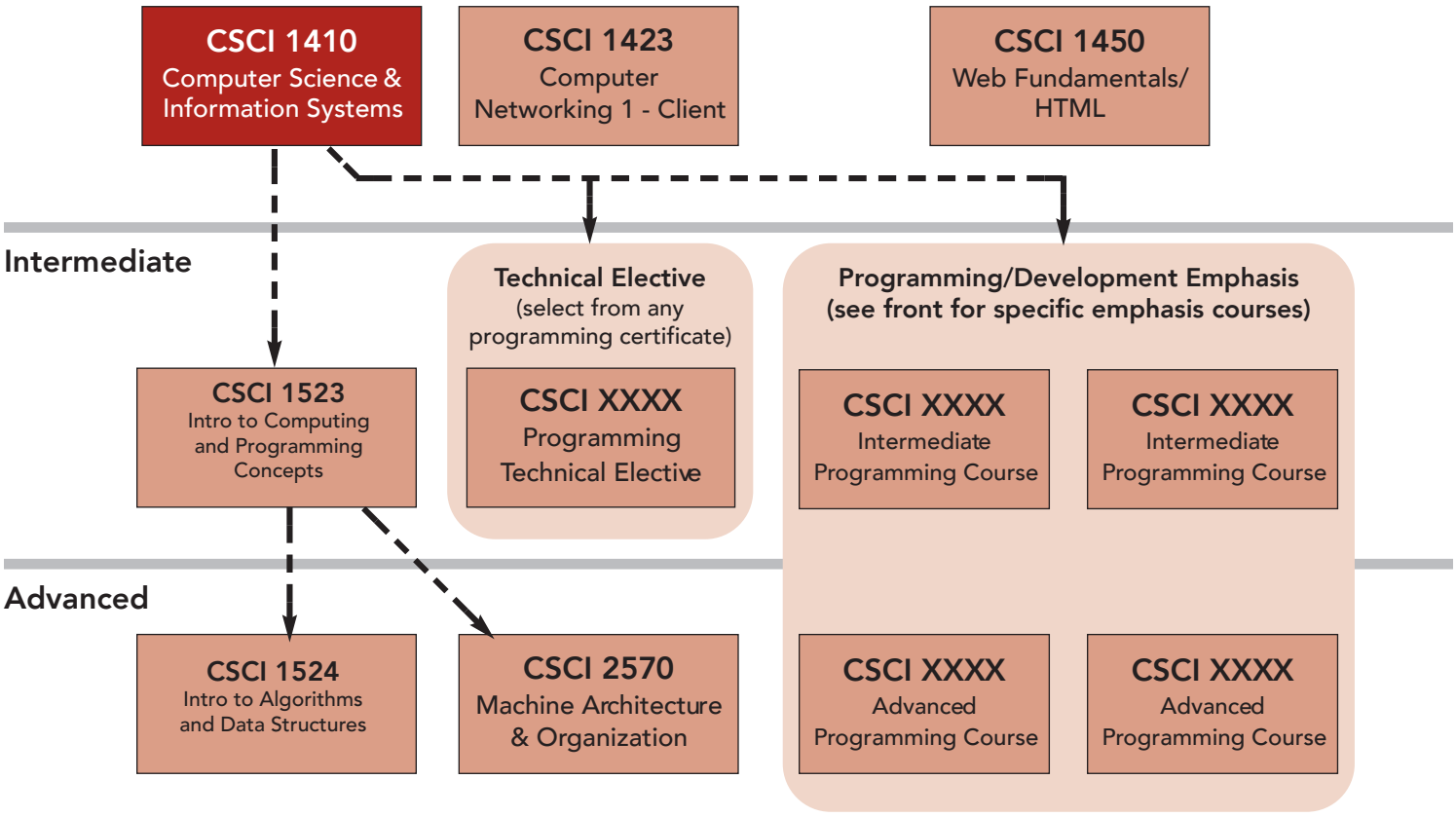
BS Computer Information Systems
College of St. Scholastica

BS Information Technology
Saint Mary's University-Twin Cities Campus

BS Operations Management
Minnesota State University-Moorhead

Computer Programming AAS Degree (44 credits + 16 GenEd credits)

The below chart illustrates the courses required for completion of this degree.



Enterprise Computing CERTIFICATE

Program Overview

The Enterprise Computing Certificate at Saint Paul College is offered in cooperation with the IBM Academic Initiative, a global program that facilitates the collaboration between IBM and educators to teach students the skills they need to be competitive within the rapidly changing information technology landscape. The program provides students with a global understanding of IBM System Z with an emphasis on system administration and ZOS, COBOL programming, CICS and Transaction Processing Systems, DB2 administration and application development.

Major companies around the world run their critical applications on large and midrange systems, such as mainframes, Power Systems, blades, and rack and cluster systems. Mainframe computing systems are transforming businesses and systems around the world. The mainframe is driving areas in cloud computing, analytics, security and mobile computing and are tackling challenges never thought possible. The need for technical skills on enterprise systems continues to grow, and students with knowledge and hands-on experience are sought after in the job market.

Career Opportunities

The IBM Academic Initiative System z program seeks to ensure that the next generation of mainframe experts will be available to help more companies and organizations leverage the superior security, availability, scalability, and efficiency of the mainframe. The demand for IT skills is growing, especially for students who have mainframe or enterprise computing skills.

Students graduating with the Enterprise Computing Certificate will learn valuable skills that will qualify them for jobs with some of the largest, and most successful companies in Banking, Insurance, Healthcare, and Information Technology. Positions that students will be able to fill include System Engineer, Mainframe Operator, Information Security Specialist, and more

Program Outcomes

1. Create COBOL applications in a zEnterprise system.
2. Create VSAM clusters to support basic file maintenance applications.
3. Integrate an IBM DB2 enterprise database with a COBOL DB2 API applications.
4. Code and test COBOL DB2 dynamic SQL interactive applications.
5. Explain the relationship between zEnterprise hardware concepts, z/OS operating system concepts, and interactive facilities such as TSO/E, ISPF, and UNIX.
6. Develop COBOL application programs that incorporate access to a DB2 database and implement transaction processing using CICS.

Program Faculty

Warren Sheaffer warren.sheaffer@saintpaul.edu

Program Requirements

☑ Check off when completed

Course	Cr
☐ CSCI 1410 Computer Science and Information Systems	4
☐ CSCI 1423 Computer Networking 1 - Client	4
☐ CSCI 1544 Enterprise Operating Systems	4
☐ CSCI 1546 COBOL Programming 1	4
☐ CSCI 1547 COBOL Programming 2	4
☐ CSCI 2470 Enterprise Database Systems	4
☐ CSCI 2472 Enterprise Transaction Processing (CICS)	4
Total Program Credits	**28**

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Start Dates

Fall, Spring, Summer

Course Sequence

This course sequence is recommended for a part-time student; however, this sequence is not required.

Not all courses are offered each semester; a selection of courses is offered summer term.

Students should consult with the Program Faculty each semester.

First Semester

CSCI 1410 Computer Science and Information Systems	4
CSCI 1423 Computer Networking 1 - Client	4
Total Semester Credits	**8**

Second Semester

CSCI 1544 Enterprise Operating Systems	4
CSCI 1546 COBOL Programming 1	4
Total Semester Credits	**8**

Third Semester

CSCI 1547 COBOL Programming 2	4
CSCI 2472 Enterprise Transaction Processing (CICS)	4
Total Semester Credits	**8**

Fourth Semester

CSCI 2470 Enterprise Database Systems	4
Total Semester Credits	**4**

Total Program Credits **28**

Minimum Program Entry Requirements

Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

Elementary Algebra: Score of 76+ or grade of "C" or better in MATH 0910

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

378C

Network Administration CERTIFICATE

Program Overview

The Network Administration Certificate is designed for individuals who already have acquired at least a minimum level of technical computer skills, either through previous education, training, and/or experience. It is designed to enhance one's current computer knowledge and skills.

Networking Specialists can work in a wide variety of jobs. The work could include purchasing, installing, configuring, administrating, and/or supporting. Some jobs in networking could include help desk support, user training, installing and maintaining local and/or wide area networks.

The student should have excellent communications and math skills. For the certificate programs the student is expected to have prior microcomputer and/or networking experience. He/she should exhibit qualities of patience, perseverance, and preciseness and be a logical thinker. The student should enjoy working in a team environment, and be able to work independently. All networking programs emphasize preparation for either the Microsoft Certified System Administration or Linux Professional Institute (LPI) Certification.

Career Opportunities

With almost every size company connected to some type of network, the jobs in networking have become the fastest growing jobs in the computer field. With companies networking to share resources and reduce expenses the networking specialist is an invaluable part of the new company structure. There is a wide variety of jobs in networking including installation, maintenance, training, managing and user support.

Graduates find excellent opportunities as Network Administrators, Network Support, and Certified Network Engineers in business, manufacturing, government and education. Jobs for Networking Specialists for all types of installations are found throughout the country with opportunities for excellent earnings and rapid advancement. Jobs include the following:

- Networking Engineer
- Network Help Desk Support
- Data Communications Specialist
- PC Network Administrator
- Information Specialist
- WAN Manager
- Network Administrator
- LAN Specialist
- Telecommunications Specialist
- Certified Network Engineer
- LAN Manager

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Outcomes

1. Graduates will have knowledge and skills in computer network engineering.
2. Graduates will have knowledge and experience in computer network system design, analysis, and maintenance.
3. Graduates of the Computer Network Programs will be prepared for employment as computer network engineers.

Program Faculty

Warren Sheaffer warren.sheaffer@saintpaul.edu

Program Requirements

☑ Check off when completed

Course	Cr
☐ CSCI 1410 Computer Science & Information Systems	4
☐ CSCI 1423 Computer Networking 1 – Client	4
☐ CSCI 1440 Networking Fundamentals	4
☐ CSCI 2451 Computer Networking 2 – Server	4
☐ CSCI 2461 Computer Networking 3 – Linux	4
☐ CSCI 2465 Computer Networking 4 – Infrastructure	4
Total Program Requirements	**24**

Program Start Dates

Fall, Spring, Summer

Course Sequence

The following sequence is recommended for a part-time student. Not all courses are offered each semester.

First Semester

CSCI 1410 Computer Science & Information Systems	4
CSCI 1440 Networking Fundamentals	4
Total Semester Credits	**8**

Second Semester

CSCI 1423 Computer Networking 1 – Client	4
CSCI 2465 Computer Networking 4 – Infrastructure	4
Total Semester Credits	**8**

Third Semester

CSCI 2451 Computer Networking 2 – Server	4
CSCI 2461 Computer Networking 3 – Linux	4
Total Semester Credits	**8**

Total Program Credits 24

See back of this guide for Course Chart

Minimum Program Entry Requirements

Students entering this program must meet the following minimum program entry requirements in addition to having acquired previous technical computer skills:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

Elementary Algebra: Score of 76+ or grade of "C" or better in MATH 0910

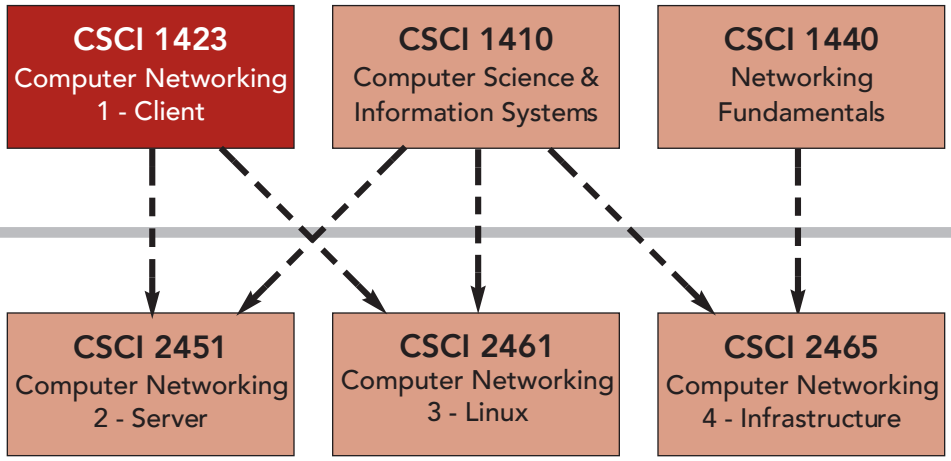
Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

298C (7183)

Network Administration CERTIFICATE *(continued)*
(24 credits)

The below chart illustrates the courses required for completion of this certificate.

Introductory



Intermediate

Java Programming CERTIFICATE

Program Overview

This is a 24 credit certificate program exploring the Java programming language and computing platform. The certificate includes a foundation course in computer science, a web fundamentals course, and an in depth study of databases. It then features a two-course sequence in Java programming and a course in Java for web development. This certificate may be completed apart from a degree program or may be selected as an emphasis in the Computer Programming AAS degree.

The student should have above average communications and math skills. He/she should exhibit qualities of patience, perseverance, and preciseness, and should enjoy working in a team environment and also be able to work independently. All programs emphasize training for industry certification.

Career Opportunities

Graduates find excellent opportunities as computer programmers in business, manufacturing, government and education. Jobs for computer programmers for all types of computer systems are found throughout the country with opportunities for good earning and rapid advancement.

Program Outcomes

1. Graduates will be able to design and code production software applications.
2. Graduates will be able to use industry standard database management systems to support their applications.

Program Faculty

Warren Sheaffer warren.sheaffer@saintpaul.edu

Program Requirements

☑ Check off when completed

This program is designed for individuals who have computer programming knowledge or are currently employed in the computer programming field.

Course	Cr
☐ CSCI 1410 Computer Science & Information Systems	4
☐ CSCI 1450 Web Fundamentals/HTML	4
☐ CSCI 1541 Java Programming 1	4
☐ CSCI 1542 Java Programming 2	4
☐ CSCI 1550 Database Management Fundamentals	4
☐ CSCI 2466 J2EE-JSP and Servlets	4
Total Program Credits	**24**

Program Start Dates

Fall, Spring, Summer

Course Sequence

The following sequence is recommended for a part-time student. Not all courses are offered every semester. Please contact the Program Faculty for course sequence.

First Semester

CSCI 1410 Computer Science & Information Systems	4
CSCI 1450 Web Fundamentals/HTML	4
Total Semester Credits	**8**

Second Semester

CSCI 1541 Java Programming 1	4
CSCI 1550 Database Management Fundamentals	4
Total Semester Credits	**8**

Third Semester

CSCI 1542 Java Programming 2	4
CSCI 2466 J2EE-JSP and Servlets	4
Total Semester Credits	**8**

Total Program Credits 24

See back of this guide for Course Chart

Minimum Program Entry Requirements

Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

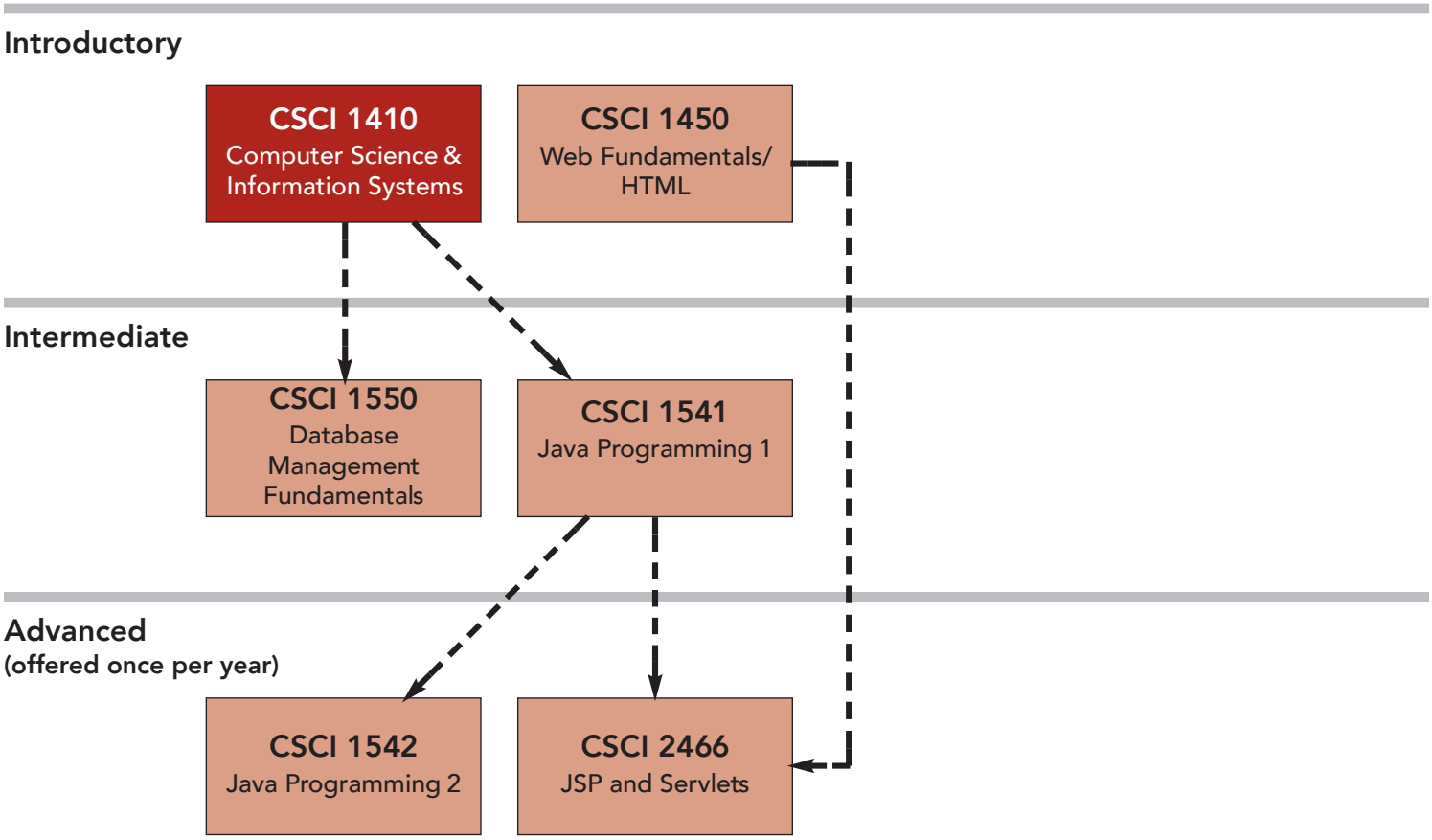
Elementary Algebra: Score of 76+ or grade of "C" or better in MATH 0910

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

299C (7177)

Java Programming CERTIFICATE *(continued)*
(24 credits)

The below chart illustrates the courses required for completion of this certificate.



Web Based 2D Game Development CERTIFICATE

Program Overview

This is a 24 credit certificate program exploring video game creation. The certificate is ideal for students who want to acquire skills needed for game design and programming. The certificate will utilize HTML5, Javascript, Tumult Hype and Phonegap to recreate classic video games for both the Desktop and mobile platforms. The capstone class will introduce students to some of the concepts of mobile app development for both the iPhone and Android platforms. This certificate may be completed apart from a degree program or may be selected as an emphasis in the Computer Programming AAS degree.

The student should have above average communications and math skills. He/she should exhibit qualities of patience, perseverance, and preciseness, and should enjoy working in a team environment and also be able to work independently. All programs emphasize training for industry certification.

Career Opportunities

Graduates find excellent opportunities as computer programmers in business, manufacturing, government and education. Jobs for computer programmers for all types of computer systems are found throughout the country with opportunities for good earning and rapid advancement.

Program Outcomes

1. Graduates will be able to design and code gaming software applications.
2. Graduates will be able to use industry standard design skills to support their applications

Program Faculty

Darren Pearson darren.pearson@sainpaul.edu

Program Requirements

☑ Check off when completed

This program is designed for individuals who have computer programming knowledge or are currently employed in the computer programming field.

Course	Cr
☐ CSCI 1450 Web Fundamentals/HTML	4
☐ CSCI 2440 Client Side Programming 1	4
☐ CSCI 2587 Web Based Game Dev. 1	4
☐ CSCI 2588 Web Based Game Dev. 2	4
☐ DGIM 2521 2D Web Animation	2
☐ DGIM 2586 Digital Sound	2
☐ DGIM Technical Elective(s)	4
Any 4 credits of DGIM classes will be allowed, although the following classes are recommended.	
DGIM 1483 Photoshop 1 - 2cr	
DGIM 1484 Photoshop 2 - 2cr	
DGIM 1490 3D Animation Fundamentals - 4cr	
DGIM 2560 Illustrator - 4cr	
Total Program Credits	**24**

Program Start Dates

Fall, Spring, Summer

Course Sequence

The following sequence is recommended for a part-time student. Not all courses are offered every semester. Please contact the Program Faculty for course sequence.

First Semester

CSCI 1450 Web Fundamentals/HTML	4
DGIM 2521 2D Web Animation	2
Total Semester Credits	**6**

Second Semester

CSCI 2440 Client Side Programming 1	4
DGIM Technical Electives	2
Total Semester Credits	**6**

Third Semester

CSCI 2587 Web Based Game Dev. 1	4
DGIM Technical Electives	2
Total Semester Credits	**6**

Fourth Semester

CSCI 2588 Web Based Game Dev. 2	4
DGIM 2586 Digital Sound	2
Total Semester Credits	**6**

Total Program Credits 24

See back of this guide for Course Chart

Minimum Program Entry Requirements

Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

Elementary Algebra: Score of 76+ or grade of "C" or better in MATH 0910

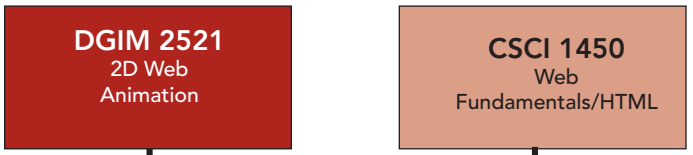
Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

379C

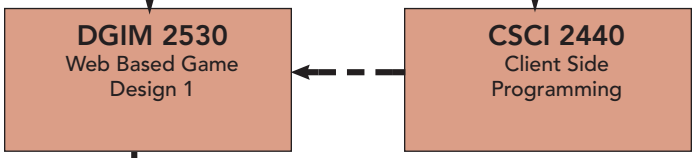
Web Based 2D Game Development CERTIFICATE *(continued)*
(24 credits)

The below chart illustrates the courses required for completion of this certificate.

Introductory



Intermediate



Advanced
(offered once per year)

Web Development CERTIFICATE

Program Overview

This is a 24 credit certificate program providing a foundation in current web technologies. It features a two course sequence in client side programming including AJAX, and also coverage of at least two current server side technologies for database driven development. It includes popular technologies like Ruby on Rails and JSP/Servlets. This certificate may be completed apart from a degree program or may be selected as an emphasis in the Computer Programming AAS degree.

Career Opportunities

Graduates find excellent opportunities as computer programmers in business, manufacturing, government and education. Jobs for computer programmers for all types of computer systems are found throughout the country with opportunities for good earning and rapid advancement.

Program Outcomes

1. Graduates will be able to design and code production web applications based on standard client and server side technologies.
2. Graduates will be able to use industry standard database management systems to support their applications.

Program Faculty

Darren Pearson darren.pearson@sainpaul.edu

Program Requirements

☑ Check off when completed

This program is designed for individuals who have computer programming knowledge or are currently employed in the computer programming field.

Course	Cr
☐ CSCI 1410 Computer Science & Information Systems	4
☐ CSCI 1450 Web Fundamentals/HTML	4
☐ CSCI 2440 Client Side Programming 1	4
☐ CSCI 2442 Server Side Programming	4
Subtotal	**16**
☐ Technical Electives	8
Select two of the following courses:	
☐ CSCI 2466 J2EE-JSP and Servlets	4
☐ CSCI 2621 Ruby on Rails	4
☐ CSCI 2622 Client Side Programming 2	4
Total Program Credits	**24**

Program Start Dates

Fall, Spring, Summer

Course Sequence

Not all courses are offered every semester. Please contact the Program Faculty for course sequence.

See back of this guide for Course Chart

Minimum Program Entry Requirements
Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

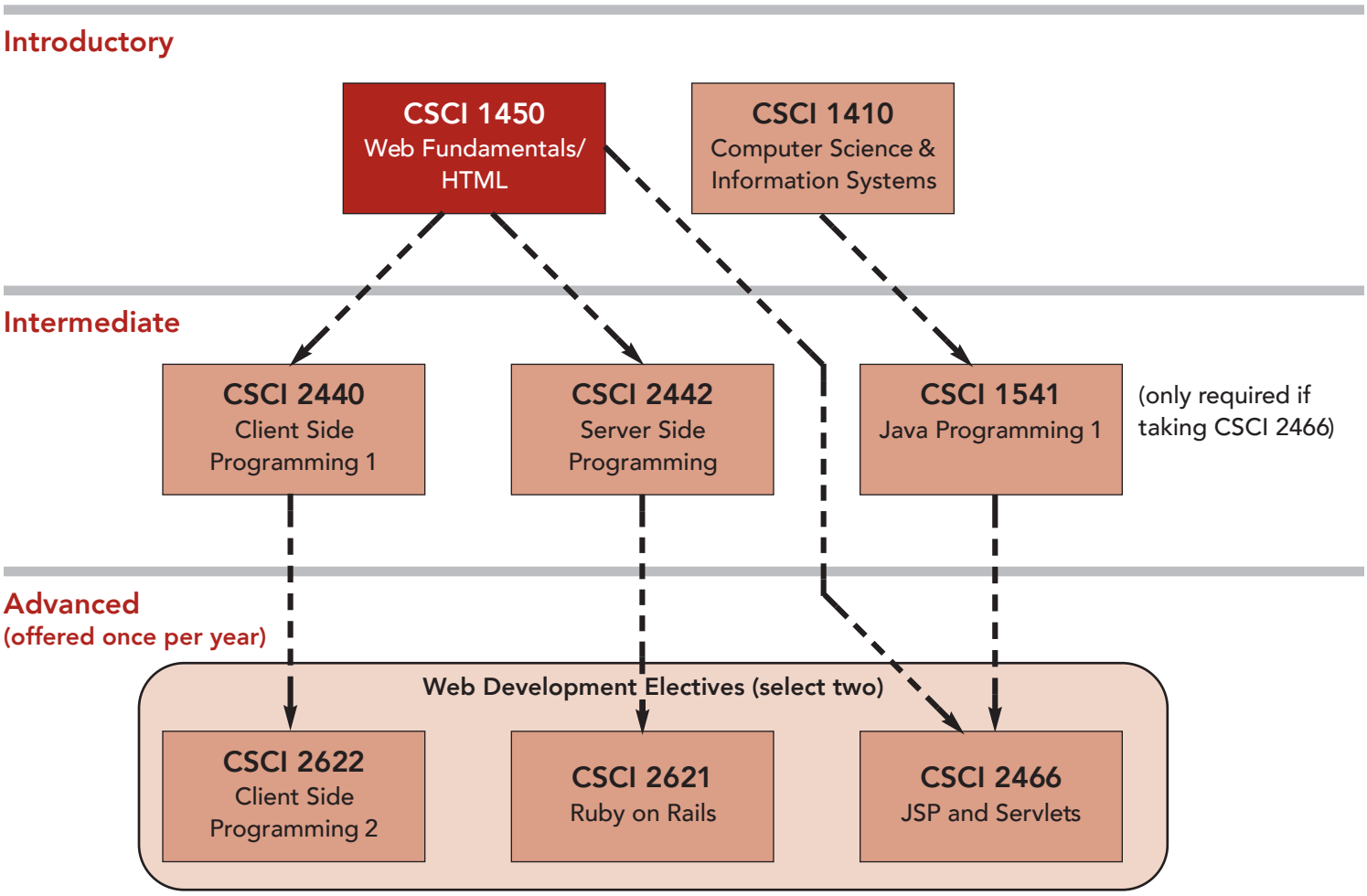
Elementary Algebra: Score of 76+ or grade of "C" or better in MATH 0910

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

244C (7117)

Web Development CERTIFICATE *(continued)*
(24 credits)

The below chart illustrates the courses required for completion of this certificate.



Mobile Development CERTIFICATE

Program Overview

This is a 24 credit certificate program introducing development on the two most popular mobile platforms: Android and iOS. The certificate includes a foundation course in computer science, a web fundamentals course, and a two course sequence exploring each mobile platform. This certificate may be completed apart from a degree program or may be selected as an emphasis in the Computer Programming AAS degree.

Career Opportunities

Graduates from the Mobile Development Certificate program will find excellent opportunities in many industries from healthcare to entertainment. Graduates can also find jobs through freelance opportunities and computer Science entrepreneurs.

Program Outcomes

1. Students will become proficient in the development of mobile applications for both the iDevice and Android mobile platforms.
2. Students will be capable of utilizing industry standard application development platforms for both iDevice and Android software.
3. Students will be knowledgeable in application deployment strategies and technologies for both iDevice and Android platforms.
4. Student will have a general knowledge of the business model surrounding mobile application development.

Program Faculty

Warren Sheaffer warren.sheaffer@saintpaul.edu

Program Requirements

☑ Check off when completed

Course	Cr
☐ CSCI 1410 Computer Science & Information Systems	4
☐ CSCI 1450 Web Fundamentals/HTML	4
☐ CSCI 1531 Objective-C Programming	4
☐ CSCI 1541 Java Programming 1	4
☐ CSCI 2628 Programming iOS Devices	4
☐ CSCI 2629 Programming Android Devices	4
Total Program Credits	**24**

Program Start Dates

Fall, Spring, Summer

Course Sequence

The following sequence is recommended for a part-time student. Not all courses are offered each semester.

First Semester

CSCI 1410 Computer Science & Information Systems	4
CSCI 1450 Web Fundamentals/HTML	4
Total Semester Credits	**8**

Second Semester

CSCI 1531 Objective-C Programming	4
CSCI 1541 Java Programming 1	4
Total Semester Credits	**8**

Third Semester

CSCI 2628 Programming iOS Devices	4
CSCI 2629 Programming Android Devices	4
Total Semester Credits	**8**

Total Program Credits **24**

See back of this guide for Course Chart

Minimum Program Entry Requirements

Students entering this program must meet the following minimum program entry requirements:

Reading: Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ or grade of "C" or better in ENGL 0922

Elementary Algebra: Score of 76+ or grade of "C" or better in MATH 0910

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

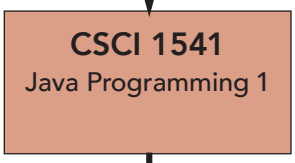
334C (7181)

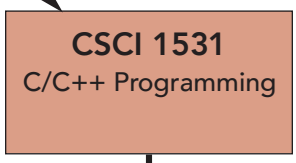
Mobile Development CERTIFICATE *(continued)*
(24 credits)

The below chart illustrates the courses required for completion of this certificate.

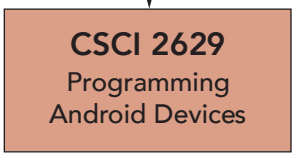
Introductory

Intermediate





Advanced



Data Science AS DEGREE

Program Overview

Data Science uses the techniques and theories from many different fields of study including mathematics, statistics, computer science, and information theory. Data scientists sort through great amounts of unstructured data such as emails, videos, social media, and other user-generated content and write algorithms to extract insights from the data. In essence, they turn data into knowledge

Students entering into this program of study will learn to collect, manage, interpret and analyze data in order to assist in making data-informed decisions for the benefit of a company or organization.

Career Opportunities

There is a growing need for individuals who have the skills to effectively collect and analyze data to make informed, data-driven decisions. Jobs for data scientists, business intelligence analysts, data mining analysts and other data science professions have emerged across all industries that use data extensively, including government, business, healthcare, online commerce and more.

Program Outcomes

1. Graduates will have knowledge and skills to understand big data and the challenges of capturing, storing and retrieving massive data.
2. Graduates will develop an understanding of the analytical and computational techniques used to analyze data for the purposes of providing meaning.
3. Graduates will be familiar with the foundations, frameworks and applications of the emerging field of data science.
4. Graduates of the Data Science program will be prepared for the application of data-based analytical approach to identify and solve problems.

Transfer Opportunities

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below. For more information please go to saintpaul.edu/Transfer.

Data Science AS

BA Individualized Studies
Metropolitan State University

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Faculty

Warren Sheaffer warren.sheaffer@saintpaul.edu

Program Requirements

☑ Check off when completed

Course	Cr
☐ CSCI 1410 Computer Science & Information Systems	4
☐ CSCI 1523 Intro to Computing and Programming Concepts	4
☐ CSCI 1524 Intro to Algorithms and Data Structures	4
☐ CSCI 1541 Java Programming 1	4
☐ CSCI 1550 Database Management Fundamentals	4
☐ CSCI 17XX Introduction to Data Science	4
☐ Technical Electives Select from CSCI, GISC, MATH; the following are recommended: CSCI 1450 Web Fund/HTML - 4 cr CSCI 1544 Enterprise Op Systems – 4 cr CSCI 2470 Enterprise Database Systems – 4 cr GISC 1760 Intro to GIS – 4 cr GISC 1765 Cartography – 3 cr GISC 2730 Programming and Scripting in GIS – 4 cr MATH2749 Calculus 1 – 4 cr	6
Subtotal	**30**

General Education/MnTC Requirements	Cr
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication ENGL 1711 Composition 1 – 4 cr COMM 17XX – 3 cr	7
☐ Goal 4: Mathematical/Logical Reasoning MATH 1740 Introduction to Statistics – 4 cr MATH 2100 Intermediate Statistics – 4 cr PHIL 1710 Logic – 3 cr	11
☐ Goal 5: History, Social Science and Behavioral Sciences ECON 1720 Macroeconomics – 3 cr OR ECON 1730 Microeconomics – 3 cr	3
☐ Goal 6: Humanities & Fine Arts PHIL 1720 Ethics – 3 cr	3
☐ Goals 1-10 of the Minnesota Transfer Curriculum Students must select a minimum of 5 additional credits such that courses from at least six (6) goal areas of the Minnesota Transfer Curriculum are met.	6
General Education Requirements	**30**

Total Program Credits 60

Program Start Dates

Fall, Spring, Summer

Course Sequence

This course sequence is recommended for a full-time student; however, this sequence is not required.

Not all courses are offered each semester; a selection of courses is offered summer term.

Students should consult with the Program Faculty each semester.

First Semester

CSCI 1410 Computer Science & Information Systems	4
Goal 1: ENGL 1711 Composition 1	4
Goal 1: COMM 17XX	3
Goal 4: PHIL 1710 Logic	3
Total Semester Credits	**14**

Second Semester

CSCI 1523 Intro to Computing and Programming Concepts	4
CSCI 1550 Database Management	4
Goal 4: MATH 1740 Introduction to Statistics	4
Goal 5: ECON 1720 Macroeconomics OR ECON 1730 Microeconomics	3
Total Semester Credits	**15**

Third Semester

CSCI 1541 Java Programming 1	4
CSCI 17XX Introduction to Data Science	4
Goal 4: MATH 2100 Intermediate Statistics	4
Goal 6: PHIL 1720 Ethics	3
Total Semester Credits	**15**

Fourth Semester

CSCI 1524 Intro to Algorithms and Data Structures	4
Technical Electives	6
MnTC Electives	6
Total Semester Credits	**16**

Total Program Credits 60

Minimum Program Entry Requirements

Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ on Reading Comprehension or grade of "C" or better in ENGL 1415

College Level Math: Score of 50+ or grade of "C" or better in MATH 0920

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

389S (7226)

Geographic Information Science AAS DEGREE

Program Overview

GIS is an acronym for Geographic Information Science. The GIS Associate of Applied Science degree will prepare students for entry level positions in various industries that require geospatial skills and thinking or for transitioning to four-year baccalaureate programs. Students completing this degree will be able to create and import digital special data representing real-world features from the surface of the Earth with the goal of viewing, manipulating, and analyzing the data to be distributed and used in decision making.

Duties for many positions requiring GIS skills typically involve a combination of outside field work and indoor computer work. While outside, raw spatial data is often collected with GPS devices for a variety of features. Some examples include the location of trees, fountains, utility poles, underground pipelines, soil sample sites, endangered species, and more. The working environment may be in a dense urban area or remote national park, depending on the employer. While inside, digital special data are imported from your GPS devices into a computer where the data is assessed for quality and revised/manipulated if necessary. Remotely sensed data from various sensors and online archives may also be used to generate additional information. GIS employees typically coordinate with other experts (e.g. geologists, business operations specialists, hydrologists, farmers, and urban planners) to discuss the scientific and managerial implications of their work.

Career Opportunities

There are abundant opportunities for employment as a GIS Analyst, GIS Technician, or GIS Specialist in a wide variety of businesses, universities, government agencies, and non-profit organizations. Employees with strong GIS skills are highly coveted in the oil and gas industry, biological and environmental sciences research, natural resource management, government agencies focus on mapping and analyzing infrastructure, intelligence collection by federal agencies, and various business groups. GIS professionals also have ample opportunity to advance into more highly-skilled positions or managerial and leadership positions.

Program Outcomes

1. Graduates will possess fundamental and applied skills in GIS such as making maps, working with rasters and vectors, geometric accuracy, georeferenceing, map projections, spatial analysis, Boolean logic, scripting, remote sensing, air photo interpretation, etc.
2. Graduates will develop a working knowledge of the most popular GIS software, ArcGIS from ESRI.
3. Graduates will develop a working knowledge of GPS devices used by a multitude of businesses and government agencies.

Program Faculty

Kirk Stueve kirk.stueve@saintpaul.edu

Program Requirements

☑ Check off when completed

Course	Cr
☐ GISC 1760 Introduction to GIS	4
☐ GISC 1765 Cartography	3
☐ GISC 1770 Spatial Thinking	3
☐ GISC 1775 Intro to Remote Sensing	4
☐ GISC 1780 Spatial Analysis	3
☐ GISC 1785 GPS Field Techniques	3
☐ GISC 2720 Web-based GIS	3
☐ GISC 2725 Object-based Image Analysis	3
☐ GISC 2730 Programming and Scripting in GIS	4
Subtotal	**30**

General Education/MnTC Requirements	Cr
Refer to the Minnesota Transfer Curriculum Course List for each Goal Area	
☐ Goal 1: Communication ENGL 1711 Composition 1 – 4 cr COMM 17XX – 3 cr	7
☐ Goal 3: Natural Sciences BIOL 1725 Environmental Science	4
☐ Goal 4: Mathematical/Logical Reasoning MATH 1740 Introduction to Statistics	4
☐ Goal 5: History, Social Science and Behavioral Sciences GEOG 1700 Physical Geography	3
☐ Goal 6: Humanities and Fine Arts	3
☐ Goals 1-10 of the Minnesota Transfer Curriculum	9
General Education Requirements	**30**

Total Program Credits **60**

Transfer Opportunities

Saint Paul College has a transfer articulation agreement between the following program and post-secondary institution for the baccalaureate degree program listed below. For more information please go to saintpaul.edu/Transfer.

Geographic Information Science AAS

BA Individualized Studies
Metropolitan State University

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Start Dates

Fall, Spring, Summer

Course Sequence

Not all courses are offered each semester; a selection of courses is offered summer term.

Students should consult with the Program Faculty each semester.

First Semester

GISC 1760 Introduction to GIS	4
GISC 1765 Cartography	3
GISC 1770 Spatial Thinking	3
Goal 1: COMM 17XX	3
Goal 5: GEOG 1700 Physical Geography	3
Total Semester Credits	**16**

Second Semester

GISC 1775 Intro to Remote Sensing	4
GISC 1780 Spatial Analysis	3
GISC 1785 GPS Field Techniques	3
Goal 4: MATH 1740 Introduction to Statistics	4
Total Semester Credits	**14**

Third Semester

GISC 2720 Web-based GIS	3
GISC 2725 Object-based Image Analysis	3
Goal 1: ENGL 1711 Composition 1	4
Goal 6: Humanities and Fine Arts	3
MnTC Elective	3
Total Semester Credits	**16**

Fourth Semester

GISC 2730 Programming and Scripting in GIS	4
Goal 3: BIOL 1725 Environmental Science	4
MnTC Elective	6
Total Semester Credits	**14**

Total Program Credits **60**

Minimum Program Entry Requirements

Students entering this program must meet the following minimum program entry requirements:

Reading: Score of 78+ or grade of "C" or better in READ 0722

Writing: Score of 78+ on Reading Comprehension or grade of "C" or better in ENGL 0922

College Level Math: Score of 50+ or grade of "C" or better in MATH 0920

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

385A (7214)

Geographic Information Science CERTIFICATE

Program Overview

In order to be admitted to the Geographic Information Science certificate program, the student must have completed an associate degree or baccalaureate degree, or receive instructor approval if currently pursuing an associate degree in another discipline.

The Geographic Information Science certificate program is designed to introduce students to fundamental concepts in GIS and prepare them for entry level positions in various industries that require some knowledge and understanding of GIS. Students completing the GIS certificate program will learn how to solve problems and support the decision making process by collecting, viewing, manipulating, and mapping digital spatial data. There will be ample opportunities in the classes for students to pursue independent GIS projects related to their interests.

Career Opportunities

Duties for most positions requiring skills obtained from the GIS Certificate program are highly variable. Some employees spend much of their time working in an office with cutting-edge GIS software, but others are outside in the field most of the time providing support for data collection activities. For instance, in a retail setting, employees may provide technical insight for modeling the most appropriate location of new stores based on a variety of variables such as distance to existing stores, population density, and demographics. In an environmental science setting, employees may identify and map locations of invasive species or provide support in developing a watershed analysis geared to improve water quality.

Most employment opportunities relevant to the GIS Certificate will be listed under a wide range of specialties in various sectors (e.g., environment field technician, business support analyst, computer programmer, etc.) where GIS is not mentioned in the title, but is a preferred skill. The opportunity you are best suited for will be shaped by your previous and ongoing education and work experience.

Program Outcomes

1. Basic skills for working with digital spatial data in a GIS environment. This includes a fundamental understanding of rasters, vectors, map projections, coordinate systems, and cartography.
2. Solid understanding of ArcGIS from ESRI.
3. Working knowledge of Trimble GPS units .

Program Faculty

Kirk Stueve kirk.stueve@saintpaul.edu

Program Requirements

☑ Check off when completed

Course	Cr
☐ GISC 1760 Introduction to GIS	4
☐ GISC 1765 Cartography	3
☐ GISC 1770 Spatial Thinking	3
☐ GISC 1785 GPS Field Techniques	3
Subtotal	**13**
Total Program Credits	**13**

Information is subject to change.
This Program Requirements Guide is not a contract.

Program Start Dates

Fall

Course Sequence

Not all courses are offered each semester; a selection of courses is offered summer term.

Students should consult with the Program Faculty each semester.

Program is not eligible for financial aid.

First Semester

GISC 1760 Introduction to GIS	4
GISC 1765 Cartography	3
GISC 1770 Spatial Thinking.	3
GISC 1785 GPS Field Techniques	3
Total Semester Credits.	**13**
Total Program Credits	**13**

Minimum Program Entry Requirements
Students entering this program must meet the following minimum program entry requirements:

Note: Students must have completed an Associate Degree or Baccalaureate degree or have instructor approval to be enrolled in this Certificate.

Assessment Results and Prerequisites: Students admitted into Saint Paul College programs may need to complete additional courses based on assessment results and course prerequisite requirements. Certain MATH, READ, and ENGL courses have additional prerequisites.

385C (7225)