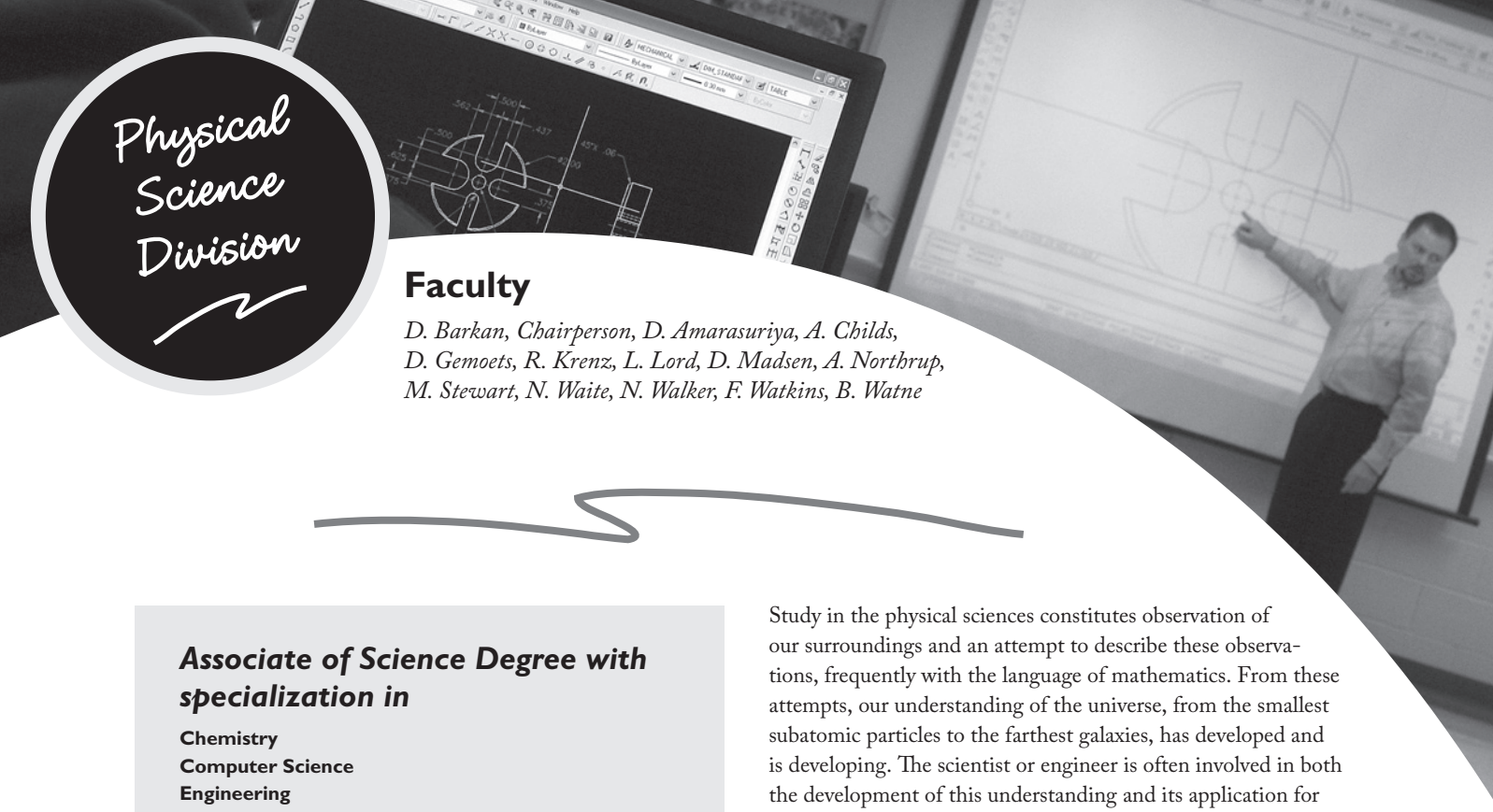

Physical Science Division

Faculty

D. Barkan, Chairperson, D. Amarasuriya, A. Childs, D. Gemoets, R. Krenz, L. Lord, D. Madsen, A. Northrup, M. Stewart, N. Waite, N. Walker, F. Watkins, B. Watne

Associate of Science Degree with specialization in

Chemistry
Computer Science
Engineering
Mathematics
Physics

Associate of Applied Science Degree

Drafting Technology

Northwest College Comprehensive Skills Certificate

Electrical Apprenticeship

Northwest College Skills Certificate

Chemical Technician

Study in the physical sciences constitutes observation of our surroundings and an attempt to describe these observations, frequently with the language of mathematics. From these attempts, our understanding of the universe, from the smallest subatomic particles to the farthest galaxies, has developed and is developing. The scientist or engineer is often involved in both the development of this understanding and its application for the betterment of humankind. The fields of physics, chemistry, computer science, drafting, engineering, astronomy, geology, and mathematics are housed in the Physical Science Division. Individuals wanting to prepare for transfer with an emphasis in any of these fields should pursue an associate of science degree. Courses used to satisfy prerequisites for courses in the Physical Science Division require a grade of "C-" or better. The individual program of study will be developed in consultation with an academic advisor.

Chemistry

Chemistry courses are offered primarily to those students who want chemistry to fill their science course requirements including Pre-Medicine, Pre-Veterinary, Pre-Dentistry, and Pre-Optometry. Individuals who want to specialize in chemistry should work closely with their advisor to devise a suitable associate of science degree program.

The Associate of Science specialization in Chemistry emphasizes the traditional areas of chemistry at the freshman and sophomore level. The specialization provides basic education in chemistry with sufficient flexibility to allow students to transfer to a variety of four-year schools offering bachelor's degrees in chemistry. Students must successfully complete core courses with a "C-" or better to meet specialization requirements. Students planning to transfer to a four-year program may need to have additional hours beyond the specialization requirements at Northwest College in order to transfer in as a junior. These students should consult with their advisor and the appropriate four-year college catalog.

Chemistry Education

For secondary education, to facilitate transfer to a four-year college as a junior, students planning to become middle school or high school teachers in chemistry are encouraged to complete both the Secondary Education specialization and at least a specialization in the subjects they plan to teach. Consult your advisor every semester when selecting courses.

ASSOCIATE OF SCIENCE with specialization in CHEMISTRY

General Education Requirements

Number and Title	Credits
Students should refer to the Graduation Requirements on pages 29-37	31-37

Four hours of Science and three hours of Mathematics will be fulfilled by taking Core Courses.

Core Courses

Number and Title	Credits
CHEM 1020—General Chemistry I	5
CHEM 1030—General Chemistry II	4
CHEM 2320—Organic Chemistry I	4
CHEM 2340—Organic Chemistry II	4
MATH 2200—Calculus I	5
MATH 2205—Calculus II	5
MATH 2310—Applied Differential Equations I (Capstone Course)	3
or	
BIOL 2395—Biological Research (Capstone Course)	1
or	
CHEM 2385—Research in the Life and Physical Sciences (Capstone Course)	3
TOTAL	**28-30**

Transfer and General Electives selected in consultation with advisor	17-20

Transfer and General Electives

It is very strongly recommended that students intending to seek a four-year degree in chemistry take at least three courses (11-hour minimum) from the following. Two of the three courses should be a PHYS sequence.

Number and Title	Credits
CHEM 2230—Quantitative Analysis	4
MATH 2210—Calculus III	5
MATH 2310—Applied Differential Equations I (Capstone Course)	3
PHYS 1110—General Physics I	4
PHYS 1120—General Physics II	4
PHYS 1310—College Physics I	4
PHYS 1320—College Physics II	4

MINIMUM CREDITS FOR DEGREE = 64

NORTHWEST COLLEGE SKILLS CERTIFICATE CHEMICAL TECHNICIAN

Chemical technicians play a vital role in a variety of industries, working with chemists and chemical engineers to develop, test, and manufacture chemical products. Their career opportunities are diverse, depending on where they work, their education, skills, and experience. Students learn to operate standard laboratory equipment; set up apparatus for chemical reactions; perform chemical tests and experiments that involve various procedures; test for quality, performance, or composition; conduct a variety of laboratory procedures, from routine process control to complex research projects; and help devise syntheses and analytical procedures.

General Education Requirements

Number and Title	Credits
ENGL 1010—English I – Introduction to Composition	3
ENGL 1020—English II – Introduction to Literature	3
or	
ENGL 2010—Technical Writing	3
or	
ENGL 2017—Introduction to Research	3
TOTAL	**6**

Core Courses

Number and Title	Credits
MATH 1400—College Algebra (or higher)	4
CHEM 1020—General Chemistry I	5
CHEM 1030—General Chemistry II	4
CHEM 2230—Quantitative Analysis	4
or	
CHEM 2320—Organic Chemistry I	4
TOTAL	**17**

TOTAL CREDITS FOR CERTIFICATE = 23

Computer Science

Computer science is the study of the limits and use of computers. Applications of computer science pervade most fields: medicine (x-ray analysis), engineering, communications (programming cell phones to successfully communicate with each other), entertainment (digital movies and video games), and home computing (word processing and the Internet.) The delivery of this specialization couples the art and science of programming with study of math, physics and the building blocks of computing machines to provide a balanced overview of the field.

This program focuses on framing and solving problems, learning skill sets necessary to solve these problems, and developing thought processes needed for further understanding in computer science. Emphasis is on the enduring concepts rather than current syntax. The Computer Science Specialization is intended for transfer to a four-year institution or as a background for computer related careers.

ASSOCIATE OF SCIENCE with specialization in COMPUTER SCIENCE

General Education Requirements

Number and Title	Credits
Students should refer to the Graduation Requirements on pages 29-37	31-37

Six credits of Mathematics will be fulfilled by taking Core Courses.

Core Courses

Number and Title	Credits
COSC 1030—Computer Science I	4
COSC 2030—Computer Science II	4
MATH 2200—Calculus I	5
MATH 2205—Calculus II	5
Capstone Course (in consultation with your advisor)	1-3
TOTAL	**19-21**

Transfer and General Electives

It is strongly recommended that students intending to seek a four-year degree in computer science take at least the following courses.

Number and Title	Credits
COSC 1010—Introduction to Computer Science	4
MATH 2210—Calculus III	5
MATH 2310—Applied Differential Equations I	3
PHYS 1310—College Physics I	4
PHYS 1320—College Physics II	4

Drafting Technology

Drafting is required for the design, development, manufacturing, and construction of most products. Drafters translate data and sketches from engineers, architects, and scientists into detailed drawings that are used in manufacturing and construction. The Drafting Technology Program at Northwest College provides students with a comprehensive education that focuses on the correct use of state-of-the-art Computer Aided Design and Drafting (CADD) software. Coursework covers basic through advanced two-dimensional (2-D) and the three-dimensional (3-D) CADD applications, through the effective use of individualized educational techniques. Students are exposed to a variety of drafting fields, including mechanical, architectural, structural, and civil drafting technology. Current drafting and related industry standards and techniques are covered in detail, in addition to building applicable work habits, logic, and skills. The program works well for students with disabilities, as customized computer workstations are available with adaptive equipment.

The Associate of Applied Science (AAS) in Drafting Technology degree prepares students to work in the drafting industry after two years of study. Students must complete the core courses with a "C-" or better grade. The AAS degree also provides students with an excellent architecture, construction technology, and technology education. Students wanting to transfer to a four-year institution will need to take additional courses beyond the AAS degree requirements at Northwest College in order to transfer in as a junior. These students should consult with their advisor and the appropriate four-year college catalog.

ASSOCIATE OF APPLIED SCIENCE DRAFTING TECHNOLOGY

General Education Requirements

Number and Title	Credits
ART 1110—Design: 2-D	3
CO/M 1010—Public Speaking	3
ENGL 1010—Introduction to Composition	3
ENGL 2010—Technical Writing	3
Government	3-6
Wellness	2
TOTAL	**17-20**

Three hours of Mathematics will be fulfilled by taking Core Courses.

Core Courses

Number and Title	Credits
BOTK 2950—Employment Orientation	1
BMIS 2000—Computer Information Systems	3
ENTK 1710—Architectural Drafting I	3
ENTK 1720—Architectural Drafting II	3
ENTK 1770—Structural Drafting	3
ENTK 2500—Computer Aided Drafting I	3
ENTK 2505—Computer Aided Drafting II	3
ENTK 2530—Computer Aided Drafting 3-D	3
ENTK 2550—Civil Drafting Technology	3
ENTK 2615—MicroStation Fundamentals	3
ENTK 2685—Project Drafting (Capstone Course)	3

Option 1

Number and Title	Credits
ENTK 2670—Practical Surveying	2
and	
MATH 1510—Technical Mathematics I	3

Option 2

Number and Title	Credits
ENTK 2070—Engineering Surveying	3
and	
MATH 1405—Precalculus Trigonometry	3
or	
MATH 1450—Precalculus Algebra & Trigonometry	5
TOTAL	**36-39**

Recommended Electives

Number and Title	Credits
ART 1050—Drawing I	4
ART 1060—Drawing II	3
ART 2100—Computer Graphics I	3
BIOL 2310—Introduction to Geographic Information Systems	3
CMAP 1930—LAN Wiring & Network Technology	3
ENTK 2625—Advanced MicroStation	3

MINIMUM CREDITS FOR DEGREE = 64

Engineering

The various fields in engineering are related in that they all require a thorough understanding of basic scientific laws. Engineers apply scientific knowledge and principles to the design and operation of machines, to the selection of materials, to the environmental betterment of humankind, and to the economical use of personnel, money, and energy.

The Associate of Science specialization in engineering emphasizes the traditional core of engineering at the freshman and sophomore level. The specialization provides basic education in engineering with sufficient flexibility to allow students to transfer to a variety of four-year schools offering bachelor of science degrees in engineering. Students must successfully complete core courses with a "C-" or better to meet specialization requirements. Students planning to transfer to a four-year program may need to have additional hours beyond the specialization requirements at Northwest College in order to transfer in as a junior. These students should consult with their advisor and the appropriate four-year college catalog.

ASSOCIATE OF SCIENCE with specialization in ENGINEERING

General Education Requirements

Number and Title	Credits
Students should refer to the Graduation Requirements on pages 29-37	31-37

Three hours of Mathematics may be fulfilled by taking Core Courses.

Core Courses

The following courses are traditionally considered to be the core of the first two years of an engineering curricula, as dictated by the American Board of Engineering and Technology Education (ABET) and by the content of the Fundamentals of Engineering Exam (FE).

Number and Title	Credits
ES 1000—Orientation to Engineering	1
ES 2110—Statics	3
ES 2120—Dynamics	3
MATH 2200—Calculus I	5
MATH 2205—Calculus II	5
MATH 2210—Calculus III	5
MATH 2310—Applied Differential Equations I (Capstone Course)	3
TOTAL	**25**

Transfer and General Electives selected in consultation with advisor	15-18

Transfer and General Electives

The student who plans to transfer to a four-year program in engineering will need to have additional hours beyond the specialization requirements at Northwest. These students should take courses from the following list of suggested electives in consultation with their advisors.

Number and Title	Credits
CHEM 1020—General Chemistry I	5
CHEM 1030—General Chemistry II	4
ENGL 2010—Technical Writing	3
ENTK 1510—Drafting I	3
ENTK 2070—Engineering Surveying	3
ENTK 2500—Computer Aided Drafting I	3
ENTK 2505—Computer Aided Drafting II	3
ENTK 2510—Computer Aided Drafting III	3
ES 1060—Introduction to Engineering Computing	3
ES 2210—Electrical Circuit Theory	4
ES 2310—Thermodynamics	4
ES 2330—Fluid Dynamics/Mechanics	3
ES 2410—Mechanics of Materials	3
PHYS 1310—College Physics I	4
PHYS 1320—College Physics II	4

NORTHWEST COLLEGE COMPREHENSIVE SKILLS CERTIFICATE ELECTRICAL APPRENTICESHIP

The Electrical Apprenticeship Program is designed to provide training for apprentices in the electrical industry. The training includes the study of the National Electrical Code and electrical theory principals and fundamentals. The program meets the required 144 hours of classroom instruction for apprentices mandated by the Department of Fire Prevention and Electrical Safety.

Number and Title	Credits
ELAP 1515—Electrical Apprenticeship I	5
ELAP 1525—Electrical Apprenticeship II	5
ELAP 1535—Electrical Apprenticeship III	5
ELAP 1545—Electrical Apprenticeship IV	5
ELAP 1555—Electrical Apprenticeship V	5
ELAP 1565—Electrical Apprenticeship VI	5
ELAP 1575—Electrical Apprenticeship VII	5
ELAP 1585—Electrical Apprenticeship VIII	5

Geology

Northwest offers several courses in Geology. The science of geology is concerned with the materials, processes, and history of the earth. It attempts to explain how the earth changes. As such, it contributes to our understanding of our environment, its resources, hazards, and limits.

Employment opportunities exist with government agencies and with consulting firms. The work ranges from resource development and solution of environmental problems to pure research into the origins and history of the earth. Education for employment requires a broad background in the physical and mathematical sciences. Most professional geologists have master's degrees.

Students who are planning to transfer to a four-year program should consult with their advisor and the appropriate four-year college catalog.

Mathematics

Mathematics courses are designed to meet the needs of students in all departments of the college: students who plan to teach mathematics; those specializing in such fields as chemistry, physics, and engineering who need a foundation in mathematics; and students who pursue other academic careers and want practice in the art of logical, clear, and accurate thinking.

Individuals who want to concentrate in mathematics in a program designed for transfer to a four-year institution may pursue an Associate of Science specialization in Mathematics.

The Associate of Science specialization in Mathematics emphasizes the traditional core of mathematics at the freshman and sophomore level. The specialization provides basic education in mathematics with sufficient flexibility to allow students to transfer to a variety of four-year schools offering bachelor of science degrees in mathematics. Students must successfully complete core courses with a "C-" or better to meet specialization requirements. Students who are planning to transfer to a four-year program may need to have additional hours beyond the specialization requirements at Northwest College in order to transfer in as a junior. These students should consult with their advisor and the appropriate four-year college catalog.

Mathematics Education

To facilitate transfer to a four-year college, students planning to become middle school or high school mathematics teachers are encouraged to complete both the Secondary Education specialization and the Mathematics specialization. Consult your advisor every semester when selecting courses.

ASSOCIATE OF SCIENCE with specialization in MATHEMATICS

General Education Requirements

Number and Title	Credits
Students should refer to the Graduation Requirements on pages 29-37	31-37

Three hours of Mathematics may be fulfilled by taking Core Courses.

Core Courses

Students must complete four of the five courses.

Number and Title	Credits
MATH 1405—Precalculus Trigonometry	3
or	
MATH 1450—Precalculus Algebra/ Trigonometry	5
MATH 2200—Calculus I	5
MATH 2205—Calculus II	5
MATH 2210—Calculus III	5
MATH 2310—Applied Differential Equations I (Capstone Course)	3
	TOTAL 18-20

(Students taking MATH 2310 may use it for their capstone course. Students not taking MATH 2310 will need to take a different capstone course selected in consultation with their advisors.)

Transfer and General Electives selected in consultation with advisor 21-28

Physics

Physics seeks to understand the fundamental laws that govern the universe, from galaxies to subatomic particles. Individuals who want to prepare for transfer to a senior institution should work closely with their advisors to devise suitable associate of science degree programs.

The Associate of Science specialization in Physics emphasizes the traditional foundations for physics at the freshman and sophomore level. It provides basic education in physics and cognate areas such as chemistry and mathematics, as well as sufficient flexibility to allow students to transfer to a variety of bachelor's degree programs in physics. Students must successfully complete core courses with a "C-" or better to meet specialization requirements. Students who are planning to transfer to a four-year program may need to have additional hours beyond the specialization requirements at Northwest College in order to transfer in as a junior. These students should consult with their advisor and the appropriate four-year college catalog.

ASSOCIATE OF SCIENCE
with specialization in PHYSICS

General Education Requirements

Number and Title	Credits
Students should refer to the Graduation Requirements on pages 29-37	31-37

Four hours of Science and three hours of Mathematics will be fulfilled by taking Core Courses.

Core Courses

Number and Title	Credits
MATH 2200—Calculus I	5
MATH 2205—Calculus II	5
MATH 2210—Calculus III	5
MATH 2310—Applied Differential Equations I (Capstone Course)	3
PHYS 1310—College Physics I	4
PHYS 1320—College Physics II	4
	TOTAL 26

Transfer and General Electives selected in consultation with advisor 19-22

Transfer and General Electives

Students who are planning to transfer to a four-year program in physics or physics education will need to have additional hours beyond the specialization requirements at Northwest. These students should take courses from the following list of suggested electives in consultation with their advisors.

Number and Title	Credits
ASTR 1050—Survey of Astronomy	4
CHEM 1020—General Chemistry I	5
CHEM 1030—General Chemistry II	4
ES 1060—Introduction to Engineering Computing	3
ES 2110—Statics	3
ES 2120—Dynamics	3
ES 2210—Electrical Circuit Theory	4
ES 2310—Thermodynamics	4