COLLEGE OF ENGINEERING AND ARCHITECTURE

www.ndsu.edu/ndsu/cea **Engineering Center 203 (701) 231-7494**
Gary R. Smith, Dean

The vision for the College of Engineering and Architecture is to provide leadership in education and research in the fields of engineering and architecture and to achieve a national reputation in selected areas. The college also will enhance the economy, environment, and society of the region through the development, communication, and application of knowledge in engineering and architecture.

Mission

The mission of the College of Engineering and Architecture is to provide outstanding education, research, and service to students, alumni, state residents, research partners, businesses, organizations, and government. Further, college faculty will provide leadership in economic development by transferring technology and by providing information and innovative design. College goals:

- Deliver quality undergraduate and graduate education by creating and utilizing effective instruction and by demonstrating commitment to each student's development.
- Encourage continuous learning among faculty, students, alumni, and the public.
- Develop distance education and continuing education for professionals seeking to upgrade skills.
- Provide laboratories and studios to facilitate quality education, research, and creativity.
- Foster research with an emphasis on engineering applications and creative design that most directly serves the region and influences the global community.
- Pursue niches of research opportunity and develop an industry/college learning center.
- Serve citizens, businesses, and industry in the region by providing professional expertise, outreach, and partnerships.

The departments include Agricultural and Biosystems Engineering, Architecture and Landscape Architecture, Civil Engineering, Construction Management and Engineering, Electrical and Computer Engineering, Industrial and Manufacturing Engineering, and Mechanical Engineering.

Accreditation

The facilities and curricula of the college are reviewed periodically by the Accreditation Board for Engineering and Technology, the National Architectural Accrediting Board, the American Council for Construction Education, and the Landscape Architecture Accreditation Board. These organizations are recognized national accrediting agencies for the engineering, architecture, landscape architecture, and construction management curricula.

Admission Requirements

Applicants for admission must satisfy the general admission requirements of the university and the special requirements of the college and department.

Recommended Preparation

Engineering programs encourage high school preparation in addition to the minimum core curriculum requirements. Prospective majors in engineering should present four units of high school mathematics including two units of algebra, one unit of geometry, and one-half unit of trigonometry. Science courses should include one unit of physics and one unit of chemistry. Students whose high school credentials or entrance examinations show deficiencies in these subjects will be required to enroll in courses designed to remove such deficiencies and cannot expect to complete a program of study in the number of semesters indicated in the printed curricula.

Selective Admission

Several programs within the College of Engineering and Architecture have selective admission. Refer to the department program descriptions below for respective selective admission criteria. Applicants should obtain information regarding the method of application from the NDSU Office of Admission.

Degree Programs

Undergraduate programs of study lead to the Bachelor of Science degree in the specific fields of agricultural and biosystems engineering, civil engineering, computer engineering, construction engineering, construction management, electrical engineering, environmental design, industrial engineering and management, manufacturing engineering, and mechanical engineering. A five-year professional degree completes the programs in architecture and landscape architecture. Each of the curricula includes a number of options for specialized study.

The college has developed its programs of study to provide an educational experience in keeping with the professions of architecture, landscape architecture, and engineering. The classrooms, studios, and laboratories are well equipped and every effort is made to keep them abreast of current technology. Graduates successfully apply for registration as professional engineers or architects after minimum periods of professional experience. Examinations of the North Dakota State Board of Registration for Engineers and Architects are given near campus each year. In addition, the Level I - Associate Constructor Certification Exam for American Institute of Constructors Certification Commission is offered each semester. All seniors are encouraged to take the examinations as soon as they are eligible.

All engineering departments have programs that lead to Master of Science and Doctor of Philosophy degrees. The Architecture department has a Master of Architecture degree. The graduate degrees are administered by The Graduate School and the College of Engineering and Architecture. A number of graduate assistantships are available to students undertaking graduate study. For more complete details, see the Graduate Bulletin online at www.ndsu.edu/gradschool/bulletin.

Degree Requirements

To earn a baccalaureate degree from any of the engineering programs or the Construction Management program, a student must complete at least 60 semester credits of professional-level course work in his/her program while in residence and enrolled in the college. Students transferring into the college from programs with professional accreditation are exempt from the residence requirement, but are subject to NDSU's residence policy. Other exemptions must be approved by the college.

Special Opportunities and Services

The college serves both students and the public. Special opportunities include the following:

General Program
www.ndsu.edu/ndsu/academic/factsheets/eng_arch
The General program of the College of Engineering and Architecture is designed to allow students, who have not chosen the branch of engineering they wish to study, to take basic courses for one year. Students are encouraged to select an engineering curriculum as soon as possible, but no later than the end of their first year.

Interdisciplinary Program
Natural Resources Management
www.ag.ndsu.nodak.edu/nrm
This multidisciplinary program is available through the College of Agriculture, Food Systems, and Natural Resources, the College of Engineering and Architecture, and the College of Science and Mathematics. Refer to the Interdisciplinary Programs section of this Bulletin for further information.

Student Societies and Organizations

All students are eligible to join one or more of these organizations which are actively supported for the benefit of students in the related curricula: American Indian Science and Engineering Society, American Institute of Architecture Students, American Society of Agricultural Engineers, American Society of Civil Engineers, American Society of Landscape Architects, American Society of Mechanical Engineers, American Water Works Association/Water Environmental Federation (AWWA/WEF) (one group), Associated General Contractors, Engineers Without Borders, Institute of Electrical and Electronic Engineers, Institute of Industrial Engineers, Institute of Transportation Engineers, Materials Research Society (MRS), National Association of Home Builders, National Society of Black Engineers (NSBE), Society for the Advancement of Material and Process Engineering (SAMPE), Society of Automotive Engineers, Society of Manufacturing Engineers, Society of Plastics Engineers, Inc. (SPE), Society of Women Engineers, and the Surface Mount Technology Association.

Air Force ROTC sponsors the Bernard S. Bennison Squadron of the Arnold Air Society (AAS). This is a non-profit student service organization dedicated to furthering the purpose, traditions and concepts of the United States Air Force. These objectives are primarily met through community service projects.

The Student Engineering and Architecture Council plans and administers many extracurricular student activities and is composed of elected representatives from the student societies.

Several national professional honor societies have chapters on the campus for which students with high academic attainments are eligible in their junior or senior years. Eligible students are selected for Tau Beta Pi from all engineering curricula, Tau Sigma Delta from architecture, Alpha Epsilon from agricultural and biosystems engineering, Eta Kappa Nu from electrical engineering, Alpha Pi Mu from industrial engineering, Sigma Lambda Alpha from landscape architecture, Sigma Lambda Chi from construction management and engineering, and Pi Tau Sigma from mechanical engineering. Membership in these societies is a coveted honor and highly regarded in the engineering and architectural professions.

The Engineering and Architecture Experiment Station and Extension Service

Research and development projects are administered by an executive staff responsible for general policies, publications, and cooperative relations with private and governmental agencies.

Executive Staff
Director, Gary R. Smith, PE
Agricultural and Biosystems Engineering, Leslie Backer
Architecture, Paul H. Gleye
Civil Engineering, Dinesh Katti, PE
Electrical and Computer Engineering, Daniel Ewert
Industrial and Manufacturing Engineering, Kambiz Farahmand
Mechanical Engineering, Alan Kallmeyer

Special research activities and projects of the college are coordinated through the Experiment Station. The professional services of faculty and the facilities of the college are available to both private and governmental agencies for research and development studies on engineering or architectural problems. Research projects of individual faculty members are sponsored and promoted by the station.

The Engineering Extension Service provides special educational project services to adult groups in conferences, workshops, short courses, and publications. The laboratory facilities of the college are available for specialized instruction under the supervision of faculty. Organizations planning educational programs or special projects for their members are invited to consult the service for assistance.

Cooperative Education

Cooperative Education, a program of the Career Center, offers undergraduate and graduate students an opportunity to integrate classroom study with paid, career-related work experience for academic credit. Work may be full or part time. Credit is granted through Continuing Education and awarded directly by the Cooperative Education program. A Cooperative Education experience may substantially improve students' employment opportunities after graduation.

Department of Aerospace Studies Aerospace Studies (Air Force ROTC)

www.ndsu.edu/afrotc

The Air Force Reserve Officer's Training Corps (AFROTC) program is conducted by the Department of Aerospace Studies. The purpose of this program is to enable qualified undergraduate and graduate students to become commissioned officers in the United States Air Force.

AFROTC learning experiences will be of long-range value whether one pursues a military or civilian career. Upon graduation and completion of the AFROTC curriculum, each student is commissioned a second lieutenant in the United States Air Force.

The initial assignment options available to the Air Force second lieutenant include the following:

1. Enter the Air Force and complete the designated technical training course prerequisite to the student's specialty, i.e., flight training, research and development, management, or support functions.
2. Apply for a delay in entering active duty for the purpose of pursuing an advanced degree.
3. Enroll in one of several Air Force sponsored graduate study programs while serving with full pay as an Air Force officer.

The Aerospace Studies curriculum is divided into two courses of instruction: the General Military Course (GMC), which parallels the freshman and sophomore academic years, and the Professional Officer Course (POC), which parallels the junior and senior academic years. Students in the four-year program normally attend four weeks of field training at a designated Air Force base during the summer between their sophomore and junior years. The student who chooses not to enroll in the GMC (first two years) may still earn a commission by enrolling in a special two-year program during the junior and senior years. Admission to this special program requires the student to make application early in the sophomore year. Qualified students will then participate in a six-week field-training program at an Air Force base the summer prior to their junior or senior year.

AFROTC college scholarships are awarded to the best-qualified students and range in length from one to four years. These grants cover the cadet's tuition, incidental lab fees and most textbooks. In addition, cadets receive a tiered monthly allowance. For example, cadets enrolled in the Professional Officer Corps (POC) receive $450 per month during their junior academic year and $500 per month during their senior academic year. Incentive scholarships also are available for students not already on scholarship.

Upon entering the Air Force, students who are selected to the pilot program will receive 48 weeks of pilot training.

Sample '08-09 Curriculum Aerospace Studies Minor

Satisfactory completion of the four-year AFROTC program, 24 credits, constitutes a minor in Aerospace Studies.

For detailed information on the Air Force ROTC program, contact the Department of Aerospace Studies at 231-7371, 101 Bentson/Bunker Fieldhouse or visit the Web site.

General Military Course Requirements	Credits
AS 110, Air Force Fitness (optional)	1
AS 111, Air Force Today I	1
AS 112, Air Force Today II	1
AS 210, Leadership Lab (1 credit each sem)	4
AS 211, Air and Space Power I	1
AS 212, Air and Space Power II	1
Total	***8***

Professional Military Course Requirements	Credits
AS 110, Air Force Fitness (optional)	1
AS 321, AF Leadership Mgmt I	3
AS 322, AF Leadership Mgmt II	3
AS 410, Leadership Lab (1 credit each sem)	4
AS 441, Prep for Active Duty I	3
AS 442, Prep for Active Duty II	3
Total	***16***

Department of Agricultural and Biosystems Engineering

www.ageng.ndsu.nodak.edu

Agricultural and Biosystems Engineering Major

The Agricultural and Biosystems Engineering (ABEN) program prepares men and women for careers requiring application of physical, biological, and engineering sciences to problems relating to the production, handling, and processing of biological materials for food, feed, fiber, and fuel, the preservation of natural resources and environmental quality, and the design and production of machine systems. A major In Agricultural and Biosystems Engineering can serve a broad range of career interests and can provide excellent career opportunities for men and women from diverse backgrounds. The program objectives of this major are to educate graduates who will become engineers who 1) have the ability to use their technical knowledge, design and problem solving skills throughout their careers, 2) have interpersonal and collaborative skills and the capacity for productive careers, and 3) can use their disciplinary knowledge and educational depth and breadth to deal with changing career opportunities in agricultural and closely related industries. These objectives support the departmental mission of developing and extending knowledge through engineering and technology that advances the productivity of agricultural production, the processing and utilization of agricultural commodities and related biological materials, and the sustainment of environmental resources management.

Agricultural and biosystems engineering integrates engineering topics, engineering design, and biological sciences in a single program with two concentrations: agricultural engineering and biosystems engineering. While there is considerable overlap between the agricultural engineering (AGEN) and the biosystems engineering (BSEN) concentrations, requirements for the BSEN concentration includes a heavier emphasis on fundamental biological and chemical sciences. The AGEN concentration includes a heavier emphasis in the engineering sciences. A wide range of electives in related disciplines can be used to compliment the disciplinary course work and to prepare for specific career interests. Although not required by the curriculum, students are encouraged to take advantage of Cooperative Education experiences (paid internships) where they gain hands-on experience in engineering.

Biosystems Engineering Concentration

Graduates in biosystems engineering integrate engineering, biology , and chemistry in a variety of applications. Graduates may work in careers with the following goals: develop innovative green products and industries; convert bio-based resources to food, fuel, and other renewable products; design new generations of devices or systems for biological systems; and control biological systems for natural resource protection, waste remediation, and ecosystem restoration. Graduates may work with industries to create new and improved processes through the innovative use of microorganisms, plant and animal cells, and enzymes or they may develop sensors, control systems and computer models to monitor and control biological processes occurring in industry or the environment. Graduates with a biosystems engineering concentration may also pursue a professional or graduate degree in engineering, medicine, veterinary medicine, management, or law.

Agricultural Engineering Concentration

Career opportunities for graduates in agricultural engineering are many and diverse. Graduates may work for companies and agencies that design, develop, test, and manufacture power and machine systems; handle, store, process, and enhance or protect the quality of agricultural commodities and processed products; design environmental control and housing systems for plant and animal production; design equipment and systems for processing, manufacturing, distribution and quality protection of food products; manage air, land and water resources; design and manage crop irrigation systems; and develop electrical and electronic applications for agricultural problems. Graduates with an agricultural engineering concentration may also pursue graduate degrees in engineering, business, or law. By selecting appropriate elective courses, students may emphasize areas such as agricultural systems, environmental systems, biomaterials and processing systems, or an emphasis area designed by the student in consultation with an advisor.

Agricultural Systems Emphasis: This emphasis is focused on courses in machinery, power, structural, electronic and sensor systems to prepare students for positions related to engineering for improved food, feed, and fiber production.

Biomaterials Emphasis: With this emphasis, students prepare for engineering positions in the rapidly expanding industries that handle and process biomaterials for food and non-food products and that create new applications of sciences in biotechnical, bioresource, and bioenvironmental fields.

Environmental Systems Emphasis: This emphasis is focused on the preparation of students for careers in environmental engineering, natural resources management, irrigation engineering, watershed management, and waste management.

Electives: Elective opportunities also are available in information and electronic systems and computer aided design. Students select elective courses with the individualized assistance of faculty advisors.

The faculty assist with career planning and job placement of graduates. Students interested in careers involving delivery, management, and technical support of systems for food, agricultural, or closely related industries rather than engineering or design should consider the Agricultural Systems Management major offered by the College of Agriculture, Food Systems, and Natural Resources.

Sample '08-09 Curriculum
Ag & Biosystems Engineering Major

General Education Requirements	Credits
First Year Experience (F):	
ABEN 189, Skills for Academic Success	1
Communications (C):	
COMM 110, Fund of Public Speaking	3
ENGL 110[1], 120, College Comp I, II	3,3
ENGL Upper Level Writing Course[2]	3
Quantitative Reasoning (R):	
MATH 165, Calculus I	4
Science & Technology (S):	
CHEM 121, 122, General Chemistry I, II	3,3
PHYS 252, 252L, Univ Physics II, Lab	4,1
Humanities & Fine Arts (A)	6
Social & Behavioral Sciences (B)	6
Wellness (W)	2
Cultural Diversity (D)[3]	--
Global Perspective (G)[3]	--
Total	***42***

Major Requirements	Credits
ABEN 110, Intro to Ag & Biosys Engr	2
ABEN 255, Comp Aided Analysis & Design	3
ABEN 263, Biomaterials Processing	3
ABEN 482, Instrument & Measurements	3
ABEN 486, 487, Design Project I, II	2,2
ABEN 496, Ag Technology Expo	1
ABEN 491, Seminar	1
CE 309, Fluid Mechanics	3
ENGR 402, Engr Ethics/Social Resp	1
IME 440, Engineering Economy	2
IME 460, Eval of Engr Data or	
STAT 330, Intro to Statistics	3
MATH 128, Intro to Linear Algebra	1
MATH 166, Calculus II	4
MATH 259, Multivariate Calc	3
MATH 266, Differential Equations	3
ME 221, Engineering Mechanics I	3
ME 222, Engineering Mechanics II	3
ME 350, Thermodynamics	3
Total	***46***

Concentration 1: Agricultural Engineering	Credits
ME 212, Fund of Visual Communications	3
ME 223, Mech of Materials	3
CE 310, Fluid Mechanics Lab	1
ABEN 377, Modeling in ABEN	3
ECE 301, Electrical Engineering I	3
ABEN Electives	9
CHEM/BIO Electives	9
Computer Electives	3
BUSN or COMM Electives	3
TECH Electives	8
Total	***45***

Concentration 2: Biosystems Engineering	Credits
CHEM 121L, General Chemistry I Lab	1
CHEM 122L, General Chemistry II Lab	1
BIOL 150, General Biology I	3
CHEM 240, Survey of Organic Chem	3
ABEN 444, Transport Processes	3
ABEN Electives	9
Computer Electives	3
CHEM/BIO Electives	6
ENGR Electives	9
TECH Electives	7
Total	***45***

Curriculum Total ***133***

1 Effective fall 2007, students with composite ACT scores of 21 or higher should register for English 120 (unless transfer credit for ENGL 120 is received). Students who complete English 120 with a C or higher will receive credit for English 110 with a passing grade (P). Students with a composite ACT score of less than 21 are required to register for English 110.

2 Refer to department or curriculum guide for course options.

3 May double count with select Humanities & Fine Arts, Social & Behavioral Science, and/or Science & Tech. Gen Ed courses.

Technical Electives: Students consult their advisor for approved courses according to their career interests and/or a selected emphasis area.

Agricultural Systems: Engineering for advancing productivity of food, feed, and fiber production; emphases may include power and machinery systems, machine design, manufacturing, structures and environment control, computer aided design, electrical and electronic systems, and instrumentation and measurements.

Biomaterials Systems: Engineering for quality maintenance, new uses, or enhanced utilization of agricultural and related biological materials; emphases may include engineering properties of biological materials, biological materials processing, food process engineering, and waste management.

Environmental Systems: Engineering for responsible use and sustainable management of environmental resources; emphases may include hydrology, soil and water resource conservation, irrigation engineering, water and wastewater engineering, water quality management, and hydrology.

Department of Architecture and Landscape Architecture

http://ala.ndsu.edu

Architecture Major

The architect must combine an understanding of society, artistic skill, and technological knowledge to shape places and spaces that enrich human life. Not only do the physical requirements need to be satisfied, but also there must be beauty to engage the human spirit. All of this requires a creative thought process that can balance and organize needs that are quite varied in nature. Clear, responsible, sensitive, and comprehensive thinking is demanded of the architect who is to integrate a wide range of factors into a design that is meaningful. For this reason an architect's education must range from the practical aspects of building construction to the study of environmental, social, and aesthetic issues.

Central to the study of architecture is the sequence of architectural studio courses. Students are assigned architectural problems, which may be hypothetical, realistic, or theoretical, and find their own solutions to them with frequent individual consultations with instructors. As the student progresses, the projects become larger and more complex or the solution becomes more detailed. In this way, knowledge and experience acquired in other classes are brought to bear on the principal responsibility of the architect and the architecture student, that of shaping separate considerations into a single design.

Selective Admission

Admission into the first-year Pre-Architecture Program is open to any student enrolled at NDSU. Transfer students are evaluated on the basis of courses taken and grades received. Upon completion of the first year, a selected number of students are admitted to the second year of the program on the basis of institutional GPA attained and performance in first-year architecture courses.

The Program

At the end of the third year of study, students may apply to the Master of Architecture degree program. The Bachelor of Science in Environmental Design is granted after the fourth year of study, and the professional Master of Architecture degree at the end of the fifth year of study. The program is fully accredited by the National Architectural Accrediting Board, and the M.Arch. degree is recognized by the National Council of Architectural Registration Boards as a professional degree.

The total number of credits required for the professional degree is 170, and the bachelor degree requirement is 134.

In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit U.S. professional degree programs in architecture, recognizes three types of degrees: the Bachelor of Architecture, the Master of Architecture, and the Doctor of Architecture. A program may be granted a 6-year, 3-year, or 2-year term of accreditation, depending on the extent of its conformance with established educational standards.

Master's degree programs may consist of a pre-professional undergraduate degree and a professional graduate degree that, when earned sequentially, constitute an accredited professional education. However, the pre-professional degree is not, by itself, recognized as an accredited degree.

Special Notice

Students who are admitted into the second year of the program will be required to purchase a laptop computer. Information on type of computer, software, purchase, and financing arrangements will be distributed to admitted students prior to purchase.

Sample '08-09 Curriculum B.S. in Environmental Design/Master of Architecture Majors

General Education Requirements	Credits
First Year Experience (F):	
UNIV 189, Skills for Academic Success	1
Communications (C):	
COMM 110, Fund of Public Speaking	3
ENGL 110[1], 120, College Comp I, II	3,3
ENGL 357, Visual Culture & Language	3
Quantitative Reasoning (R)	3
Science & Technology (S)	10
Including: PHYS 120, Fundamentals of Physics	
Humanities & Fine Arts (A):	
ENVD 101, Intro/Environmental Design	3
ARCH 321, History of Arch I	3
Social & Behavioral Sciences (B):	
PSYC 111, Intro to Psychology	3
ANTH 111, Intro to Anthropology	3
Wellness (W)	2
Cultural Diversity (D)	--
ANTH 111, Intro to Anthropology	
Global Perspective (G)	--
ARCH 321, History of Arch I	
Total	***40***

Major/Related Requirements	Credits
ENVD 130, Drawing/Environmental Design	3
ENVD 172, Environmental Design Fund	4
ARCH 231, Arch Drawing	3
ARCH 232, Design Technology	2
ARCH 271, 272, Arch Design I, II	6,6
ARCH 322, History of Arch II	3
ARCH 326, Design Theory	3
ARCH 344, Arch Structures I	3
ARCH 351, Materials & Const	4
ARCH 354, Arch Detailing	3
ARCH 371, 372, Arch Design III, IV	6,6
ARCH 443, Arch Structures II	3
ARCH 453, Environ Control Sys: Passive	3
ARCH 454, Environ Control Sys: Active	3
ARCH 461, Urban Design	2
ARCH 471, 472, Arch Design V, VI	6,6
LA 341, Site Dev & Detailing I	4
MATH 105, Trigonometry	3
SOC 110, Intro to Sociology	3
Additional Humanities Electives[2]	7
Total	***92***

Additional Requirements (Master of Arch. Degree Only)	Credits
ARCH 663, Programming & Thesis Prep	3
ARCH 681, Prof Practice	3
ARCH History/Theory Seminar	4
ARCH 771, Advanced Arch Designs	6
ARCH 772, Design Thesis	8
ARCH 789, Professional Topics In Arch	6
Electives (Graduate or Undergraduate)	8
Total	***38***

B.S. in Environmental Design Major

Curriculum Total ***132***

Master of Architecture

Curriculum Total ***170***

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2 Refer to department or curriculum guide for course options.

Landscape Architecture Major

The Landscape Architecture program is one of approximately 63 accredited programs in the United States. The curriculum is reviewed periodically by the nationally organized Landscape Architecture Accreditation Board and has been fully accredited since 1991.

Landscape architects provide a wide variety of professional services for individual clients, organizations, corporations, and government agencies. They are involved at every phase of the development of a site, from the initial discussion of ideas with the client through the supervision of construction for the project.

Master planning of parks, zoos, golf courses, playgrounds, and recreation areas are familiar projects for landscape architects. They may also design multifunctional areas for urban renewal projects, college campuses, industrial parks, new communities, natural areas, reclaimed lands, and wetlands.

Besides designing sites, landscape architects often select building locations, prepare cost estimates, initiate long-range planning studies, determine utility corridors, and prepare environmental impact statements for future construction. Whether specializing within a large firm of landscape architects or working in a small professional office, the landscape architect is often collaborating with other professionals, such as engineers, city planners, and architects.

Most landscape architects spend some of their time at the drawing board or computer. They also spend many hours in the field, investigating and analyzing potential project sites, developing field notes for design layouts, completing visual surveys, and supervising construction. It is at the computer and drawing board that projects are actually organized and shaped into a creative and imaginative solution. The work and responsibility of each landscape architect depends principally on individual interests and abilities. Opportunities may range from professional practice on a small scale to administration of governmental programs.

Those who plan careers in landscape architecture should be able to work independently, have a capacity for solving technical problems, be artistically inclined, and willing to learn computer use. They should be prepared to work in the competitive environment of the profession, where great value is placed on leadership and the ability to work effectively with others. The range of interests and knowledge required in the profession of landscape architecture is broad; therefore, the courses required of students include many fields of study options. A student may specialize by selecting one of the options provided: Land Reclamation/Natural Resources Management, Landscape Construction

and Technology, Rural Community Development, or Design and Communication. Students may also tailor their own option area with their academic advisor.

Selective Admission

Admission into the first-year Pre-Landscape Architecture program is open to any student enrolled at NDSU. Transfer students are evaluated on the basis of courses taken and grades received. Upon completion of the first year, a selected number of students are admitted to the second year of the program. The basis for selection is institutional GPA and performance in first-year landscape architecture courses.

Special Notice

Students in the second year of the program will be required to purchase a laptop computer. Information on type of computer, software, purchase, and financing arrangements will be distributed to students prior to purchase.

Sample '08-09 Curriculum Landscape Architecture Major

General Education Requirements	Credits
First Year Experience (F):	
UNIV 189, Skills for Academic Success	1
Communications (C):	
COMM 110, Fund of Public Speaking	3
ENGL 110[1], 120, College Comp I, II	3,3
ENGL 357, Visual Culture & Language	3
Quantitative Reasoning (R):	
MATH 104, Finite Math or	
Math 146, Applied Calc I	3 or 4
Science & Technology (S):	
CSCI 114, Microcomputer Packages	3
BIOL 150, General Biology I	3
GEOL 105, Physical Geology	3
Co-Requisite Lab	1
Humanities & Fine Arts (A):	
ENVD 101, Intro to Environmental Design	3
ARCH 321, History of Arch I	3
Social & Behavioral Sciences (B):	
PSYC 111, Intro to Psychology or	
SOC 110, Intro to Sociology	3
ANTH 111, Intro to Anthropology	
Wellness (W)	2
Cultural Diversity (D)	--
ANTH 111, Intro to Anthropology	
Global Perspective (G)	--
ARCH 321, History of Arch I	
Total	***40***

Major Requirements	Credits
ENVD 130, Draw for Environ Designers	3
ENVD 172, Environmental Design Fund	4
LA 132, Intro to Landscape Arch.	2
LA 231, Landscape Arch Graphics	1
LA 232, Design Technology	2
LA 271, 272, Landscape Arch I, II.	4,4
LA 322, Hist of Landscape Arch	4
LA 341, 342, Site Dev & Detailing I, II	4,3
LA 344, Site Dev & Detailing Lab.	2
LA 351, Landscape Design	3
LA 371, 372, Landscape Arch III, IV	4,4
LA 441, Site Dev & Detailing III.	3
LA 471, 472, Adv Landscape Arch I, II	6,6
LA 491, Seminar.	3
LA 531, Adv Landscape Arch Planting Design	4
LA 552, Adv Landscape Planning	2
PLSC 355, Woody Plants.	3
CSCI Elective	3
Total	***74***

Additional Requirements (B.S. Degree)	
Program Option Area Courses[2]	12
Electives	6
Total	***18***
Curriculum Total (B.S. Degree)	***132***

Additional Requirements (BLA Degree)	
LA 563, Programming & Thesis Preparation	3
LA 571, Adv Landscape Arch Design III.	6
LA 572, Design Thesis	8
LA 581, Professional Practice	3
LA 590, Seminar-Spring Trip	2
LA 590, Seminar-Fall Trip	2
Program Option Area Courses[2]	16
Electives	6
Total	***46***
Curriculum Total (B.L.A).	***160***

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2 Refer to department or curriculum guide for course options.

Department of Civil Engineering

www.ce.ndsu.nodak.edu

Civil Engineering Division

The mission of the Department of Civil Engineering is to provide quality education to prepare nationally competitive undergraduate students for a successful career in civil engineering; to provide advanced skills and knowledge in state-of-the-art research and design in sub-areas of civil engineering for graduate students; and to provide service to the university, engineering profession, and the public.

The following program education objectives are developed with the goal of preparing students to enter a modern civil engineering workforce and to be successful in their career and profession. The educational objectives are consistent with the university, college and department missions as well. The objectives are:

1. To ensure that graduates will have a mastery of fundamental knowledge, problem solving skills, engineering experimental abilities, and design capabilities necessary for entering civil engineering career and/or graduate school.
2. To produce graduates that have the knowledge and skills necessary for identifying and assessing design alternatives and the related social, economic, environmental, and public safety impacts.
3. To produce graduates who have verbal and written communication skills necessary for successful professional practice.
4. To prepare graduates to function effectively on teams.
5. To prepare graduates to deal with ethical and professional issues, taking into account the broader societal implications of civil engineering.
6. To prepare graduates for professional licensure, leadership roles and life-long learning.

Civil engineering includes the planning, design, construction, maintenance, and operation of large and permanent engineering projects of our civilization. Civil engineers are in demand wherever there are people. The major subdivisions of civil engineering are structural, geotechnical, environmental, sanitary, water resources, and transportation engineering.

The civil engineer is responsible for such projects as bridges and large buildings, dams, and other river and harbor work, municipal water supply and sanitation facilities, streets, highways, and other transportation facilities. On many projects, civil engineers work in close cooperation with engineers and scientists from other fields.

The Civil Engineering program at NDSU is accredited by the Engineering Accrediting Commission of the Accreditation Board for Engineering and Technology (ABET).

Civil Engineering Major

The Civil Engineering curriculum is designed to give students a thorough mathematical and scientific background in all of the subdivisions of the field. At the same time it provides students with an opportunity to place further emphasis on his/her chosen subdivision through technical electives.

Twelve credits of the curriculum are available for technical electives. Students are required to choose three technical electives from the five major areas, while at the same time satisfying the ABET design requirement. All Civil Engineering students must take a capstone design course, CE 489, which is designed to bring concepts learned in different courses to culminate in a major design experience.

Students interested in structural engineering may choose courses like finite element analysis, advanced reinforced concrete, advanced steel design, timber design, pre-stressed concrete, foundation engineering, and dynamics of structures.

Students interested in water resources, sanitary, or environmental engineering may choose courses like solid waste management, applied hydraulics and hydrology, ground water and seepage, water and wastewater laboratory practices, properties of open channels, hazardous waste management, water quality management, and sanitary engineering problems.

Students interested in transportation engineering may choose courses like transportation planning, airport planning and design, railway planning and design, geometric highway design, or traffic engineering and pavement design.

Students interested in geotechnical engineering may choose courses in foundation engineering, earth slopes, and geosynthetics.

The curriculum includes a core of social humanistic subjects to provide the student with a background essential to a proper understanding of the role of engineering in society.

Students in Civil Engineering are strongly encouraged to participate in the Cooperative Education program to enhance their classroom education with practical experience in engineering-related positions in industry.

Students transferring into Civil Engineering from other departments or institutions are encouraged to do so no later than the beginning of the junior year if they wish to complete the degree requirements within two academic years.

Graduate programs leading to Master of Science and Doctor of Philosophy degrees are available in specialized fields. For more complete details, see the Graduate Bulletin online at www.ndsu.edu/gradschool/bulletin.

Civil Engineering Major

All Civil Engineering students at NDSU are required to have a minimum cumulative grade-point average of 2.0 and to have received a grade of C or better in Math 165, 166, 128, 259, and 266, and ME 221, 222, and 223, before enrolling in any classes that utilize these courses as prerequisites.

Sample '08-09 Curriculum Civil Engineering Major

General Education Requirements	Credits
First Year Experience (F):	
CE/UNIV 189, Skills for Academic Success	1
Communications (C):	
COMM 110, Fund of Public Speaking.	3
ENGL 110[1], 120, College Comp I, II	3,3
ENGL 321, Writing in the Tech Professions	3

Quantitative Reasoning (R):
MATH 165, Calculus I....4
Science & Technology (S):
CHEM 121, 121L, Gen Chemistry I, Lab....3,1
CHEM 122, 122L, Gen Chemistry II, Lab....3,1
GEOL 105, Physical Geology....3
Humanities & Fine Arts (A)....6
Including: ENGR 311, History Tech in America
Social & Behavioral Sciences (B)....6
Including: ENGR 312, Impact of Tech on Society
Wellness (W)....2
Cultural Diversity (D)[2]....--
Global Perspective (G)....--
GEOL 105, Physical Geology
Total....42

Major/Related Requirements	Credits
CE 303, Civil Engineering Data	3
CE 204, Surveying	4
CE 309, Fluid Mechanics	3
CE 316, Soil Mechanics	3
CE 212, Graphic Communication	3
CE 310, Fluid Mechanics Lab	1
CE 343, Structural Analysis	4
CE 370, Environmental Engineering	3
CE 371, Environmental Engineering Lab	1
CE 404, Reinforced Concrete	3
CE 408, Water Resource & Supply	3
CE 418, Transportation Engineering	4
CE 444, Structural Steel Design	3
CE 483, Contracts & Specs	3
CE 489, Senior Design	2
CE 111, Intro to Civil Engineering	2
ENGR 402, Engr Ethics & Soc Resp	1
IME 460, Evaluation of Engineering Data	3
IME 440, Engineering Economy	2
MATH 128, Intro to Linear Algebra	1
MATH 166, Calculus II	4
MATH 259, Multivariate Calc	3
MATH 266, Intro Diff Equations	3
ME 221, Engineering Mechanics I	3
ME 222, Engr Mechanics II	3
ME 223, Mech of Materials	3
ME 350, Thermal & Heat Transfer	3
PHYS 252, Univ Physics II	4
Technical Electives[3]	12
Total	***90***

Curriculum Total....132

1 Effective fall 2007, students with composite ACT scores of 21 or higher should register for English 120 (unless transfer credit for ENGL 120 is received). Students who complete English 120 with a C or higher will receive credit for English 110 with a passing grade (P). Students with a composite ACT score of less than 21 are required to register for English 110.

2 May double count with select Humanities & Fine Arts, Social & Behavioral Science and/or Science & Tech. Gen Ed courses.

3 Refer to department or curriculum guide for course options.

Note: Department permission required for graduate level courses. Credit may be earned only at the undergraduate level. Department permission also is required for some undergraduate courses. There are specific prerequisites and grade requirements to be allowed to take certain courses.

Department of Construction Management and Engineering

www.ndsu.edu/cme

The mission of the Department of Construction Management and Engineering at North Dakota State University is to provide quality programs for preparing nationally competitive undergraduate and graduate students for a successful career in construction. The programs are designed to provide education, research, and outreach opportunities that serve both the needs of students and those of the construction industry. The educational objectives of the programs are to provide students with: (a) basic skills necessary to plan, organize, and control resources to manage the overall construction process, (b) technical knowledge, design, and problem solving skills for a career in construction, (c) knowledge and skills necessary to identify, define, and compare design alternatives, (d) necessary communication skills for successful practice of the construction profession, and (e) opportunities to learn the need for professionalism and life-long learning, and the need to understand the broader societal implications of construction projects.

The continued rapid growth of the construction industry demands new kinds of professionals, the construction engineer, and manager. These professional constructors will be required to integrate new and high-level technology into all aspects of the design and construction process. All the aspects that contribute to the finished construction project from the initial planning stage through the final project turnover require close and careful attention. An individual with management and technical ability to oversee an entire project is essential to the industry. To fill the need for qualified professionals, the following degrees are awarded: Bachelor of Science in Construction Management and Bachelor of Science in Construction Engineering.

The construction programs are very practical in nature and are designed to prepare the graduate for entry into the construction industry on a professional level. Construction graduates build homes, highways, bridges, power plants, dams, tunnels, skyscrapers, and many other facilities of benefit to society.

Construction Engineering Major

The Construction Engineering program is a blend of engineering, construction, and construction management courses. This program is designed for those who want to work in the construction industry and enjoy the status of a professional engineer. It is somewhat similar to the Construction Management program, but has more emphasis on engineering and technical courses. The Construction Engineering program is accredited by the Engineering and Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 - Tel: (410) 347-7700.

Educational Objectives

1. To prepare students for entry in successful careers in construction engineering emphasizing a fundamental understanding of the practice of construction engineering and management principles. Students will gain the ability to define, prioritize, and solve a broad set of engineering problems in construction, learn the importance of engineering judgment, and gain knowledge of contemporary and global issues. Students will also learn the creative process of engineering design, experimentation, data analysis, and the fundamentals of leadership.
2. To prepare students for the practice of construction engineering design and management with an emphasis on multiple solutions, sustainable construction, design alternatives, and impacts using the skills, techniques, and tools of modern engineering practice to achieve safety, quality, scheduling, economic, environmental, political, and social project objectives.
3. To facilitate an understanding of the societal and economic impacts of construction engineering practice and the professional and ethical responsibilities of the construction engineer.
4. To provide learning opportunities which prepare the construction engineering and management graduate to function in team-oriented, multi-disciplinary, open-ended engineering activities.
5. To provide a broad curriculum giving students a solid background in the basic sciences and mathematics; the ability to communicate effectively; and understanding and an appreciation for the humanities, social sciences, and management sciences; and the ability to engage in life-long learning through self-study, and/or continuing education.

Sample '08-09 Curriculum Construction Engineering Major

General Education Requirements	Credits
First Year Experience (F):	
UNIV 189, Skills for Academic Success	1
Communications (C):	
COMM 110, Fund of Public Speaking	3
ENGL 110[1], 120, College Comp I, II	3,3
ENGL 320, Business & Profess Writing or	
ENGL 321, Writing in the Tech Profess	3
Quantitative Reasoning (R):	
MATH 165, Calculus I	4
Science & Technology (S):	
CHEM 121, 121L, Gen Chemistry I, Lab	3,1
CHEM 122, Gen Chem II	3
PHYS 252, Univ Physics II	4
Humanities & Fine Arts (A)	6
Social & Behavioral Sciences (B)	6
Including: ECON 105, Elements of Econ or	
ECON 201, Prin of Microeconomics or	
ECON 202, Prin of Macroeconomics	
Wellness (W)	2
Cultural Diversity (D)[2]	--
Global Perspective (G)	--
ECON 105, 201, or 202	
Total	***42***

Major/Related Requirements	Credits
BUSN 431, Business Law I	3
CE 309, Fluid Mechanics	3
CE 316, Soil Mechanics	3
CE 343, Structural Analysis	4
CE 370, Intro to Environmental Engr	3
CE Technical Electives	10
CM&E 111, Intro to CM&E	1
CM&E 200, Construction Documents/Codes	3
CM&E 204, Construction Surveying	2

CM&E 240, Financial Cost Concepts 3
CM&E 212, Const Graphic Com 3
CM&E 301, Construction Equipment 4
CM&E 315, Specs & Contracts 3
CM&E 380, Construction Estimating 4
CM&E 385, Construction Safety 2
CM&E 403, Scheduling 4
CM&E 412, Capstone 3
CM&E 489, Construction Design Capstone 3
ECON 202, Prin of Macroeconomics 3
ENGR 402, Engr Ethics & Soc Resp 1
MATH 166, Calculus II 4
MATH 128, Intro to Linear Algebra 1
MATH 259, Multivariate Calculus 3
MATH 266, Intro to Diff Equations 3
ME 221, Engr Mechanics I 3
ME 222, Engr Mechanics II 3
ME 223, Mechanics of Materials 3
STAT 330, Intro to Statistics 3
Total ***88***

Curriculum Total ***130***

1 Effective fall 2007, students with composite ACT scores of 21 or higher should register for English 120 (unless transfer credit for ENGL 120 is received). Students who complete English 120 with a C or higher will receive credit for English 110 with a passing grade (P). Students with a composite ACT score of less than 21 are required to register for English 110.

2 May double count with select Humanities & Fine Arts, Social & Behavioral Science and/or Science & Tech. Gen Ed courses.

Construction Management Major

Construction management is a combination of engineering technology, construction techniques, and management to meet the needs of the rapidly growing construction industry. The program is designed to prepare students for the art of achieving maximum profit by efficient use of people, machines, materials, and money to complete a construction project on time and to the satisfaction of the owner.

A meld of engineering, construction, management, and business gives the student a background and understanding of management's point of view in the construction industry. The Construction Management program is accredited by the American Council for Construction Education.

Junior and senior Construction Management majors must maintain a minimum 2.50 institutional grade-point average to be eligible for enrollment in 300-400 level courses offered by the College of Business Administration.

Educational Objectives

1. To provide students with the knowledge and skills required to identify, define, and solve problems involving construction methods, processes, and alternatives using appropriate management techniques and tools.
2. To provide students with the basic skills necessary to plan, organize and control project resources (labor, equipment, and materials) in order to manage the overall construction process.
3. To provide students with the required communication skills (oral and written) for successful practice of the construction profession.
4. To provide students with the necessary skills to function effectively on multi-disciplinary teams and to understand and appreciate the contributions of other disciplines within the construction process.
5. To provide students with professional opportunities and skills to pursue life-long learning and involvement in professional associations within the broader societal context of the construction profession.
6. To provide students with the exposure to ethical, societal and, global issues related to decision making in the construction management profession.

Sample '08-09 Curriculum Construction Management Major

General Education Requirements	Credits
First Year Experience (F):	
UNIV 189, Skills for Academic Success	1
Communications (C):	
COMM 110, Fund of Public Speaking	3
ENGL 110[1], 120, College Comp I, II	3,3
ENGL 320, Business & Profess Writing or	
ENGL 321, Writing in the Tech Profess	3
Quantitative Reasoning (R):	
MATH 165, Calculus I	4
Science & Technology (S):	
CHEM 121, 121L, Gen Chem I, Lab	3,1
CHEM 122, Gen Chemistry II	3
GEOL 105, Physical Geology	3
Humanities & Fine Arts (A)	6
Social & Behavioral Sciences (B):	
ECON 105, Elements of Economics	3
PSYC 111, Intro to Psychology	3
Wellness (W)	2
Cultural Diversity (D)[2]	--
Global Perspective (G)	--
ECON 105, Elements of Econ	
Total	***41***

Major/Related Requirements	Credits
ACCT 102, Fundamentals of Accounting	3
BUSN 431, Business Law I	3
BUSN 350, Foundations of Mgmt	3
BUSN 300-400 Level Electives	12
CM&E 111, Intro to CM&E	1
CM&E 200, Construction Documents/Codes	3
CM&E 203, Building Construction	3
CM&E 204, Construction Surveying	2
CM&E 240, Financial Cost Concepts	3
CM&E 250, Construction Statics/Mechanics	3
CM&E 212, Const Graphic Com	3
CM&E 301, Construction Equipment	4
CM&E 310, Construction Quality Control	2
CM&E 315, Specs & Contracts	3
CM&E 320, Soils & Foundations	4
CM&E 380, Construction Estimating	4
CM&E 385, Construction Safety	2
CM&E 403, Scheduling	4
CM&E 412, Capstone	3
CM&E 421, Electrical & Mechanical Const	3
CM&E 430, Land Development	3
CM&E 435, Concrete Design	3
CM&E 450, Steel Design for Technologies	3
MATH 105, Trigonometry or	
MATH 107, Precalculus	3
PHYS 211, 211L, College Physics I, Lab	3,1
STAT 330, Intro to Statistics	3
Total	***84***

Curriculum Total ***125***

1 Effective fall 2007, students with composite ACT scores of 21 or higher should register for English 120 (unless transfer credit for ENGL 120 is received). Students who complete English 120 with a C or higher will receive credit for English 110 with a passing grade (P). Students with a composite ACT score of less than 21 are required to register for English 110.

2 May double count with select Humanities & Fine Arts, Social & Behavioral Science and/or Science & Tech. Gen Ed courses.

Department of Electrical and Computer Engineering

www.ece.ndsu.nodak.edu

The mission of the Department of Electrical and Computer Engineering is to provide quality educational opportunities for undergraduate and graduate students through teaching, research, and professional service, and to provide specialized support to the greater community.

Departmental objectives:

1. Prepare our students to become competent electrical and computer engineers.
2. Promote life-long learning practice through continuous curriculum review, research, design, and other scholarly activities.
3. Stimulate student and faculty professional development through publications, participation in professional meetings and societies, and research involvement.
4. Maintain and enhance a positive departmental environment conducive to teamwork, discovery, and professional development.
5. Promote public awareness, interest, and respect for science, engineering, and technology.
6. Provide specialized services to the region, industrial partners, and the professional community.

The intended student outcomes of this major are to provide students with: a) an ability to apply knowledge of mathematics, science, and engineering; b) an ability to design and conduct experiments, as well as to analyze and interpret data; c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability; d) an ability to function on multidisciplinary teams; e) an ability to identify, formulate, and solve engineering problems; f) an understanding of professional and ethical responsibility; g) an ability to communicate effectively; h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context; i) a recognition of the need for, and an ability to engage in life-long learning; j) a knowledge of contemporary issues; k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice; and l) ability to grow in the knowledge of and make professional contributions to at least one specific area of ECE.

Electrical and computer engineers create products and services for society out of materials that exist in nature by using principles of science and creativity. The profession is broad, encompassing products valued by society in many technical specialties from electric power and energy utilization to those for current and future information transmission. Career employment opportunities within the profession range over design, development, manufacturing, sales, management, teaching, and research for industry and government.

Selective Admission

Departmental admission requirements for freshmen are an ACT (or equivalent) math test score of 23, or a top 30 percent class standing with a math ACT of 20. Transfer students from U.S. institutions must have a 2.3 GPA; transfer students from international institutions must have a 3.0 GPA.

Further, the department policy is that transfer credits with grades of D in mathematics, science, or engineering courses are not accepted for the Electrical and Computer Engineering curriculums.

An institutional GPA of 2.0 or above is required prior to registration in junior- and senior-level courses. Majors must have a grade of C or better in the following courses: all required mathematics courses through MATH 266; ECE 111, 173, 275, and EE 206.

The Programs

Major components of the undergraduate programs are basic science and mathematics, humanities and social sciences, communication, engineering science, engineering design and ethics, and both breadth and depth in electrical and computer engineering.

Graduate studies leading to Master of Science and Doctor of Philosophy degrees are offered in the department. For more complete details, see the Graduate Bulletin online at www.ndsu.edu/gradschool/bulletin.

Computer Engineering Major

The Computer Engineering program provides a background in three broad areas: computer hardware, software, and hardware-software integration. Fundamental computer topics included in the program are microprocessors, embedded systems, computer architecture, digital systems, data communications and other related computing material. In addition, the program includes core engineering subjects that are common to all engineering disciplines and basic university studies in humanities and social science. The Computer Engineering program at NDSU is accredited by the Engineering Accrediting Commission of the Accreditation Board for Engineering & Technology (ABET).

Recommended '08-09 Curriculum Computer Engineering Major

General Education Requirements	Credits
First Year Experience (F):	
UNIV 189, Skills for Academic Success	1
Communications (C):	
COMM 110, Fund of Public Speaking	3
ENGL 110[1], 120, College Comp I, II	3,3
ENGL Upper Level Writing Course[2]	3
Quantitative Reasoning (R):	
MATH 165, Calculus I	4
Science & Technology (S):	
CHEM 121, General Chemistry I	3
PHYS 251, 252, Univ Physics I, II,	4,4
Science Lab	1
Humanities & Fine Arts (A)	6
Social & Behavioral Sciences (B)	6
Wellness (W)	2
Cultural Diversity (D)[3]	--
Global Perspective (G)[3]	--
Total	***43***

Major Requirements	Credits
CSCI 161, Computer Science II	4
CSCI 222, Discrete Math	3
CSCI 474, Operating Systems Concepts	3
ECE 111, Intro to ECE	3
ECE 173, Intro to Computing	3
ECE 275, Digital Systems I	3
ECE 311, Circuit Analysis II/Lab	4
ECE 321, Electronics I/Lab	5
ECE 343, Signals & Systems	4
ECE 351, Applied EM/Lab	4
ECE 341, Random Process	3
ECE 373, Assembly Programming	3
ECE 376, Embedded Systems, Lab	4
ECE 401, Design I (capstone)	1
ECE 403, Design II (capstone)	2
ECE 443, Communications I, Lab	4
ECE 405, Design III (capstone)	3
EE 206, Circuit Analysis I	4
ENGR 402, Engr Ethics/Social Resp	1
MATH 129, Basic Linear Algebra	2
MATH 166, Calculus II	4
MATH 265, Calculus III (w/Vectors)	4
MATH 266, Intro Diff Equations	3
ME 221, Engineering Mechanics I	3
CprE Core Electives[2]	9
ECE or ENGR Science Electives[2]	3
Total	***89***
Curriculum Total	***132***

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2 Refer to department or curriculum guide for course options.

3 May double count with select Humanities & Fine Arts, Social & Behavioral Science and/or Science & Tech. Gen Ed courses.

Electrical Engineering Major

The Electrical Engineering program at NDSU is accredited by the Engineering Accrediting Commission of the Accreditation Board for Engineering and Technology (ABET).

EE Specialization

The Electrical Engineering program is designed to reflect the broad nature of the field, and students may tailor their studies within broad parameters. Students are encouraged to develop an individual program of study in close consultation with their advisors. Examples are available to illustrate how specialization may be obtained in a number of different technical areas. Students may mix and match from the examples to suit their particular interests. Technical areas include the following:

Biomedical Engineering: This area is firmly based in engineering and the life sciences. The integration of medicine and engineering serves to provide appropriate products, tools, and techniques for research diagnosis and treatment by health care professionals. Some important products are artificial hearts, medical imaging (MRI, ultrasound, CT scans), prosthetic devices, and computer aids for diagnosis. Biomedical engineers help identify the problems and needs that can be solved using engineering technology and systems methodology to provide high-quality health care at reasonable cost.

Communication and Signal Processing: These are closely related fields within electrical engineering. Communication is the process of transferring information from one point in time and space to another point. Signal processing involves signal representation, as well as signal design and filtering. Students with this specialization find challenging opportunities worldwide to meet the need for more convenient, inexpensive, and reliable communication and signal processing.

Computer Engineering: This area involves hardware and software for small and large computers and for all the products that have dedicated computers within the product, such as microwave ovens and automobiles.

Control Engineering: This is the design and implementation of algorithms for controlling physical systems. Examples include active suspension for cars, auto pilots for aircraft, and robot motion control.

Electromagnetics: This area includes electromagnetic compatibility, fiber optics, antennas, microwave devices, radar, sonar, satellite systems, power and communication transmission lines, grounding, shielding, and propagation.

Electronics and Microelectronics: Examples are integrated circuits, VLSI, transistors, lasers, consumer electronics, defense electronics, power electronics, and electronic materials.

Optical Engineering: The Optical Engineering option was developed jointly with the Department of Physics. Many technical disciplines now use optics. Medicine uses laser surgery and optical diagnostics. Communications is expanding optical fiber communication. Image processing is using optical techniques. The Optical Engineering option prepares future engineers in such areas as quantum theory; coherent/incoherent, polarized/non-polarized light; geometric, physical and Fourier optics; holography; and image processing and acquisition.

Power Systems: This area includes the generation, transmission, distribution, and utilization of electric energy subject to safety, environmental, and economic concerns.

Recommended '08-09 Curriculum Electrical Engineering Major

General Education Requirements	Credits
First Year Experience (F):	
UNIV 189, Skills for Academic Success	1
Communications (C):	
COMM 110, Fund of Public Speaking	3
ENGL 110[1], 120, College Comp I, II	3,3
ENGL Upper Level Writing Course[2]	3
Quantitative Reasoning (R):	
MATH 165, Calculus I	4
Science & Technology (S):	
CHEM 121, General Chemistry I	3
PHYS 251, 252, Univ Physics I, II,	4,4
Science Lab	1
Humanities & Fine Arts (A)	6
Social & Behavioral Sciences (B)	6
Wellness (W)	2
Cultural Diversity (D)[3]	--
Global Perspective (G)[3]	--
Total	***43***

Major/Related Requirements	Credits
ECE 111, Intro to ECE	3
ECE 173, Intro to Computing	3
ECE 275, Digital Systems I	3
ECE 311, Circuit Analysis II/Lab	4
ECE 321, Electronics I/Lab	5
ECE 343, Signals & Systems	4
ECE 351, Applied EM/Lab	4
ECE 341, Random Process	3
ECE 401, Design I (capstone)	1
ECE 403, Design II (capstone)	2
ECE 405, Design III (capstone)	3
EE 206, Circuit Analysis I	4
ENGR 402, Engr Ethics/Social Resp	1
MATH 129, Basic Linear Algebra	2
MATH 166, Calculus II	4
MATH 265, Calculus III (w/Vectors)	4
MATH 266, Intro Diff Equations	3
ECE Electives[2]	6 or 9
ECE Electronics Electives[2]	3
EE Core Electives w/Lab[2]	12
ENGR Science Electives[2]	3 or 6
Math/Science Elective[2]	3
Total	***86***

Curriculum Total ***129***

1 Effective fall 2007, students with composite ACT scores of 21 or higher should register for English 120 (unless transfer credit for ENGL 120 is received). Students who complete English 120 with a C or higher will receive credit for English 110 with a passing grade (P). Students with a composite ACT score of less than 21 are required to register for English 110.

2 Refer to department or curriculum guide for course options.

3 May double count with select Humanities & Fine Arts, Social & Behavioral Science and/or Science & Tech. Gen Ed courses.

Note: For students interested in pursuing one of the areas of specialization, lists of recommendations for specific electives are available from the ECE Department.

Department of Industrial and Manufacturing Engineering

www.ndsu.edu/ndsu/ime

Two majors are offered within the Industrial and Manufacturing Engineering Department (IME): Industrial Engineering and Management (IE&M) and Manufacturing Engineering (MfgE). Both programs are professionally accredited through the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

Career positions for graduates of the two programs often have some similarity; so, many of the courses required for the two majors are the same. Industrial Engineering and Management encompasses manufacturing as well as service industries. Industrial engineers have the technical training to make improvements in a manufacturing setting as well as to evaluate and improve productivity and quality in service Industries. Manufacturing engineers apply scientific principles to the production of goods. They are key team members in production of a wide range of products, including automobiles, airplanes, tractors, electronics, toys, building products, foodstuff, and sports and recreational equipment. In all cases, manufacturing engineers design the processes to make products with the required functionality, to high quality standards, and available when and where customers prefer, at the best possible price.

Following the differing ways that graduates are employed in career positions, the two IME programs are differentiated by specific courses that address particular needs of the respective career tracks. IE&M students take additional courses in systems engineering and in the application of engineering skills in people management. MfgE students take additional courses in the analysis and design of manufacturing processes and of production systems.

In addition, both majors offer the student opportunities for specialization in the junior and senior years. IE&M students can apply their elective courses to extra study in production operations and management, healthcare management engineering, and reliability and quality management. MfgE students can elect additional specialization in electronics manufacturing and process engineering.

Both IE&M and MfgE students learn in an environment of professional realism. Many of the major courses fulfill their learning objectives through projects that are done with industrial companies. Students interact with practicing professionals to learn the real-world applications of the theories they master in the classrooms. There also are many laboratories where students gain hands-on understanding of machinery and engineering systems. Students in both IME majors are urged to take advantage of Cooperative Education and internship positions wherever possible. The knowledge gained through these experiences enhances career preparation and provides for expanded placement opportunity upon graduation.

Learning in the IME Department is a partnership of student and faculty. The student's responsibility is to learn - to master the concepts, theories and practices that lead to career success. The faculty responsibility is four-fold: to provide an atmosphere that is conducive to learning; to assure availability of the tools necessary for effective and efficient learning; to offer guidance on educational and professional matters; and to evaluate student achievement. The usual faculty role is one of mentor, encouraging students to grow in stature as soon-to-be engineers and as practicing professionals.

IME graduates are prepared for careers that design, develop and implement devices, processes and systems that manufacture, construct, operate and service products, equipment and facilities that are often conceived in other engineering disciplines. Career positions in IE&M and MfgE form the vital linkages between abstract concepts and the reality of products and facilities of real use to customers. Graduates are in demand for employment in a very wide range of industries from production of all types of goods to transportation and distribution to information to healthcare to consulting.

In all cases, career positions for IME graduates involve design of processes and procedures in advanced technology environments. These professions routinely apply sophisticated modern tools in information handling, distributed communications, computer-driven controls, and a wide variety of technologically advanced equipment and apparatus. In addition, IME career professionals are skilled in the integration of people and technology within the business context of world-class enterprises. They make satisfying careers in organizations of all sizes and types, located in all parts of the world. Graduates generally have a wide choice in where they work and live, as well as the size and kind of company for which to work.

Post-graduate studies also are available in the IME department, leading to the Master of Science and Doctor of Philosophy degrees. For more complete details, see the Graduate Bulletin online at www.ndsu.edu/gradschool/bulletin.

Industrial Engineering and Management Major

Industrial Engineering and Management is a good choice for people with the aptitude and interest for careers that blend technology and people. First, this is an engineering program, with the traditional content of mathematics, sciences, engineering analysis and design. Graduates are traditionally very successful in nationally-normed professional engineering examinations. Beyond the basics, this program also challenges students to integrate resources with technology. In addition to scientific principles and technological systems, IE&M students study people systems, cost analysis, facilities and other elements of the business enterprise. The "engineering" and "management" pieces are blended and integrated.

Just as the profession requires a blend of scientific, technological and humanistic skills, student learning in IE&M is an integrated process. The discipline-specific courses place the student in position to experience many elements of real situations in industry and commerce. Moreover, the program has been nationally cited for integrating design across all levels, with freshmen and juniors or sophomores and seniors often working together.

Graduates of the IE&M program will be able to:

1. Apply statistical, operations research and simulation tools to solve problems relevant to modern production, commercial, social and /or governmental organizations, with principal emphasis on quality, productivity, continuous improvement, and enterprise integration.
2. Design processes and systems to effectively and economically employ and integrate technology and people in organizational environments in industrial, healthcare, logistics, service and/or governmental settings, with appropriate consideration for environmental factors, health and safety, manufacturability and ethical, economic, social and political issues.
3. Engage in effective learning in topics and areas relevant to professional advancement and to enhancing the quality of personal life.
4. Participate effectively in multidisciplinary teams in both leadership and followership roles.
5. Effectively communicate complex technological concepts, issues and professional details to a variety of audiences.

IE&M graduates are in high demand across a wide spectrum of industries. In recent years, the most active employers have represented transportation, warehousing and distribution, healthcare, information systems, software, facilities development and consulting industries, as well as many of the production sectors that have been the traditional concentration for industrial engineers. IE&M graduates are sought after for responsible positions in project and organizational management, financial modeling, technological training, logistics, and design of processes, procedures, facilities, and systems.

Sample '08-09 Curriculum Industrial Engineering and Management Major

General Education Requirements	Credits
First Year Experience (F):	
ME/UNIV 189, Skills for Academic Success	1
Communications (C):	
COMM 110, Fund of Public Speaking	3
ENGL 110[1], 120, College Comp I, II	3,3
ENGL 321, Writing in the Tech Profess	3
Quantitative Reasoning (R):	
MATH 165, Calculus I	4
Science & Technology (S):	
CHEM 121, 121L, Gen Chemistry I, Lab	3,1
CHEM 122, Gen Chemistry II or	
CHEM 240, Survey of Organic Chem	3
PHYS 252, 252L, Univ Physics II, Lab	4,1
Humanities & Fine Arts (A)	6
Social & Behavioral Sciences (B)	6
Wellness (W)	2
Cultural Diversity (D)[2]	--
Global Perspective (G)[2]	--
Total	***43***

Major/Related Requirements	Credits
ENGR 402, Engr Ethics & Social Resp	1
IME 111, Intro to IME	3
IME 311, Work/Station Design	3
IME 330, Mfg Processes I.	3
IME 440, Engineering Economy	3
IME 450, Systems Engineering Mgmt	3
IME 456, Program & Project Mgmt	3
IME 460, Evaluation of Engineering Data.	3
IME 461, Quality Assurance & Control	3
IME 462, Total Quality in Industrial Mgmt	3
IME 470, Operations Research I	3
IME 472, Simulation of Busn & Industrial Syst	3
IME 480, Production & Inventory Control	3
IME 482, Automated Manufacturing Systems	3
IME 485, Indust & Manufact Facility Design	3
MATH 129, Basic Linear Algebra.	2
MATH 166, Calculus II.	4
MATH 259, Multivariate Calc.	3
MATH 266, Intro Diff Equations	3
ME 212, Fund of Visual Communication	3
ME 221, Engineering Mechanics I.	3
ME 222, Engr Mechanics II.	3
Engineering Science Electives[3]	12
Technical Electives[3]	12
Total	***88***
Curriculum Total	***131***

1 Effective fall 2007, students with composite ACT scores of 21 or higher should register for English 120 (unless transfer credit for ENGL 120 is received). Students who complete English 120 with a C or higher will receive credit for English 110 with a passing grade (P). Students with a composite ACT score of less than 21 are required to register for English 110.

2 May double count with select Humanities & Fine Arts, Social & Behavioral Science and/or Science & Tech. Gen Ed courses.

3 Refer to department or curriculum guide for course options.

Industrial Engineering and Management Minor

Students majoring in any engineering discipline may elect a minor in Industrial Engineering and Management. These optional studies offer engineering students the opportunity to add important career-enhancing skills to their technological competencies. The elected courses in an IE&M minor add skills for integrating technology and resources within the complex of people, technology, machinery and information that make up the successful modern business enterprise. Students completing this minor will achieve better understanding of organizational and management processes and will be better prepared to work in the multifunctional teams crucial to success in industry.

Minors at NDSU require a minimum of 16 credits. The foundation requirements for the IE&M minor are:

IME 111, Introduction to IME

IME 311, Work/Station Design

The remaining 10 credits may be selected from any IME 300- and 400-level courses for which prerequisites are in place. The only exception is Evaluation of Engineering Data (IME 460), which does not count toward this minor.

Interested students are encouraged to visit with relevant faculty in the IME Department for advice on course selection to best suit their career interests. Students must complete the graduation requirements for another engineering major before the designation of the IE&M minor will be placed on their transcripts.

Industrial Engineering and Management Areas of Emphasis

Students majoring in Industrial Engineering and Management may prepare for specific career choices by careful use of the technical electives included in the IE&M major. It is suggested that students confer with their academic advisor for assistance in choosing the most appropriate optional courses. Particular areas of emphasis may be selected in the following special interests:

- Healthcare management engineering
- Production operations and management
- Process and production engineering
- Reliability and quality management
- Lean manufacturing
- Specialized manufacturing processes (electronics, aircraft, plastics and composites)

These topical areas are also available for post-graduate study, leading to the Master of Science in Industrial Engineering and Management and the Doctor of Philosophy in Industrial and Manufacturing Engineering degrees. For complete details, see the Graduate Bulletin online at www.ndsu.edu/gradschool/bulletin.

Sample '08-09 Curriculum Industrial Engineering and Management Minor

Requirements	Credits
IME 110, Introduction to IME	3
IME 311, Work Station / Design.	3
IME 300-400 level Courses	10
Total	***16***

Management Sequence for Non-Majors

The practices and procedures learned in the Industrial Engineering and Management major are universally applied in public and private organizations of all kinds. IE&M courses are available as electives for students majoring in computer science, mathematics, sciences, business administration, cereal science, agricultural economics, and facility management. Courses recommended for non-majors are: Work/Station Design (IME 311), Engineering Economy (IME 440), Mgmt of People Systems (IME 455), Program & Project Mgmt (IME 456), and Evaluation of Engineering Data (IME 460).

Manufacturing Engineering Major

Manufacturing Engineering is a good choice for people who have both aptitude and interest in production of goods for improved living standard for the general populace. This career field is all about the production of goods - from automobiles and tractors and airplanes ... to electronic products, recreational products, sports equipment, books and toys ... to foodstuffs. Manufacturing engineers are employed in every industry that produces goods of some kind.

Manufacturing engineers may focus on the interaction between work piece and tool as process scientists or process engineers. They may concentrate on integrating the many different processes and parts necessary to make up finished products - as production engineers. Or, as manufacturing systems engineers, they may take a very wide view of the manufacturing enterprise, including its supply chain, distribution channels, financial structure and resource management. In every particular focus, manufacturing engineers are the people who design the processes through which products are made with the required functionality, to high quality standards, in the quantities needed, available when and where customers prefer, and at the best possible price.

Every day, manufacturing engineers make decisions about technology, machinery, people, and money. The preparation for the excitement and challenge of modern manufacturing requires students to master the mathematics and applied science common to all engineering disciplines. They then will master the fundamentals of process engineering and production engineering so that they may apply these principles to production of any type of goods.

Graduates of the Manufacturing Engineering program will be able to:

1. Solve problems relevant to modern manufacturing industries, with principal emphasis on process engineering and production engineering, as well as selected aspects of process science and the manufacturing enterprise.
2. Design competitive manufacturing processes and production systems, integrating machinery, technology, people and money, with appropriate consideration for environmental factors, health and safety, sustainability and ethical, economic, social and political issues.
3. Engage in effective learning in topics and areas relevant to professional advancement and to enhancing the quality of personal life.
4. Participate effectively in multi-disciplinary teams in both leadership and followership roles.
5. Effectively communicate complex technological concepts, issues and professional details to a variety of audiences.

Manufacturing Engineering graduates are well positioned to select career employment in any manufacturing industry. Graduates are actively recruited by companies that produce agricultural and construction machinery and vehicles, complex industrial apparatus, recreational vehicles, airplanes, household goods, building products, and both industrial and consumer electronics. Manufacturing Engineering graduates generally begin their careers designing processes and production systems or directly managing some phase of manufacturing. Frequently, they progress to increased responsibilities, with broader scope and yet more opportunity.

Sample '08-09 Curriculum Manufacturing Engineering Major

General Education Requirements	Credits
First Year Experience (F):	
ME/UNIV 189, Skills for Acad Success	1
Communications (C):	
COMM 110, Fund of Public Speaking.	3
ENGL 110[1], 120, College Comp I, II	3,3
ENGL 321, Writing in the Tech Profess	3
Quantitative Reasoning (R):	
MATH 165, Calculus I.	4
Science & Technology (S):	
CHEM 121, 121L, Gen Chemistry I, Lab.	3,1
CHEM 122, Gen Chemistry II or	
CHEM 240, Survey of Organic Chem	3
PHYS 252, 252L, Univ Physics II, Lab.	4,1
Humanities & Fine Arts (A)	6
Social & Behavioral Sciences (B)	6
Wellness (W).	2
Cultural Diversity (D)[2].	--
Global Perspective (G)[2].	--
Total	***43***

Major/Related Requirements	Credits
ENGR 402, Engr Ethics & Social Resp	1
IME 111, Intro to IME.	3
IME 311, Work/Station Design.	3
IME 330, Mfg Processes I.	3

IME 380, CSD/CAM for Manufacturing.....3
IME 430, Process Engineering 3
IME 431, Production Engineering.....3
IME 432, Composite Materials Manufacturing.....3
IME 440, Engineering Economy 3
IME 456, Program & Project Mgmt 3
IME 460, Evaluation of Engineering Data.....3
IME 461, Quality Assurance & Control 3
IME 480, Production & Inventory Control 3
IME 482, Automated Manufacturing Systems 3
IME 489, Manufacturing Engr Capstone 3
MATH 128, Intro to Linear Algebra 1
MATH 166, Calculus II.....4
MATH 259, Multivariate Calc.....3
MATH 266, Intro Diff Equations 3
ME 212, Fund of Visual Communication 3
ME 221, Engineering Mechanics I.....3
ME 222, Engr Mechanics II.....3
ME 223, Mech of Materials.....3
ME 331, Engr Materials I.....4
CSCI Elective 3
Engineering Science Electives[3] 9
Technical Electives[3] 6
Total ***88***

Curriculum Total ***131***

1 Effective fall 2007, students with composite ACT scores of 21 or higher should register for English 120 (unless transfer credit for ENGL 120 is received). Students who complete English 120 with a C or higher will receive credit for English 110 with a passing grade (P). Students with a composite ACT score of less than 21 are required to register for English 110.

2 May double count with select Humanities & Fine Arts, Social & Behavioral Science and/or Science & Tech. Gen Ed courses.

3 Refer to department or curriculum guide for course options.

Manufacturing Engineering Areas of Emphasis

Students majoring in Manufacturing Engineering may prepare for specific career choices by careful use of the two technical electives and the three Engineering Science requirements included in the Manufacturing Engineering major. It is suggested that students confer with their academic advisor for assistance in choosing the most appropriate optional courses. These topical areas also are available for post-graduate study, leading to Master of Science in Manufacturing Engineering and Doctor of Philosophy in Industrial and Manufacturing Engineering degrees. For more complete details, see the Graduate Bulletin online at www.ndsu.edu/gradschool/bulletin.

Sample '08-09 Curriculum Manufacturing Engineering Minor

Requirements	Credits
IME 330, Manufacturing Processes	3
IME 380, CAD/CAM in Manufacturing	3
IME 430, Process Engineering	3
IME 431, Production Engineering.	3
IME 300-400 Level Electives[1] (min)	4
Total	***16***

1 Refer to department or curriculum guide for course options.

Manufacturing Sequences for Non-Majors

Most industrial enterprises engage in the production of some sort of goods in some way and to some degree. Students majoring in other disciplines can enhance their career value by expanding their knowledge of process engineering and production engineering.

For students majoring in other engineering disciplines or in the agricultural or physical sciences, the technological foundations of manufacturing can be acquired through Manufacturing Processes I (IME 330), Process Engineering (IME 430) and Production Engineering (IME 431). Also, engineering majors from other disciplines may elect to acquire more depth in electronics manufacturing (IME 427) and plastics and composite manufacturing (IME 432, 435).

Department of Mechanical Engineering and Applied Mechanics

www.ndsu.edu/me

Mechanical engineering is a broad field primarily concerned with the principles of motion, energy, and force. Mechanical engineers are called upon to design machinery, mechanisms, and systems that function safely, reliably, and efficiently to serve needs of society. To accomplish this, mechanical engineers apply scientific principles to problems that involve the motion of heat, gases, fluids, and solid materials.

Mechanical engineers may be found in nearly all segments of society. They work in industry, consulting practices, government facilities, and universities. In industry, mechanical engineers work for equipment manufacturers, utilities, material processing plants, environmental firms, and companies that deal with aerospace, transportation, petroleum, biomedical products, and others. Mechanical engineers employed by the government and universities contribute to the betterment of society by conducting research to solve present and future problems. As technology becomes more prevalent in daily life, mechanical engineers are increasingly called upon to apply that technology to develop devices that improve the standard of living.

Mechanical Engineering Major

The Mechanical Engineering program at NDSU is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). The curriculum is designed to produce baccalaureate-level graduates who are well prepared to accept engineering positions in industry and government or to pursue advanced degree studies.

The mission of the Mechanical Engineering Department is to educate undergraduate and graduate students in the fundamentals of the discipline, prepare graduates to effectively function in society in the field of their choice, and to provide the learning skills to adapt to evolving personal and professional goals. To accomplish this mission, the educational objectives of the program are to produce graduates who:

1. Are well educated in the fundamentals of the discipline, and posses the ability and willingness to adapt to emerging technologies through continued professional development.
2. Will contribute in a competent manner to the engineering profession in the field of their choice.
3. Demonstrate a commitment to uphold ethical and professional standards in the practice of engineering.
4. Can effectively function in a team environment and interact with people of diverse backgrounds.
5. Understand the context in which their designs will be implemented and the corresponding impact of their activities on society.

A complete listing of the program outcomes associated with these objectives can be viewed on the department's web site.

Strong program emphasis is placed on engineering science, laboratory, and design. The use of modern computer tools and techniques in engineering practice also is incorporated throughout the curriculum. In addition, liberal arts education is included to prepare graduates for becoming concerned and productive members of society.

Students transferring into mechanical engineering from other departments or institutions are encouraged to do so no later than the beginning of the junior year if they wish to complete the degree requirements within two academic years.

Graduate programs leading to Master of Science and Doctor of Philosophy degrees in Mechanical Engineering are offered by the department. For more complete details, see the Graduate Bulletin online at www.ndsu.edu/gradschool/bulletin.

Selective Admission

The Department of Mechanical Engineering has a selective admission policy. To be admitted to the basic program (freshman and sophomore level), freshman applicants must either rank in the top one-third of their high school graduating class or have received a score of 26 or higher in the math portion of the ACT. Transfer students, whether from another university or from another department at NDSU, must have an institutional grade point average (GPA) of at least 2.8.

To enter the professional program (junior and senior level), students must complete the basic program with an institutional GPA of 2.8, and a core course GPA of 2.8, with no grade below C in any one of the core courses.

A minimum institutional GPA of 2.5 is required for graduation from Mechanical Engineering. No course grades less than C are acceptable to fulfill a program requirement.

Curriculum Options

All Mechanical Engineering majors have a common curriculum during the first two years. At the beginning of the third year, students may choose one of the following curriculum options to complete their program of study:

Standard: Students who are interested in exploring a spectrum of technical electives may follow the Standard curriculum and choose a minimum of five technical elective courses. These courses cover a wide range of topics and students may tailor their choices to reflect their special interests in solid mechanics and design, thermal sciences, materials and nanotechnology, injection molding, biomechanical engineering, or other areas as added in the future. For a complete list of technical electives available in each area, students should consult with their advisor or the department.

Coatings and Polymeric Materials: The Coatings and Polymeric Materials option in Mechanical Engineering at NDSU is a unique program offered nowhere else in the United States. Upon completion of this option, students are eligible to receive a minor in Coatings and Polymeric Materials. This minor is for students wishing to prepare for a career as a mechanical engineer in the plastics and coatings industries, or for a career in a manufacturing industry as a mechanical engineer with expertise in the fields of plastics and coatings.

Numerous career opportunities for mechanical engineers with this specialized training are available in the coatings industry, which manufactures paints and coatings to enhance and preserve such items as automobiles, ships, steel structures, machines, and household appliances. Many other opportunities are available in various manufacturing industries where more and more components previously fabricated from metals are now made from plastics and fiber-reinforced composite materials. Due to the unique nature of this program, the demand for graduates far exceeds the supply.

Sample '08-09 Curriculum
Mechanical Engineering Major

General Education Requirements	Credits
First Year Experience (F):	
ME/UNIV 189, Skills for Acad Success	1
Communications (C):	
COMM 110, Fund of Public Speaking	3
ENGL 110[1], 120, College Comp I, II	3,3
ENGL 321, Writing in the Tech Profess	3
Quantitative Reasoning (R):	
MATH 165, Calculus I	4
Science & Technology (S):	
CHEM 121, 122, General Chemistry I, II	3,3
PHYS 252, 252L, Univ Physics II, Lab	4,1
Humanities & Fine Arts (A)	6
Social & Behavioral Sciences (B)	6
Wellness (W)	2
Cultural Diversity (D)[2]	--
Global Perspective (G)[2]	--
Total	***42***

Major Requirements	Credits
ECE 301, Electrical Engineering I	3
ECE 303, Electrical Engr II	3
ECE 306, Electrical Engr I Lab	1
ENGR 402, Engr Ethics & Social Resp	1
IME 330, Mfg Processes I	3
MATH 129, Basic Linear Algebra	2
MATH 166, Calculus II	4
MATH 259, Multivariate Calc	3
MATH 266, Intro Diff Equations	3
ME 212, Fund of Visual Communication	3
ME 213, Modeling of Engr Systems	3
ME 221, Engineering Mechanics I	3
ME 222, Engr Mechanics II	3
ME 223, Mech of Materials	3
ME 331, Engr Materials I	4
ME 351, Thermodynamics I	3
ME 352, Fluid Dynamics	3
ME 412, Engr Measurements	3
ME 423, Interm Mech of Materials	3
ME 421, Theory of Vibrations	3
ME 442, Machine Design I	3
ME 454, Heat & Mass Transfer	3
ME 457, Thermal Systems Lab	3
ME 461, Design Project I	3
ME 462, Design Project II	3
Total	***72***

Additional Requirements (Standard ME Major)	
Technical Electives[3]	15
Total	***15***

Additional Requirements (Coatings & Polymeric Materials Option)	
CHEM 341, 341L, Org Chemistry I, Lab	3,1
CHEM 342, Org Chemistry II	3
CPM 451, Lab, Chem, Radiation, Biol Safety	1
CPM 474, 484, Coatings I, Lab	3,2
CPM 475, Coatings II	3
ME 473, Polymer Engineering	3
ME 433/474, Composite Materials Elective	3
Technical Electives[3]	6
Total	***28***

Curriculum Total (Standard ME Major) 129

Curriculum Total (Coatings & Polymeric Materials Option) 142

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2 May double count with select Humanities & Fine Arts, Social & Behavioral Science and/or Science & Tech. Gen Ed courses.

3 Refer to department or curriculum guide for course options. No more than six credits of approved technical electives may be taken from outside the department.

Aviation Program

A program of flight training is available, which prepares students for the FAA examinations for the Private Pilot's License. Three courses are offered under this program: ME 311 Introduction to Aviation, ME 312 Introduction to Flight, and ME 313 Commercial Instrument Ground School.

Any student enrolled at NDSU or one of the other two Tri-College institutions may enroll in this program. No other courses are required as prerequisites.

Cooperative Education

Students in Mechanical Engineering may participate in the Cooperative Education program at NDSU starting in their sophomore year. Students gain valuable industrial experience to complement their academic studies. Internships may last from one to three semesters.

Wages and benefits for Cooperative Education students are determined by the employer and are influenced by such factors as established wage scales, the co-op student's responsibilities, and the nature of the employer's business.

Department of Military Science

Military Science (Army ROTC)

www.ndsu.edu/armyrotc

The Army Reserve Officers Training Corps (Army ROTC) program is conducted by the Department of Military Science. Army ROTC gives students the opportunity to become involved in a unique program that adds the leadership dimension to their college education. It also provides several financial assistance options. Students, regardless of their majors, are eligible to participate in this program. The primary objective of the program is to provide the knowledge and skills required for men and women to serve as commissioned officers in the active Army, Army Reserve, or Army National Guard. NDSU's Military Science Department is seeking students who have leadership potential, particularly those who are scholars, athletes, and leaders.

The Army ROTC program is a four-year program of instruction in the military sciences taken in conjunction with an academic program curriculum. Advanced placement credit may be received for previous or current military service. The program requires a minimum of 22 credit hours and leads to a minor in Military Science. The program is divided into two parts: the basic course and the advanced course.

The basic course is normally taken during the freshman and sophomore years. Students participating in the basic course incur no military obligation or commitment. Instruction offered in the basic course include: physical fitness class, military leadership and management, land navigation, U.S. military history, first aid, tactics, and drill and ceremonies. Military skills laboratories also are offered. These include adventure activities such as rappelling, rope bridging, tactics, military equipment use, drill and ceremony, survival techniques, and a leadership reaction course.

Students entering the advanced course must have a minimum of two years of academic work remaining in a curriculum leading to either a baccalaureate or graduate degree. Students may qualify for entry into the advanced course by one of the following: completing basic training, attending the five-week ROTC Leaders Training Course (LTC), or having prior military service in any of the armed forces of the United States. Members of the Army National Guard or Army Reserve may qualify for direct entry into the advanced course and can maintain membership in their Guard/Reserve Unit by enrolling for the Simultaneous Membership Program (SMP) option.

Scholarship cadets and advanced course students receive a monthly monetary tax-free allowance of $350 to $500 per month (tiered from freshman through senior year).

Advanced course students receive instruction in advanced leadership and management and are afforded the opportunity to apply their acquired knowledge to practical situations. Military skills laboratories also are offered. In addition to the listed military science curriculum, advanced course students must complete an approved course in written communication skills, military history, and computer literacy.

Students also attend the five-week Leader Development and Assessment Course (LDAC) at Fort Lewis, Wash. (near Tacoma) between the first and second year of the advanced course. The Leader Development and Assessment Course is designed to develop and evaluate a student's judgment and decision-making abilities, build physical endurance and self-confidence, and allow a student to apply leadership skills. Leadership positions are rotated among the students so that each person experiences firsthand what it takes to apply leadership skills and develop an organization.

Four-, three-, and two-year Army ROTC scholarships are available, which provide for payment of tuition and fees. Students receive $600 per semester for books and equipment, and an allowance of $350 to $500 per month for each year the scholarship is in effect. Generally, four-year scholarships are awarded to high school students who wish to compete during their senior year for a scholarship, but college freshmen also have been awarded this highly desirable scholarship.

Students who do not qualify for the ROTC program or who do not wish to pursue an officers' commission may audit courses in the advanced ROTC program, if approved by the professor of military science. Auditing students' participation is limited to the classroom and they are not eligible for monetary allowances.

For detailed information on the Army ROTC program, contact the Department of Military Science, 1-800-798-7575 or 231-7575, Room 103 Bentson/Bunker Fieldhouse or visit the department web site.

Sample '08-09 Curriculum
Military Science Minor

Requirements (Years 1-2)	Credits
MS 101, Foundations of Officership	1
MS 102, Basic Leadership	1
MS 110, Army ROTC Fitness	2
MS 201, Indiv Leadership Studies	2
MS 202, Leadership & Teamwork	2
Total	***8***

Requirements (Years 3-4)	Credits
MS 301, Leadership & Prob Solving	3
MS 302, Leadership & Ethics	3
MS 320, Leadership Lab	1
MS 401, Leadership & Mgmt	3
MS 402, Officership	3
MS 420, Leadership Lab	1
Total	***14***