ENGINEERING AND COMPUTER SCIENCE

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Academic Programs	Credits
BS: Computing	40
Computer Science Emphasis	
Software Systems Emphasis	
Minor in Computing	20
BS in Engineering	
Electrical and Computer Engineering Emphasis	66
Mechanical Engineering Emphasis	66
Minor in Engineering	20
MS: Software Engineering	32
MSA: Engineering Management	
See the School of Business	

Undergraduate Programs

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Two emphases are available in Computing—**Computer Science** and **Software Systems**.

Computer Science focuses on a study of computing as well as on its role in an application area. Areas of interest include artificial intelligence, compilers, computer architectures, computer graphics, computer networks, operating systems, program development, and analytical theory. A degree in computing with the Computer Science emphasis prepares students for graduate study, employment in computer systems/networks, administration/development, software development/maintenance, and for careers in education.

Software Systems is an applied study of computing, focusing on the development and maintenance of software in an application area. A minor in an application area is included as part of the degree. Typical minors might include one of the sciences, behavioral science, or business. Supervised "real-world" projects are a requirement for this degree. A degree in Computing with the Software Systems emphasis prepares students for employment in developing and maintaining commercial applications and for graduate studies in applied computing such as software engineering.

BS in Computing

Major requirements—40
Common core—19
CPTR151, 152, 276, 440, 460, 466
CPTR310, 427, 450

Major electives—12
Chosen from CPTR courses in consultation with an advisor.
A minimum of 12 upper division credits required.
Cognate requirements—36–38
MATH182, 355; STAT340 (9)
Minor in an advisor-approved application area (20-22)

Minor in Computing—20

Required courses—12
CPTR125, 151, 152, 276
Minor electives—8
Chosen from CPTR courses in consultation with an advisor.
Notes:
No course grade below a C- may apply to a major or minor in Computing.

A minimum GPA of 2.25 may apply to a major or minor in Computing.

A secondary-education endorsement is available for students seeking either a major or minor in Computing. In such cases, CPTR459 must be taken. Consult the School of Education for further information.

E ee

The engineering program at Andrews University leads to a Bachelor of Science in Engineering degree with emphases in Electrical and Computer Engineering and in Mechanical Engineering. These two emphases build on a strong traditional mathematics, science, and engineering core. The Electrical and Computer Engineering emphasis focuses on the areas of digital systems, communication systems, and computer controlled instrumentation and computer simulation. The Mechanical Engineering emphasis focuses on mechanical design and the electromechanical elements of smart machines.

The mathematics courses listed as cognates for the engineering degree satisfy the requirements for a minor in mathematics. A second major in mathematics requires 6 additional credits in mathematics, and a second major in physics requires 14–17 additional credits in physics. See the Mathematics and Physics department listings for details.

BS in Engineering

Major requirements—66
Common core—30
ENGR120, 125, 180, 185, 225, 275, 285, 310, 450, 491, 492
Cognates—35
MATH141, 142, 215, 240, 286; STAT340
CHEM131
PHYS241, 242, 271, 272

Electrical and Computer Engineering Emphasis

Required courses—31
CPTR151, 152, 465, ENGR325, 335, 385, 415, 435, and 455.
Major electives—5
Chosen from upper division ENGR and CPTR courses in consultation with an advisor.

Mechanical Engineering Emphasis

Required courses—30
CPTR125, ENGR320, 330, 340, 350, 360, 390, 410, 420, and 440.
Major electives—6
Chosen from upper division ENGR courses in consultation with an advisor.

Minor in Engineering—20

Required courses—10
ENGR120, 125, 185, 225
Minor Electives—10
Chosen from ENGR courses in consultation with an engineering advisor.
Cognates: MATH182 or MATH141, 142

Graduate Programs

MS: Software Engineering

Software Engineering is an applied study of computing focusing on the software development process through the application and synthesis of principles from computer science and related fields. Emphasis is placed on practical results balanced by scientific foundation. Supervised “real-world” projects are a requirement for this degree.

Admission requirements. In addition to meeting the general graduate admission requirements on pp. 44–46 of the bulletin, students applying for admission to the MS: Software Engineering program must show evidence that they have taken academic course work and/or demonstrate proficiency in the following areas:
Calculus
Computer Organization and Assembler
Discrete Mathematics
Elementary Data Structures
Probability or Statistics
Programming proficiency in two computer languages (including C or C++)

Degree requirements—34
A minimum of 34 semester credits. At least 22 credits chosen from 500- and 600-level graduate courses. The Comprehensive Examination must be successfully completed prior to graduation. Completion of the following requirements:

Foundation—0–9
CPTR427, 440 and 460 are required unless previously taken at the undergraduate level.
Core courses—10
CPTR560, 561, 562, 637
Thesis—6
A thesis option must involve software development.
Electives—9–18
Complete any acceptable 400-600 level CPTR courses chosen in consultation with an advisor.

MSA: Engineering Management Emphasis

See graduate programs for the School of Business.

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CPTR125 **$ (3)**

Programming in a selected language. Mayents—3

scripting languages and data manipulation. Manipulating database using SQL. Sessions, authentication and security. Prerequisite: CPTR151. *Spring* (odd years)

CPTR416 **$ Alt (3)**

A study of current technologies and their effects, including web server software, e-commerce, various scripting languages, human-computer interaction, perception, and related issues. Prerequisite: CPTR152. *Fall* (even years)

CPTR425 **$ Alt (3)**

Survey of current programming languages, including structure, runtime systems, the specification of syntax, and semantics. Definition of syntax for formal languages with emphasis on context-free languages. Techniques for scanning and parsing programming languages. Automated grammar analysis parsers. Prerequisite: CPTR276. *Fall* (even years)

CPTR427 **$ Alt (3)**

Emphasizes the study of object-oriented analysis and design methodologies and the application of these to the development of advanced software. Includes survey of object-oriented programming languages and environments. Prerequisite: CPTR152. *Fall* (odd years)

CPTR436 **$ Alt (3)**

CPTR495 **(1–3)**

Directed study of material of special interest chosen in consultation with the instructor. No more than 6 credits may be earned in CPTR495. Graded S/U.

CPTR496 **(1–3)**

Project chosen in consultation with instructor. No more than 6 credits may be earned in CPTR495. Graded S/U.

CPTR536 **Alt (3)**

Storage allocation for programs, subroutine linkage, and code generation and optimization. Simple translator written in course. Prerequisites: CPTR276, 425. *Spring* (odd years)

CPTR548 **Alt (3)**

Database design and theory. Concurrency, distributed databases, integrity, security, query optimization, transaction processing, object-oriented databases. A survey of the design and implementation tradeoffs considered for these topics in the creation of available database packages. Includes a term project and reading from the literature. Prerequisite: CPTR467 or equivalent. *Spring* (odd years)

CPTR555 **Alt (3)**

CPTR698 **(1–4)**

Special project chosen in consultation with student's advisor and instructor. To be repeated to 6 credits. Grade S/U.

CPTR699 **(1–6)**

To be repeated to 6 credits. Graded S/U.

E ee

ENGR120 **$ (2)**

Introduces students to the engineering profession. Various engineering disciplines, job functions, engineering designs and engineering ethics will be discussed. Tips on how to succeed in the classroom, advice on how to gain actual, hands-on experience will be discussed. Introduces computer tools such as Mathcad and Microsoft Excel. *Fall*

ENGR125 **(2)**

Fundamentals of drawing as applied to mechanical engineering problems. Orthographic projections, auxiliary and sectional views, dimensioning and tolerancing, oblique and isometric views, detail and assembly drawing. Sketching and computer-aided drafting. Weekly: 1 lecture and a 3-hour lab. *Fall*

ENGR135 **(1)**

Solution of basic space problems. Determination of distances and angles, intersections of lines and surfaces, intersections of lines and development of surfaces. Prerequisite: ENGR125. *Spring*

ENGR180 **$ (4)**

Introduction to the study of materials used in industry. Deals with the fundamentals of structure and classification of materials. A weekly hands-on laboratory helps demonstrate the relationship of properties of materials studied in lecture. Weekly: 3 hours lecture and a 3-hour lab. Prerequisite: CHEM131. *Spring*

ENGR185 **(3)**

Principles of statics and their application to engineering problems; forces, moments, couples, friction, centroids and moments of inertia. Corequisite: MATH141. *Spring*

ENGR225 **$ (3)**

Resistive circuit analysis, network theorems, dependent sources, energy storage elements, 1st and 2nd order circuit transient responses, ac circuit analysis using phasors and impedances, and ac complex power. Weekly: 2 hours lecture and a 3-hour lab. Corequisite: MATH142. *Fall*

ENGR248 **(1–4)**

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ENGR360 **(3)**

Fluid statics and dynamics of fluid motion. Conservation of mass, momentum, and energy in laminar and turbulent flow. Boundary layer flow, lift and drag forces, viscous flow in conduits, open channel flow, flow measurements. Prerequisite: ENGR285 and 330; Corequisite: MATH286. *Spring*

ENGR380 **$ (2)**

Introduction to typical programmable logic controllers and

the value of the experience to the student. Grade S/U. Repeatable to 4 credits. Prerequisite: junior/senior standing and permission of the person who will direct the study.

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ENGM520 **(3)**

The application of ergonomics and engineering principles to the design analysis and measurement of human work systems. *Summer*

ENGM530 **(3)**

Total quality management, analysis and use of state-of-the-art concepts and methods for total quality control and management. Probability studies and tests of significance. Prerequisite: STAT285 or 340. *Spring*

ENGM555 **(3)**

Planning and design of industrial and service facilities: site selection, process layout, materials handling, and storage. *Summer*

ENGM560 **(3)**

Planning and control of manufacturing systems: design and management of production systems, strategies and competition for product design and processing, forecasting, inventory, supply chain management, operation scheduling and shop floor control. Prerequisites: MATH142, STAT285 or 340. *Fall*

ENGM565 **(3)**

The development and use of mathematical models to analyze elements of production and service systems: linear programming, probabilistic models, game theory, dynamic programming, queuing theory, and simulation. Prerequisites: ENGR460; STAT285; MATH142 or 182. *Spring*

ENGM570 **(3)**

Design and management of engineering projects: proposals, planning, resource requirements, organization, scheduling, and cost and schedule control. *Fall*

ENGM690 **(1–4)**

Individual study of research in some area of engineering management under the direction of a member of the engineering faculty.

ENGM698 **(2)**

Research methods and a research project in an area of engineering management.