AGRI467
Concepts of International Agriculture
A study of the relative significance of the role of external institutions and agencies, financial programs for agricultural development, human resource development, and agricultural education as a means of fostering worldwide agricultural development.

AGRI468
International Agricultural Implementation
The application of scientific agricultural principles of food production, utilizing cultural practices based on appropriate agricultural technologies that support a philosophy of sustainability for future generations.

AGRI498
Internship
Field practicum on site.

AGRI499
Project in ___________
Individual research in some field of agriculture Repeatable to 10 credits.

ENGINEERING, COMPUTER SCIENCE, AND ENGINEERING TECHNOLOGY
Haughey Hall, Room 312
(616) 471-3420; FAX: (616) 471-3797
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Faculty
Ronald L. Johnson, Acting Chair
Gerald W. Coy
Glenn E. Johnson
Gunnar Lovhoiden
Roberto Ordonez
James Wolfer

Academic Programs
BS in Computing with options in
Computer Science and Software Systems
BS: Industrial and Operations Engineering
70
BS in Engineering Program
First two years on Andrews campus and final two years at Walla Walla College, College Place, WA
BSET: Computer Engineering Technology
60
BSET: Electronics Engineering Technology
60
Biomedical Electronics Technology
Industrial Electronics Technology
BSET: Mechanical Engineering Technology
60
BSIT: Electronics Technology
60
BSIT: Production Systems
60
AET: Computer Engineering Technology
40
AET: Electronics Engineering Technology
40
AET: Mechanical Engineering Technology
40
Minor in Electronics
30
Minor in Engineering
30
MS in Software Engineering

Programs

ENGINEERING INTEGRATED FOUR-YEAR PROFESSIONAL ENGINEERING PROGRAM
Andrews University offers the first two years of an integrated four-year professional engineering program. The final two years of the Bachelor of Science in Engineering degree program are offered at Walla Walla College (College Place, WA). Students may specialize in civil, electrical, or mechanical engineering. The department at Andrews University may assist students by coordinating a program with another engineering school upon request.

A BS degree with a concentration in Industrial and Operations Engineering is offered entirely on the Andrews campus. This program prepares students to use analytical methods in the design of efficient production and service systems, and for either employment or graduate study. Electives may be chosen to place emphasis on health-care systems or production industries.

Professional Engineering
(first two years)

Required courses to be taken during the two years at Andrews: CHEM121, 122, 123; COMM104; COSC161; ENGL111, 112; ENGR120, 135, 225, 281, 282; MATH171, 172, 173, 281, 282, 283; MECT121, PHYS251, 252, 253, 261, 262, 263; Religion (8 credits); Social Studies and Humanities (8 credits).

Minor in Engineering
Required courses—30
ENGR120, 225, 281, 282 or 300; plus 16-17 credits of engineering electives (may include ELCT152 and 172, 153 and 173, 204, 224, 324, 340, 385; MECT121, 386.

BS: Industrial and Operations Engineering
Major requirements—70
BSAD355; ECON225, 226; ENGR120, 135, 225, 281, 282, 465; INDT320, 410, 440, 450, 460; MECT121; plus 16 credits selected from BSAD 436, 440; COSC162, 163, 436; ENGR224; INSY448; MATH401, 402, 427; MECT155; TCED254, 456.
Cognate requirements—63
MATH171, 172, 173, 281, 282, 283; CHEM121, 122; COSC161; STAT251; PHYS251, 252, 253, 261, 262, 263.

MSA with Engineering Management Emphasis
See graduate programs for the School of Business, p. 156.

COMPUTER SCIENCE
For information on the BS in Computing with options in Computer Science and Software Systems, and the MS in Software Engineering, see the supplement to the bulletin.

ENGINEERING TECHNOLOGY
Engineering technology—the area of the technological employment spectrum between the engineer and the skilled craftsman—includes both the engineering technician (Associate of Engineering Technology) and the engineering technologist (Bachelor of Science in Engineering Technology).

Industrial technology—the portion of the technological employment spectrum between the skilled craftsman and management—combines the development of a technical skill with courses in industrial management.

SEQUENCE OF TWO-YEAR AND FOUR-YEAR PROGRAMS
Most programs are structured so students can earn an associate degree in two years. Students may
then take a job in industry or continue their education another two years to earn a four-year baccalaureate degree.

**BSIT: Production Systems**

**Major requirements—60**

ELCT151, 152, 171, 172; INDT320, 440, 460; MATH162; MECT122, 155, 185, 186; TCED141, 251, 252; plus 12 credits selected from ELCT205; ENGT395; MATH163; MECT226, 455; TCED142.

**BSIT Core requirements—27**

BSAD355, ECON226, INDT310, 450, MECT121, TCED254, 456.

**Courses**

See inside back cover for symbol code.

**ELECTRONICS**

**ELCT105**

**Electronics Survey**

Survey of electronic devices such as diodes, transistors, and integrated circuits. Sufficient circuit theory covered to permit the study of the above devices in simple power supply, analog, and digital circuits. Intended for non-electronics students. Includes lab.

**ELCT115, 152, 153**

**Basic Electronics**

Study of AC and DC electric circuit theory, characteristics of diodes, transistors, and linear integrated circuits and their behavior in simple circuits. Prerequisites or corequisites: MATH162, 163, 165. Corequisites: ELCT161, 162, 163 or ELCT171, 172, 173.

**ELCT161, 162, 163**

**Electronics Laboratory Practice**

Practical application of the theory studied in ELCT151, 152, 153. Intended to give extensive hands-on experience to students planning a career in electronics. Corequisites: ELCT151, 152, 153.

**ELCT171, 172, 173**

**Electronics Laboratory**

Practical application of selected topics studied in ELCT151, 152, 153. Intended to give non-electronics students some exposure to the equipment and procedures used in electronics. Corequisites: ELCT151, 152, 153.

**ELCT204**

**Instrumentation and Measurements**


**ELCT205**

**Electrical Machinery**

Characteristics and applications of DC motors and generators; transformers, AC motors and generators, motor starters and controls; power factor correction; power systems. Includes lab. Prerequisite: ELCT151.

**ELCT224**

**Digital Electronics**

Binary numbers and codes, Boolean algebra, logic circuits, flip-flops and registers, arithmetic circuits, counters, multiplexers, demultiplexers, design of state machines, and comparison of IC logic families. Includes lab. Prerequisite: ELCT153.

**ELCT300**

**Troubleshooting and Servicing**

Lab experience in troubleshooting and servicing electronic equipment. Repeatable to 4 credits. Prerequisite: ELCT204.

**ELCT305**

**Digital Troubleshooting**

Techniques and tools of digital equipment troubleshooting. Prerequisite: ELCT324. May not be offered each year.

**ELCT314**

**Basic Documentation**

Documentation as applied to electronic systems. Specifically, computer documentation and analysis tools are integrated to facilitate the documentation process. Prerequisites: ELCT153; ENGL111; and MECT121. May not be offered each year.

**ELCT315**

**Circuit Design and Testing**

The design, breadboarding, testing, and debugging of a simple electronic system. Prerequisites: ELCT204, 224. May not be offered each year.

**ELCT316**

**Printed Circuit Laboratory**

Basic methods of layout and fabrication of single layer etched circuit boards. Prerequisite: ELCT153. May not be offered each year.

**ELCT324**

**Microprocessors**

Introduction to computer organization, microprocessors, assembly language programming, memory devices, I/O devices, interfacing with emphasis on control applications. Includes lab. Prerequisite: ELCT224 or COSC255.

**ELCT330**

**Programmable Controllers**

A study of relay logic. Application and programming of industrial programmable controllers to accomplish these relay logic functions. Includes lab. Prerequisite: ELCT224. May not be offered each year.

**ELCT340**

**Communications Electronics**

Filters, oscillators, frequency response plots, tuned circuits, impedance matching, and Fourier series. Amplitude, frequency, phase, and pulse modulation. Includes lab. Prerequisites: ELCT204; MATH163.

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**Electronics Technology Adviser.**

Courses selected in consultation with Electronics Technology adviser.

**AET: Computer Engineering Technology**

**Major requirements—40**

COSC125 (meets computer science General Education requirement), 161, 162, 163, 165; ELCT151, 152, 153, 171, 172, 173, 224, 324; and 8 credits selected from COSC and ELCT courses in consultation with an adviser.

**Cognate requirements—8**

MATH215 or 281 and MATH235 or 355 for the General Education requirements.

**AET: Computer Engineering Technology**

**Major requirements—40**

COSC125 (meets computer science General Education requirement), 161, 162, 163; ELCT151, 152, 153, 171, 172, 173, 224, 324, 340, 375, plus one of the following options:

- **Biomedical Electronics Technology—20**
  - BIOL111, 112; ELCT346, 437; plus 4 credits selected from ELCT305, 345, 364, 385, 424; TCED251, 456 in consultation with electronics technology adviser.

- **Industrial Electronics Technology—20**
  - ELCT330, 364; ENGT495; plus 12 credits selected from ELCT305, 345, 385, 424; MECT155, 410, 455; TCED251; ENGT390 in consultation with electronics technology adviser.

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**BSIT: Electronics Technology**

**Major requirements—60**

ELCT151, 152, 153, 161, 162, 163, 204, 224, 300, 314, 315, 316, 324, 340, 375, plus 18 credits selected from one of the options listed above in consultation with electronics technology adviser.

**Cognate requirements—8**

MATH162, 163.

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**AET: Electronics Engineering Technology**

**Major requirements—40**

ELCT151, 152, 153, 161, 162, 163, 204, 224, 300, 314, 315, 316, 324, 340, plus 18 credits selected from one of the options listed above in consultation with electronics technology adviser.

**Minor in Electronics**

**Minor requirements—30**

ELCT151, 152, 153, 171, 172, 173, 204, 224 plus 10 credits selected in consultation with electronics technology adviser.
ENGM520 **Ergonomics and Work Design**
The application of ergonomics and engineering principles to the design analysis and measurement of human work systems.

ENGM555

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

**ENGM565 Operations Analysis and Modeling**
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; MATH163 or 172 or 182.

ENGM690 **Independent Study (Topic)**
Individual study or research in some area of engineering management under the direction of a member of the engineering faculty.

ENGR281 **Cooperative Work Experience**
Work experience in industry directed by a faculty member—150 hours of work is required per credit. Prerequisites: ELCT153; MATH163. May not be offered each year.

ENGR285 **Control Systems**
Analysis of electronic control circuits; feedback circuits, electronic timers, photovoltaic devices, motor control, heating system control, servomechanisms. Includes a lab. Prerequisites: ELCT153; MATH163. May not be offered each year.

ENGR370 **The Technical World and Man**
Gives general students an understanding of how modern technology affects society. Topics include how humans respond to technological change, the social consequences of technology, and technological issues in national decisions.

ENGR385 **Pulse and Switching Circuits**
Pulse and switching circuits as applied to computers, communication systems, and test equipment. Includes linear waveshaping, clipping, clamping, gating, switching, and multivibrator circuits. Includes a lab. Prerequisite: ELCT153. May not be offered each year.

ENGR465 **Operations Analysis and Modeling**
The methodology of mathematical modeling and its relation to solving problems in industrial and public systems. Linear programming, scheduling, queuing, simulation, optimization, and decision analysis. Prerequisites: IND460; STAT251. May not be offered each year.

**ENGR520 Introduction to Engineering**
Explores specialized areas and job functions of engineers and technologists. A design project emphasizes the engineering design process. Introduces Mathcad.

**ENGR282 Dynamics for Engineers**
Vectorial kinematics of moving bodies in fixed and moving reference frames. Kinetics of particles, assemblies of particles, and rigid bodies, with emphasis on the concept of momentum. Keplerian motion, moment of inertia, elementary vibrations, and conservative dynamic systems. Prerequisite: ENGR281; prerequisite or corequisite: MATH282.

**ENGR300 Mechanics of Materials**
Application of principles of mechanics to the solution of problems in stress and strain on engineering material: resistance to direct force, bending, torque, shear, eccentric load, deflection of beams, buckling of columns, compounding of simple stresses. Prerequisite: ENGR281. May not be offered each year.

**ENGR324 Descriptive Geometry**
Solution of basic space problems. Determination of distances and angles, intersections of lines and surfaces, intersections and development of surfaces. Prerequisite: MECT121.

**ENGR524 Circuit Analysis**

**ENGR528 Statics for Engineers**
Principles of statics and their application to engineering problems: forces, moments, couples, friction, centroids, and moment of inertia. Prerequisite: MATH173.

**ENGR390 Independent Study in Engineering Technology**
Individual study, research, or project in some field of engineering technology under the direction of a member of the Engineering Technology faculty. Prerequisite: permission of person who will direct study.

**ENGT395 Practicum**
Lab or on-the-job experience to build skills in a specific area of engineering technology. Repeatable to 6 credits. Prerequisite: A fundamental course in the area.

**ENGT397 Introduction to Business**
The fundamentals of business administration. Topics include organization, duties, human relations, training, evaluation, promotion, grievances, and management-employee relationships.
MECT120 (4) Computer-Aided Drawing
Introduces the use of AutoCad, graphics generation and editing, file maintenance, plotting, and 2- and 3-dimensional drawings. Credit may not be earned in MECT120 and 121 or 122.

MECT121 (3) Mechanical Drawing I

MECT122 (4) Mechanical Drawing II
Limit dimensional drawing, and interpretation of weld symbols. Solid modeling and production drawings using CAD. Prerequisite: MECT121.

MECT155 (4) Manufacturing Processes
Study of manufacturing processes used in industry. May not be offered each year.

MECT185 (4) Materials Technology
Study of industrial materials. Properties of materials correlated with the internal structure. Includes metals, plastics, and ceramics.

MECT186 (1) Materials Technology Lab
Corequisite: MECT185.

MECT226 (4) Fluid Power Systems
Principles and applications of fluid power systems to actuate and/or control machines. Electro-hydraulic-pneumatic systems studied. Principles of fluids introduced. Prerequisite: MECT265. May not be offered each year.

MECT265 (4) Statics
Analysis of static force systems. Forces, moments, resultants, free-body diagrams, equilibrium, center of mass, moment of inertia, and friction. Assignments designed to develop problem-solving abilities. A minimum grade of C required in order to enroll in MECT365. Prerequisite: MATH163.

MECT310 (4) Introduction to Numerical Control
Introduction to the numerical control process including design features, function, controls for position and continuous path, manual and computer-aided programming. Prerequisites: COSC125 and TCED251 or MECT155. May not be offered each year.

MECT345 (4) Kinematics
Study of the basic theories and techniques in the analysis of relative motion, acceleration, and acceleration of machine parts such as linkages, cams, gears, and other mechanisms. Prerequisite: MATH163; MECT265. May not be offered each year.

MECT364 (5) Dynamics
Fundamentals and applications of dynamics; displacement, velocities, acceleration, work, energy, power impulse, momentum, and impact. Prerequisites: MATH163; MECT265, 345.

MECT365 (4) Strength of Materials
Study of internal stress and deformation of elastic bodies resulting from the action of external forces including tension, compression, shear, bending, torsion, and buckling. Topics include shear and bending-moment diagrams, deflections, strain/stress relationships, and combined stresses. Prerequisite: A minimum grade of C in MECT265. May not be offered each year.

MECT371 (4) Heat Power I
Thermodynamic properties, first and second law of thermodynamics, ideal gas law, the Carnot Cycle, power and refrigeration cycles, heat transfer. Prerequisite: MATH163. May not be offered each year.

MECT372 (4) Heat Power II
Continuation of power and refrigeration cycles, non-flow gas processes, mixtures of ideal gases, psychrometric chart, air conditioning, fluid statics, kinematics, and dynamics. Includes lab. Prerequisites: MECT265 and 371. May not be offered each year.

MECT375 (4) Fluid Mechanics
Dimensionless parameters, compressible flow, flow in pipes, open channel flow, drag, lift. Includes lab. Prerequisites: MECT265 and 372. May not be offered each year.

MECT386 (4) Machine Design
The design of machine elements and the calculations necessary in determining the size and shape of machine parts. The selection of materials and the application of standard machine components. Includes bearings, gears, clutches, and couplings. Prerequisites: MECT185, 365. May not be offered each year.

MECT410 (4) Computer-Aided Manufacturing
Basic elements and principles including terminology, computer hardware/software requirements, interfacing, systems integration, flexible manufacturing systems, and industrial robots. Prerequisite: COSC125. May not be offered each year.

MECT455 (4) Fundamentals of Robotics
Robot motion, mechanical systems, manipulators, end of arm tooling. Control sensors, data acquisition, programming, vision systems. Robot safety. Robot applications. Prerequisites: ELCT204, 224, MECT345. May not be offered each year.