

AGRI467 (4)
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 (4)
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 (1-6)
Internship
 Field practicum on site.

AGRI499 (1-5)
Project in _____
 Individual research in some field of agriculture under the direction of the staff. Repeatable to 10 credits.

ENGINEERING, COMPUTER SCIENCE, AND ENGINEERING TECHNOLOGY

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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.

Academic Programs	Credits
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.

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.

BSET: Computer Engineering Technology

Major requirements—60

COSC125 (meets computer science General Education requirement), 161, 162, 163, 461; ELCT153, 171, 172, 173, 224, 305, 324, 424; ENGT495; plus 22 credits from COSC, INSY, 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; and 8 credits selected from COSC and ELCT courses in consultation with an adviser.

BSET: Electronics

Engineering Technology

Major requirements—60

ELCT153, 161, 162, 163, 204, 224, 300, 314, 315, 316, 324, 340, 375, plus one of the following options:

Biomedical Electronics Technology—20

BIOL111, 112; ELCT436, 437; plus 4 credits selected from ELCT305, 345, 364, 385, 424; TCED251, 456 in consultation with electronics technology adviser.

or

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.

BSIT: Electronics Technology

Major requirements—60

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.

Cognate requirements—8

MATH162, 163.

AET: Electronics

Engineering Technology

Major requirements—40

ELCT151, 152, 153, 161, 162, 163, 204, 224, 300, 324; MECT121; and 5 credits from ELCT305, 314, 315, 316, 340, 364, 375 chosen 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.

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.

BSET: Mechanical

Engineering Technology

Major requirements—60

ELCT153, 171, 172, 173, 204, 385; MECT122, 345, 364, 365, 366, 371, 372, 375, 386; 4-8 credits selected from MECT155; TCED141, 251, 252; plus 4-8 credits selected from ENGR135; ENGT395, 495; INDT320, 410, 440, 460; MECT226, 310, 410, 455.

AET: Mechanical

Engineering Technology

Major requirements—40

ELCT151, 171, 205; MECT121, 122, 185, 186, 265; one of the following sequences: (Drafting & Design) ENGT395 (4 credits); MECT345, 365; (Thermal Systems) MECT371, 372, 375; (Manufacturing) MECT155, TCED141, INDT310 or 440 or 460; plus 4 credits selected from ELCT152, 172; other MECT courses.

Courses

(Credits)

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.

ELCT151, 152, 153

(3,3,3)

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

\$(3,3,3)

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

\$(1,1,1)

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

\$(4)

Instrumentation and Measurements

Theory and application of electrical transducers and recording devices. Measurement errors and calibration. Includes lab. Prerequisite: ELCT153.

ELCT205

\$(4)

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

\$(4)

Digital Electronics

Binary numbers and codes, Boolean algebra, logic circuits, flipflops and registers, arithmetic circuits, counters, multiplexors, demultiplexors, design of state machines, and comparison of IC logic families. Includes lab. Prerequisite: ELCT153.

ELCT300

\$(2)

Troubleshooting and Servicing

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

ELCT305

\$(2)

Digital Troubleshooting

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

ELCT314

\$(2)

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

\$(2)

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

\$(2)

Printed Circuit Laboratory

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

ELCT324

\$(4)

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

\$(2)

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

\$(4)

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.

May not be offered each year.

ELCT345 \$ (4)

Microwaves and Transmission Lines

Basic transmission line analysis using the Smith chart. Methods of generating, transmitting, detecting, and amplifying microwave signals. Includes lab. Prerequisites: ELCT340; MATH163. May not be offered each year.

ELCT364 \$ (4)

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 lab. Prerequisite: ELCT153. May not be offered each year.

ELCT375 \$ (4)

Linear Electronics

A study of the specifications, capabilities, and applications of opamps, voltage regulators, and other related linear ICs. Applications to filtering and A/D conversion are emphasized. Includes a lab. Prerequisites: ELCT153; MATH163. May not be offered each year.

ELCT385 \$ (4)

Control Systems

Analysis of electronic control circuits; feedback circuits, electronic timers, photoelectric devices, motor control, heating system control, servomechanisms. Includes a lab. Prerequisites: ELCT204; MATH163. May not be offered each year.

ELCT420 (4)

Avionics Equipment

A study of operating principles and circuits of communication and navigation equipment used in general aviation. Prerequisite: ELCT324, 340. May not be offered each year.

ELCT424 \$ (4)

Microprocessor Application

Microprocessor interfacing and applications in the area of process monitoring and control. Includes lab. Prerequisite: ELCT324. May not be offered each year.

ELCT436, 437 (3,3)

Biomedical Electronic Equipment

Examines the specifications, operation procedures, servicing, and maintenance of the full range of biomedical electronic equipment. ELCT437 includes lab. Prerequisites: ELCT324, 375; BIOL112. May not be offered each year.

ENGINEERING MANAGEMENT

ENGM 510 (4)

Industrial Supervision

The fundamentals of industrial supervision. Topics include organization, duties, human relations, training, evaluation, promotion, grievances, and management-employee relationships.

ENGM520 (4)

Ergonomics and Work Design

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

ENGM555 (4)

Facilities Planning

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

ENGM565 (4)

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: INDT460; STAT285; MATH163 or 172 or 182.

ENGM570 (3)

Project Management

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

ENGM690 (1-4)

Independent Study (Topic)

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

ENGM698 (2)

Research

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

ENGINEERING

ENGR120 (2)

Introduction to Engineering

Explores specialized areas and job functions of engineers and technologists. A design project emphasizes the engineering design process. Introduces Mathcad.

ENGR135 (1)

Descriptive Geometry

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

ENGR224 \$ (5)

Engineering Materials

Study of the science of engineering materials. Engineering properties are correlated with internal structure and service environment. Weekly: a 3-hour lab. Prerequisite: CHEM121.

ENGR225 \$ (4)

Circuit Analysis

Direct and alternating current circuits. Network theorems, graph theory, computer methods. Developing/solving integrodifferential equations. Weekly: a 3-hour lab. Prerequisite: MATH173.

ENGR248 (1-4)

Workshop

Provides flexibility for the occasional workshop where it is appropriate to offer engineering credit. Workshop requirements must be approved by the department.

ENGR281 (3)

Statics for Engineers

Principles of statics and their application to engineering problems; forces, moments, couples, friction, centroids, and moment of inertia. Prerequisite: MATH173.

ENGR282 (5)

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 (4)

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.

ENGR305 \$ (1)

Mechanics of Materials Laboratory

Lab work involving the measurement of stress and strain and the experimental verification of theory developed in ENGR300. Prerequisite or corequisite: ENGR300. May not be offered each year.

ENGR370 (4)

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.

ENGR465 (4)

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: INDT460, STAT251. May not be offered each year.

ENGINEERING TECHNOLOGY

ENGT390 (1-4)

Independent Study in _____

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 (1-4)

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.

ENGT396 (1-4)

Cooperative Work Experience

Work experience in industry directed by a faculty member—150 hours of work is required per credit. A report must be submitted indicating what the student learned. Graded S/U. Repeatable to 6 credits. Prerequisites: junior/senior standing.

ENGT475 (1-4)

Topics in _____

Repeatable in different subjects (prerequisites depend on topic). May not be offered each year.

ENGT495 (1-4)
Design Project
 A significant design project which culminates in a working system. Repeatable to 6 credits.
 Prerequisite: at least one of the following courses: ELCT324, 375; INDT320, 460; MECT345 or 386.

INDUSTRIAL TECHNOLOGY

INDT310 (4)
Industrial Supervision
 Introduction to and overview of the fundamentals of industrial supervision. Topics include organization, duties, human relations, training, evaluation, promotion, grievances, management-employee relationships. May not be offered each year.

INDT315 (4)
Succeeding in the Workplace
 Focus on the development of attitudes, performance, and communication that will assist in making the transition from the classroom to the workplace an enjoyable and profitable experience.

INDT320 (4)
Work Methods and Measurements
 Principles and applications of basic methods and techniques for improvement of the man-job-time relationship; job standards, time and motion studies, and work-space design for efficient use of manpower.

INDT410 (4)
Project Management
 Methodology used successfully to carry out a technical project including proposals, planning, work breakdown, scheduling, creativity, monitoring progress, and documentation. May not be offered each year.

INDT440 g (4)
Quality Control
 Analysis of the factors affecting product quality during manufacturing. Topics include basic statistics, sampling, control charts, measurement methods, inspection systems, reliability, and motivation programs. Prerequisite: STAT251 or 285. May not be offered each year.

INDT450 g (4)
Industrial Economy
 Study of engineering decision methodology and criteria used to include economic factors in determining the best alternative in the design and selection of equipment, structures, methods, and processes. Prerequisite: MATH165 or equivalent.

INDT460 g (4)
Production Planning and Control
 Planning and coordination of manufacturing facilities and materials for economic production: forecasting, estimating, process planning, plant layout, product flow, scheduling, production controls, materials acquisition and handling, and inventory. Prerequisite: MATH165 or equivalent, STAT251 or 285.

MECHANICAL TECHNOLOGY

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
 Fundamentals of drawing as applied to mechanical engineering problems. Ortho-graphic projections, auxiliary and sectional views, dimensioning, oblique and isometric views. Manual and computer-aided drafting.

MECT122 \$ (4)
Mechanical Drawing II
 Limit dimensioning, 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.

MECT366 \$ (1)
Strength of Materials Laboratory
 Lab work involving the measurement of stress and strain and the experimental verification of theory developed in MECT365. Prerequisites or corequisites: ELCT151, MECT365. 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.