civilization and its impact upon society and the environment. The origin of landscape architectural styles and their characteristics will be explored. An introspective look at personalities of landscape designers through the ages and their influence upon the American landscape. *Fall*

HORT355 **$ Alt (3)**
(was AGRI355)
Landscape Site Design
Concentrates on landscape accessories and hard-scapes (curbing, sidewalks, driveways, terraces, pools, walls, fences). Lab includes practice in creating specification plans for hardscapes. Weekly: 2 lectures and 3 hours lab. Recommended: HORT135. *Fall*

HORT359 **$ Alt (3)**
(merges AGRI260, 370)
Greenhouse Environment and Construction
Controlling the plant environment to enhance plant growth and optimal development through temperature, humidity, light, nutrients sanitation and carbon dioxide levels. Structures, coverings and mechanical systems used are explored to produce the most cost-effective horticultural crops. Weekly: 2 hours lecture and 3 hours lab. *Fall*

HORT360 **$ Alt (3)**
(was AGRI360)
Arboriculture
Care of shade and ornamental trees living under environmental stress of urbanization, their legal protection and value. Includes tree anatomy and physiology, soils nutrition and water relations, transplanting, diseases and insect control, mechanical injury and pruning to develop a healthy tree. Weekly: 2 lectures and 3 hours lab. *Fall*

HORT365 **$ Alt (3)**
(was AGRI365)
Urban Landscape Design
Designing landscapes to meet the environmental challenges and conditions of urban settings. Circulation patterns for conducting business, aesthetic and functional aspects of design for corporate/institutional, governmental agencies and municipal areas. Weekly: 2 lectures and 3 hours lab. Recommended: HORT135. *Spring*

HORT367 **Alt (3)**
(was AGRI367)
Golf Course Supervision
Management and culture for modern golf courses and country clubs. Topics include integration of turfgrass agronomics with the administrative components of budgeting, supervision and personnel management, country club organizational structures, and design of construction and environmental issues. Golf course history, U.S. golf association rules and U.S. Golf Course Superintendents' Association certification
program will be covered. *Spring*

HORT378 **Alt (4)**
(merges AGRI368, 369)
Integrated Pest/Disease Management
Study of significant diseases and pests of agricultural and horticultural plant materials, including life cycles and influence of environmental conditions; determination of effective control methods for crop, ornamental and turfgrass
production. *Fall*

HORT417 **Alt (3)**
(was AGRI417)
Advanced Turfgrass Management
Principles of advanced turfgrass management based on turf genera, cultivar, vegetative seed identification and optimal use criteria; detailed analysis of soil fertility management and research results; development of comprehensive management plan incorporating principles of integrated pest management into a cultural program to optimize the performance based on use systems. Use systems studied include golf courses, parks, lawns, athletic fields, bowling greens, cricket fields, and grass tennis courts. *Spring*

HORT429 **$ (3)**
(merges AGRI345, 429)
Computer Landscape Design
Principles and practices of computer-aided land-scape design, including creating scale perimeter plot plans, using drawing tools, plant/site relationships, plant selection and use leading to a computer-generated landscape drawing. Laboratory emphasizes skill development and proficiency in integrating software and hardware to create CAD-generated landscape designs. Prior landscape drawing course work is recommended. *Fall, Spring*

HORT448 **$ Alt (4)**
(merges AGRI409, 425)
Advanced Design and Graphics
Landscape design concepts relating to the more challenging problems of residential design. Field application of grading relating to contours, specifications, exploring deck design, planting combinations, and exercises in graphics and rendering for presentations. Weekly: 2 lectures and 3 hours lab. Recommended: HORT135. *Spring*

ENGINEERING, COMPUTER SCIENCE, AND ENGINEERING TECHNOLOGY

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Glenn E. Johnson
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Roberto Ordóñez
Stephen Thorman
James Wolfer

Academic Programs	Credits
BS: Computing	40
Computer Science Emphasis	
Software Systems Emphasis	
Minor in Computer Science	20
BS in Engineering Program	
First two years on Andrews campus and final years at Walla Walla College, College Place, WA	
BSET: Engineering Technology	
Computer Engineering Technology	40
Mechatronics Engineering Technology	40
Minor in Engineering Technology	20
MS: Software Engineering	32
MSA in Engineering Management	
See the School of Business	

Undergraduate Programs

COMPUTING

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

Computer Science focuses on a study of the 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: Computing

Major requirements—40
Common core—15
CPTR125, 151, 152, 275, 461

Computer Science Emphasis

Required courses—12
CPTR425, 436 or 437, 462, 485 or 487
Cognate requirement—32-34
MATH141, 142, 281, 286, 355; STAT340 (20)
ELCT335 (4)
BIOL165; 166 (10)
or CHEM131, 132 (8)
or PHYS141, 142 (8)
or PHYS241, 242, 271, 272 (10)
or ELCT141, 142 (8)

Software Systems Emphasis

Required courses—12
CPTR427, 460, 466; INFS428
Cognate requirements—32-34
MATH182, 215, 355; STAT340 (12)
Minor in an adviser-approved application area (20-22)
Major electives—13
Chosen from CPTR courses in consultation with an adviser. A minimum of 12 upper division credits required.

Minor in Computing—20

Required courses—12
CPTR125, 151, 152, 275;
Minor electives—8
Chosen from CPTR courses in consultation with an adviser.

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.

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 computer, civil, electrical, or mechanical engineering. The department at Andrews University will assist students in coordinating a program with another engineering school upon request.

Professional Engineering

(First two years)
Suggested courses to be taken during the two years at Andrews**—68**
MATH141, 142, 240, 281, 286; CHEM131,132; PHYS241, 242, 271,272; MECT121; ENGR120, 135, 225, 280; CPTR125 or 151; ENGL115; COMM104; Religion (6 credits); Social Studies and Humanities (3 credits); PE (1 credit).

BSET: Engineering Technology

Engineering Technology–the area of the technological employment spectrum between the engineer and the skilled craftsman–includes both the engineering technician (2-year associate degree) and the engineering technologist (Bachelor of Science in Engineering Technology).

Individualized associate degree programs (AT) in engineering technology can be designed for students needing an associate degree.

BSET: Computer Engineering Technology

Major requirements—40
CPTR125 (meets BSET general education requirement), 151, 152, 461; ELCT235, 325, 335, 360; ENGT491, 192; plus 12 credits chosen from upper division CPTR and ELCT courses.

BSET: Mechatronics Engineering Technology

Major requirements—40
MECT122, 285, 355, 415; ELCT235, 307, 355; ENGT491, 492; plus 10 credits chosen from upper division ELCT and MECT courses.

Minor in Engineering Technology—20

A minimum of 20 credits chosen from ENGR, ELCT, INDT, and MECT courses in consultation with an engineering technology adviser.

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 p. 33 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—32
A minimum of 32 semester credits. At least 18 credits chosen from 500- and 600-level graduate courses. Completion of the following requirements:

Foundation—0-6
CPTR427 and 460 are required unless previously taken at the undergraduate level.
Core courses—10
CPTR560, 561, 562, 637
Project or Thesis—6
Two projects (CPTR698) or a single thesis (CPTR699) is required. Thesis option if selected must involve software development.
Electives—10-16
a. ***Systems*** (Choose at least two)
CPTR461, 462, 550, 555, 556, 565
b. ***General***
Complete any acceptable 400-600 level CPTR courses chosen in consultation with an adviser.

MSA with Engineering Management Emphasis

See graduate programs for the School of Business.

Courses

(Credits)

See inside front cover for symbol code.

COMPUTING AND SOFTWARE ENGINEERING

CPTR125 **$ (3)**
Introduction to Computer Programming
Programming in a selected language (BASIC, FORTRAN, Pascal, COBOL). May be repeated for a total of three unique languages. Satisfies general education requirements for computing majors. Only 3 credits of CPTR125 may apply toward a computing major or minor. Prerequisites: Math placement exam score of 2.0 (4.0 FORTRAN) and keyboarding skills of 20+wpm. *Fall, Spring*

CPTR151 **$ (3)**
(was CPTR161, 162)
Computer Science I
An introduction to programming methodology using C++, UNIX usage, problem-solving, algorithm development, control structures, arrays, program style, design correctness and documentation techniques, as well as a brief overview of computer systems and computer history. Prerequisites: MATH165, CPTR125, and keyboarding skills 20+wpm. *Fall, Spring*

CPTR152 **$ (3)**
(was CPTR162, 163)
Computer Science II
A continuation of CPTR151 examines program specifications, design, coding, correctness, and style with additional coverage of pointers and arrays, and an in-depth study of recursion and data structures. Includes simple lists, stacks, queues, and files, and an overview of computer ethics. Prerequisites: CPTR151. *Fall, Spring*

CPTR275 **$ (3)**
(was CPTR255, 265)
Computer Organization and Assembler
Covers data representation, number base conversion, representation for integer fractions and floating numbers, Boolean algebra, truth table digital logic and circuit representations of basic computational building blocks, introduction to computer architecture; interrupt schemes; an introduction to system software including assemblers, loaders and linkers, and operating systems. Includes assembly language programming using a macro-assembler. Prerequisite: CPTR152. *Fall*

CPTR295 **(1-3)**
Directed Computer Language Study
Directed study of computer language in consultation with the instructor. Normally, the language is not included in other courses taught by the department. A programming project may be required. Prerequisites: CPTR151 or equivalent.

CPTR416 **$? (3)**
Internet Technologies
A study of current technologies and their effects, including web server software, e-commerce, various scripting languages, human-computer interfacing, perception, and related issues. Prerequisite: CPTR151. *Summer*

CPTR425 **$? (3)**
(was CPTR426, 456)
Survey and Analysis of Programming Languages
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. A major programming project is required. Prerequisite: CPTR275. *Fall*

CPTR427 **$? (3)**
Object-Oriented Design and Programming
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. A major programming project is required. Prerequisite: CPTR152. *Fall*

CPTR436 **$ Alt ? (3)**
Numerical Methods and Analysis
A study of common numerical techniques applicable on the computer. Includes interpolation, extrapolation, approximation techniques, numerical methods for linear problems, root finding, function fitting, numerical integration, location of extremes, efficiency of numerical algorithms, and minimization of computational error. Prerequisites: FORTRAN and MATH215 or 281. *Spring*

CPTR437 **$ Alt ? (3)**
Formal Theory of Computation
Includes post productions, Turing machines, and recursive functions. Recursive and recursively enumerable sets. Undecidability results of computation. Prerequisites: CPTR152 and MATH235, 281 or 355. *Spring*

CPTR459 **Alt (2)**
Secondary Methods: Computer Science
Considers computer science programs in the secondary school and presents information and materials for teaching computer science in secondary school. Topics include organization and maintenance of equipment, publications, legal issues, dealing with diversity of abilities, problem-solving skills, and strategies for debugging programs. Prerequisite: CPTR275.

CPTR460 **$? (3)**
Software Engineering
Surveys basic software engineering topics associated with the processes, documents, and products of the entire software life cycle. Topics include software evolution, project organization, and management, feasibility studies, product definition, design, implementation, and testing issues, and the role of the software engineer within the life cycle. Prerequisite: CPTR152. *Fall*

CPTR461 **$? (3)**
Operating Systems I
Process management, including asynchronous concurrent processes and deadlock. Virtual storage management and job and process scheduling. Multiprocessing. Disk scheduling and file and data-base systems. Performance and security. Prerequisite: CPTR275. *Fall*

CPTR462 **$ Alt ? (3)**
Operating Systems II
Continuation of Operating Systems I with emphasis on comparing different systems. A major project including contemporary operating system development is required. Prerequisite: CPTR461. *Spring*

CPTR466 **(2)**
Software Engineering Group Project
The implementation of a group project and the study of topics related to the group project, including CASE tools, 4GL's, and graphical user interfaces. Emphasizes written documents and oral presentations associated with group project rather than lecture. Prerequisite: CPTR460. *Spring*

CPTR475 **? (1-4)**
Topics in _____
Selected topics of current interest in computer science such as Robotics, advanced languages, or others. Repeatable with different subjects. Prerequisite: CPTR275 or other depending upon the topic.

CPTR485 **$ Alt ? (3)**
Computer Graphics
Introduction to computer graphics examining raster and/or vector images, 2D and 3D images, polygons, transformations, segments, widowing, clipping, hidden line removal. Prerequisites: CPTR152 and MATH215 or 281. *Fall*

CPTR487 **$ Alt ? (3)**
Artificial Intelligence
Provides the conceptual basis for understanding current trends in Artificial Intelligence. Topics include both symbolic and numeric processing, intelligent search methods, problem representation, machine learning, expert systems, and a survey of some social implications of AI. Prerequisite: CPTR152. *Fall*

CPTR495 **(1-3)**
Independent Study
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. Prerequisite: CPTR275.

CPTR496 **(1-3)**
Special Projects
Project chosen in consultation with instructor. No more than 6 credits may be earned in CPTR495. Graded S/U. Prerequisite: CPTR275.

CPTR536 **Alt (3)**
Compiler Construction
Storage allocation for programs, subroutine linkage, and code generation and optimization. Simple translator written in course. Prerequisites: CPTR275, 425. *Fall*

CPTR548 **Alt (3)**
Database Design
Database design and theory. Concurrency, distributed databases, integrity, security, query optimization. A survey of the design and implementation tradeoffs involved in using various available database packages. Includes a term project and reading from the literature. Prerequisite: INFS428, CPTR152. *Spring*

CPTR550 **(3)**
Network Architecture
A study of the concepts and implementation of the client/server model of computing. Examines four implementations of the client/server model. Surveys the hardware and software used in network communications, including the specifications and protocols associated with thin and thick coax, twisted pair, fiber optics, slow IP mediums, UDP/IP and TCP/IP. Prerequisite: CPTR152. *Fall*

CPTR555 **Alt (3)**
Advanced Operating Systems
May include system structures and algorithms, reliability, security, distributed systems, study of operating systems highlighting these concepts, and recently published research in these and other areas. Includes a term project and readings from the literature. Prerequisite: CPTR461. *Spring*

CPTR556 **(3)**
Real Time Systems
A survey of the system architecture and software engineering aspects of real time systems such as operating systems, and process-control software. Includes a term project and readings from current literature. Prerequisite: CPTR275. *Fall*

CPTR560 **(3)**
Advanced Software Engineering
A study of applied software product development issues, including requirement analysis, systems and software design methodologies, software-project planning models (e.g., COCOMO), implementation, testing and reuse, language, tool and hardware selection, software economics, productivity measurement, risk management, statistical process evaluation, and control. Prerequisites: CPTR460, MATH182 or 141, STAT285. *Spring*

CPTR561, 562 **(2,2)**
Software Engineering Group Project I, II
The implementation of a group project and the

study of topics related to the group project including CASE tools, 4GL's, graphical user interfaces. Generally, the project begun in CPTR561 carries over to CPTR562. Prerequisites: CPTR460. *Fall, Spring*

CPTR565 (3)
Computer Architecture
Functional analysis of computer hardware and software systems including a comparative study of past, present, and proposed architecture as well as computer performance analysis and optimization. Prerequisite: CPTR275. *Summer*

CPTR585 Alt (3)
Advanced Computer Graphics
Advanced topics and current research in computer imaging--may include shading, ray tracing, radiosity, color spaces, lighting models, texture mapping, and recently published research in computer imagery. Includes term project and readings from the literature. Prerequisite: CPTR485. *Spring*

CPTR587 Alt (3)
Advanced Artificial Intelligence
Provides a forum for exploring current topics in machine intelligence through a survey of recent research results, independent readings, and hands-on projects. Typical topics include machine vision, speech recognition, natural language processing, and machine learning systems. Prerequisite: CPTR487. *Spring*

CPTR625 Alt (3)
Analysis of Algorithms
Technique for analyzing and designing algorithms, including average/worst case analysis, assymptotics, recurrences, empirical experimentation, intractability proofs (i.e., NP-Completeness) and heuristic alternatives. Application of such techniques as divide-and-conquer, graph, greedy, dynamic programming, backtracking, branch-and-bound, and probabilistic algorithms. Prerequisites: CPTR152, MATH281, 355, STAT340. *Spring*

CPTR637 (3)
Formal Methods
A survey of the different paradigms associated with formal methods. Applies formal methods to the specification, verification, and validation of software systems. Case studies are examined and a programming project is included. Prerequisites: CPTR460, MATH215 or 235, STAT285. *Spring*

CPTR660 (0)
Thesis/Project Extension

CPTR689 (1-4)
Topics in _____
Topics in computer science such as graphics, parallel processors, compiler design and optimization, communications and signal processing, distributed systems, graph theory, artificial intelligence, and formal theory. Repeatable with different topics to 6 credits. Prerequisite:
Depends upon topic.

CPTR690 (1-4)
Independent Study
Directed study of material of special interest chosen in consultation with the instructor. May be repeated to 6 credits. Grade S/U.

CPTR698 (1-4)
Master's Research Project
Special project chosen in consultation with student's adviser and instructor. To be repeated to 6 credits. Grade S/U.

CPTR699 (1-6)
Master's Thesis
To be repeated to 6 credits. Graded S/U.

ELECTRONICS

ELCT141, 142 $ (4,4)
(merges ELCT151, 152, 153, 161, 162, 163, 171, 172, 173)
Basic Electronics
Study of AC and DC electric circuit theory, characteristics of diodes, transistors, and linear integrated circuits and their behavior in simple circuits. Weekly: a 3-hour lab. Prerequisite for ELCT141: MATH168. Prerequisite for ELCT142: ELCT141. *Fall, Spring*

ELCT235 $ (4)
(was ELCT224)
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. Weekly: a 3-hour lab. Prerequisite: ELCT142. *Spring*

ELCT307 $ (4)
(was ELCT204)
Instrumentation and Process Control
Theory and application of electrical transducers and recording devices. Emphasis on signal conditioning in process control applications. Measurement errors and calibration. Weekly: a 3-hour lab. Prerequisite: ELCT235. *Fall*

ELCT325 $ (3)
(was ELCT305)
Computing, Network Operations and Maintenance
Techniques and tools of computer and network operation and troubleshooting. Weekly: a 3-hour lab. Prerequisite: ELCT335. *Spring*

ELCT328 $ Alt (2)
(was ELCT316)
Printed Circuit Layout
Basic methods of layout and fabrication of single and double layer etched circuit boards. Weekly: a 3-hour lab. Prerequisite: ELCT235. *Spring*

ELCT335 $ (4)
(was ELCT324)
Microprocessors
Introduction to computer organization, microprocessors, assembly language programming, memory devices, I/O devices, interfacing with emphasis on control applications. Weekly: a 3-hour lab. Prerequisite: ELCT235 or equivalent. *Fall*

ELCT350 $ Alt (2)
(was ELCT330)
Programmable Logic Controllers
A study of relay logic. Application and programming of industrial programmable controllers to accomplish these relay logic functions. Weekly: a 3-hour lab. Prerequisite: ELCT235. *Spring*

ELCT355 $ (4)
(was ELCT205)
Electrical Machinery and Controls
Characteristics and applications of DC motors and generators; transformers, AC motors and generators, motor starters and controls, power factor corrections, and speed controls. Weekly: a 3-hour lab. Prerequisite: ELCT307. *Spring*

ELCT360 $ (4)
(was ELCT340)
Communication Systems and Electronics
Filters, oscillators, frequency response plots, tuned circuits, impedance matching, and Fourier series. Amplitude, frequency, phase, and pulse modulation. Weekly: a 3-hour lab. Prerequisite: ENGT310. *Spring*

ELCT365 Alt (3)
(was ELCT345)
Transmission Systems
Signal transmission via wire, coaxial cable, waveguide, antenna, and optical fiber media. Attenuation and distortion effects. System power budget. Prerequisite: ELCT360. *Spring*

ELCT380 $ Alt (4)
(merges ELCT364, 375)
Amplifier and Wave-Shaping Circuits
Linear amplifiers with an emphasis on op-amp circuits and their amplitude and frequency limitations. Includes linear wave-shaping, clipping, clamping, gating, switching, and comparator circuits. Weekly: a 3-hour lab. Prerequisite: ENGT310. *Fall*

ELCT420 (4)
Avionics Principles and Systems
A study of operating principles and circuits of communication and navigation equipment used in general aviation. Prerequisites: ELCT335, 360, 380. May not be offered each year. *Fall*

ELCT439 $ Alt (4)
(was ELCT424)
Embedded Systems
Microprocessor interfacing and applications in the area of process monitoring and control. Use of BASIC or C++. Weekly: a 3-hour lab. Prerequisite: ELCT335. *Spring*

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. *Fall*

ENGR135 (1)
Descriptive Geometry
Solution of basic space problems. Determination of distances and angles, intersections of lines and surfaces, intersections of lines and development of surfaces. Prerequisite: MECT121. *Spring*

ENGR224 $ (4)
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: CHEM131. *Fall*

ENGR225 **$ (3)**
Circuit Analysis
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: a 3-hour lab. Prerequisite: MATH142. *Spring*

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.

ENGR280 **(5)**
(merges ENGR281, 282)
Engineering Mechanics
Principles of statics and their application to engineering problems; forces, moments, couples, friction, centroids, and moments of inertia. 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, elementary vibrations, and conservative dynamic systems. Prerequisite: MATH142; prerequisite or corequisite: MATH286. *Fall*

ENGR370 **(2)**
Technical World and Man
Gives general students an understanding of how modern technologies affect society. Topics include how humans respond to technological change, the social consequences of technology, and technological issues in national decisions. *Spring*

ENGR465 **(3)**
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, STAT340. May not be offered each year. *Spring*

ENGINEERING MANAGEMENT

ENGM520 **(3)**
Ergonomics and Work Design
The application of ergonomics and engineering principles to the design analysis and measurement of human work systems. *Summer*

ENGM555 **(3)**
Facilities Planning
Planning and design of industrial and service facilities: site selection, process layout, materials handling, and storage. *Summer*

ENGM565 **(3)**
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 programing, queuing theory, and simulation. Prerequisites: INDT460; STAT285; MATH142 or 182. *Spring*

ENGM570 **(3)**
Project Management
Design and management of engineering projects: proposals, planning, resource requirements, organization, scheduling, and cost and schedule control. Prerequisite: INDT460. *Spring*

ENGM690 **(1-4)**
Independent Study
Individual study of 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 TECHNOLOGY

ENGT310 **(3)**
Linear Systems Analysis
Convolution, analysis and spectra of continuous time domain signals, Fourier and Laplace transforms, discrete time domain signals, and the z-transform. Prerequisite: MATH182, ELCT142. *Fall, Spring*

ENGT390 **(1-3)**
Independent Study
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 4 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. Grade S/U. Repeatable to 4 credits. Prerequisite: Junior/Senior standing. *Spring*

ENGT475 **(1-4)**
Topics in _____
Repeatable in different subjects (prerequisites depend on topic.)

ENGT491, 492 **(2,2)**
(was ENGT495)
Senior Design Project I, II
A significant design project which culminates in a working system. Prerequisite: at least one of the following courses: ELCT335, 360; MECT375 or 415. *Fall, Spring*

INDUSTRIAL TECHNOLOGY

INDT310 **(3)**
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. *Spring*

INDT315 **(3)**
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. *Fall*

INDT320 **(3)**
Work Methods and Measurements
Principles and applications of basic methods and techniques for improvement of the man-job-time relationships; job standards, time and motion studies, and work-space design for efficient use of manpower. *Spring*

INDT410 **(3)**
Project Management
Methodology used successfully to carry out a technical project including proposals, planning, work breakdown, scheduling, creativity, monitoring progress, and documentation. *Spring*

INDT440 **(3)**
Quality Control
Analysis of the factors affecting product quality during manufacturing. Topics include basic statistics, sampling, control charts, measurements methods, inspection systems, reliability, and motivation programs. Prerequisite: STAT 285 or 340. *Spring*

INDT450 **(3)**
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. *Spring*

INDT460 **(3)**
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. Prerequisites: MATH165 or equivalent, STAT 285 or 340. *Fall*

MECHANICAL TECHNOLOGY

MECT120 **$ (3)**
Computer-Aided Drawing
An introduction to the use of AutoCad, graphics generation and editing, file maintenance, plotting, and 2- and 3-dimensional drawings. Weekly: a 3-hour lab. Credit may not be earned in MECT120 and MECT121. *Fall*

MECT121 **$ (2)**
Mechanical Drawing I
Fundamentals of drawing as applied to mechanical engineering problems. Orthographic projections, auxiliary and sectional views, dimensioning, oblique and isometric views. Sketching and computer-aided drafting. Weekly: a 3-hour lab. *Fall*

MECT122 **$ (3)**
Mechanical Drawing II
Limit dimensioning, drawing, and interpretation of weld symbols. Solid modeling and production drawings using CAD. Weekly: a 3-hour lab. Prerequisite: MECT121. *Spring*

MECT235 **$ (4)**
(was MECT185, 186)
Materials Technology
Study of industrial materials. Properties of materials correlated with the internal structure. Includes metals, plastics, and ceramics. Weekly: a 3-hour lab. Prerequisites: MATH168, CHEM131. *Spring*

MECT285 **(4)**
(merges MECT265, 365, 366)
Statics and Strength of Materials
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. Study of internal stress and deformation of elastic bodies. A minimum grade of C required in order to enroll in MECT355. Prerequisite: MATH182. *Fall*

MECT326 **$ Alt (4)**
(was MECT226)
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. Weekly: a 3-hour lab. Prerequisite: MECT285. *Fall*

MECT355 **(4)**
(merges MECT345, 364)
Dynamics and Kinematics
Fundamentals and applications of dynamics; displacement, velocities, acceleration, work, energy, power impulse, momentum, and impact. Also a 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. Prerequisites: MATH182, MECT285. *Fall*

MECT370 **$ Alt (4)**
(merges MECT371, 372)
Heat Power
Thermodynamics properties, first and second law of thermodynamics, ideal gas law, the Carnot Cycle, power and refrigeration cycles, heat transfer power and refrigeration cycles, non-flow gas processes, mixtures of ideal gasses, psychrometric chart, air conditioning, fluid statics, kinematics, dynamics. Weekly: a 3-hour lab. Prerequisite: MECT355. *Fall*

MECT375 **$ Alt (4)**
Fluid Mechanics
Dimensionless parameters, compressible flow, flow-in pipes, open channel flow, drag, lift. Weekly: a 3-hour lab. Prerequisite: MECT355. *Spring*

MECT415 **(3)**
(was MECT386)
Mechanical Design and Fabrication
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. Prerequisite: MECT355. *Spring*

TECHNOLOGY EDUCATION

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Donald L. May
James R. Newkirk
Sharon J. Prest
Renee A. Skeete
Marc G. Ullom
William D. Wolfer

Academic Programs	Credits
BT: Automotive Technology	60
Auto Body	
Auto Mechanics	
AT: Automotive Technology	40
Auto Body	
Auto Mechanics	
BT: Construction Management	74
BT: Digital Multimedia Technology	74
BT: Graphic Imaging Technology	79-96
Electronic Publishing	
Screen Printing	
Web Development	
AT: Graphic Imaging Technology	40
BS: Photographic Imaging	66
BS: Technology Education	64-69
Secondary Teaching Certification	
Minor in Automotive Technology	20
Minor in Construction	20
Minor in Imaging Technology	22
Minor in Photography	20
Minor in Screen Printing	20
Minor in Web Development	20

SEQUENCE OF TWO-YEAR AND FOUR-YEAR PROGRAMS

The Department of Technology Education plans programs using the "ladder concept," allowing a student to complete as much education as desired before entering the work force. Two- and four-year programs are available. Students completing the two-year program may go directly into a four-year program in the same area. The ladder concept allows students to reach the educational goal that best fits their specific needs.

ANCILLARY OPERATIONS

Screen Graphics and LithoTech are ancillary operations of the Department of Technology Education providing students with experience in graphic arts unavailable elsewhere on campus.