

audio editing, media management, narration and industry terminology. Lab required. Prerequisites: DGME175, VDEO130.

VDEO320 **\$ (3)**

An introductory course covering the essential components in video compositing. Students learn how to create innovative visual effects and motion graphics for video. Emphasis on text animation, keyframing, masks, alpha channels, 3-D compositing, rendering, application integration, advanced visual and artistic effects. Lab required. Prerequisites: DGME215, VDEO210.

VDEO340 **\$ (3)**

An advanced study in digital video, exploring professional level cameras, lighting, sound and other equipment necessary to make good video, aesthetic issues of creating visual and audio stories, and developing skills and knowledge beyond an introductory level. Lab required. Prerequisites: ART214; JOUR230; VDEO130, 210.

VDEO360 **\$ (4)**

A study of basic 3-D modeling principles and techniques. Students learn 3-D modeling terminology and how to create 3-dimensional models using polygonal, nurbs, and subdivision techniques. Students also learn basic lighting and surfacing. Lab required. Prerequisites: ART104; DGME175.

VDEO370 **\$ (4)**

A study of 3-D animation techniques implementing key frame, forward and inverse kinematics, dynamics, lighting, paint effects, rendering and more. Lab required. Prerequisites: DGME215; VDEO210, 360.

VDEO390 **\$ (3)**

A course emphasizing production of interactive DVD- Video, DVD authoring, work flow, story boarding, navigation, menu design, bit budgeting, video and audio encoding, DVD video navigational structures, web linking, proofing, pre-mastering, and recording to DVD-R. Lab required. Prerequisite: DGME347.

VDEO465 **\$ (3)**

Study and application of documentary storytelling techniques. Students will explore the technical and creative use of digital video cameras in documentary filmmaking. Emphasis on interview techniques, story selection and structure. One lab required. Prerequisites: VDEO130, 210, 340.

ENGINEERING AND COMPUTER SCIENCE

Haughey Hall, Room 312

(269) 471-3420

Fax: (269) 471-3797

engr-info@andrews.edu cs-info@andrews.edu

<http://www.andrews.edu/COT/>

Faculty

William Wolfer,

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	

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

Computer Science Emphasis**Required courses—9**

CPTR425, 437, 467

Major electives—12

Chosen from CPTR courses in consultation with an advisor.

A minimum of 12 upper division credits required.

Cognate requirements—26–28

MATH141, 142, 355; STAT340 (14)

ENGR385 (4)

BIOL165; 166 (10)*

or CHEM131, 132 (8)*

or PHYS141, 142 (8)*

or PHYS241, 242, 271, 272 (10)*

* These courses may apply toward the general education natural science requirement

Software Systems Emphasis**Required courses—9**

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.

ENGINEERING

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 fo654.875 15215(r) Tf9 0 0 9 54.875 104.2747 Tm[cal]-24(des*s)25,(nEMC [able]-24(for)-25(studary-ed

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.

COURSES**(Credits)**

See inside front cover for symbol code.

COMPUTING AND SOFTWARE ENGINEERING**CPTR125** \$ (3)

Programming in a selected language. 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.

CPTR151 \$ (4)

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.

CPTR152 \$ (3)

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 files, lists, stacks, queues, trees, graphs, and an overview of computer ethics. Prerequisite: CPTR151.

CPTR276 \$ (3)

A study of techniques for the design and analysis of algorithms using appropriate data structures covered in CPTR152. Topics include: asymptotic complexity bounds, graph and tree algorithms, fundamental algorithmic strategies (such as greedy, divide-and-conquer, backtracking, branch-and-bound, heuristics, pattern matching and string/text algorithms), numerical approximation and dynamic programming. Prerequisite: CPTR152.

CPTR295 (1–3)

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.

CPTR310 Alt (3)

A study of basic database principles and web applications using technologies such as PHP, MySQL, Three Tier Architectures,

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

CPTR436 \$ Alt (3)

A study of common numerical techniques applicable on a 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: CPTR276 and MATH215. (even years)

CPTR437 \$ Alt (3)

Includes post productions, Turing machines, and recursive functions. Recursive and recursively enumerable sets. Undecidability results of computation. Prerequisites: CPTR152 and MATH355. (odd years)

CPTR440 \$ Alt (3)

Process management, including asynchronous concurrent processes and deadlock. Virtual storage management and job and process scheduling. Multiprocessing. Disk scheduling and file and database systems. Performance and security. Prerequisite: CPTR276. (odd years)

CPTR450 Alt (3)

Concepts applicable to constructing a computer network and the application of computing algorithms and solutions using networked computers and devices. Study topics such as physical transmission media, protocols and associated layers, TCP/IP, application programming interfaces and frameworks, sockets, clustering and security. Prerequisite: CPTR152. (even years)

CPTR459 Alt (2)

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: CPTR276.

CPTR460	\$ (3)	CPTR496	(1-3)
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.		Project chosen in consultation with instructor. No more than 6 credits may be earned in CPTR495. Graded S/U.	
CPTR465	Alt (3)	CPTR536	Alt (3)
Focus on hardware aspects of computing and logical concepts. Includes data representation for numbers and other data types, Boolean algebra, digital logic circuit representations of basic computational building blocks, CPU components, interrupt schemes and buses. Relevance of supporting concepts is discussed, including system software, assemblers, assembly language programming and operating systems. Prerequisite: CPTR152. (odd years)		Storage allocation for programs, subroutine linkage, and code generation and optimization. Simple translator written in course. Prerequisites: CPTR276, 425. (odd years)	
CPTR466	(2)	CPTR548	Alt (3)
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. Corequisite: CPTR460.		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. (odd years)	
CPTR467	Alt (3)	CPTR555	Alt (3)
Study of issues relevant to abstract and concrete aspects in both the creation of database management system software and its use. Indexing, buffering and other internal and physical database design issues. Relational model algebra, calculus and query languages (including SQL). Functional dependencies and normalization. Study of and modeling using Entity-Relationship and other relevant paradigms. Common application databases. Introduction to the use of transactions, query optimization and non-relational database models. Design and programming assignments using databases. Prerequisite: CPTR152. (even years)		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: CPTR440. (even years)	
CPTR475	(1-4)	CPTR556	Alt (3)
Selected topics of current interest in computer science such as Robotics, advanced languages, or others. Repeatable with different subjects.		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: CPTR276. (odd years)	
CPTR485	\$ Alt (3)	CPTR557	Alt (3)
Introduction to computer graphics examining raster and/or vector images, 2D and 3D images, polygons, transformations, segments, windowing, clipping, hidden line removal. Prerequisite: CPTR152. (odd years)		A study of the concepts, conceptual design and implementation of the client/server, multi-tier and distributed models of computing. Consider topics such as physical media, protocols and layers, application programming interfaces, clustering, distributed computing and security from the perspective of a programmer using these tools as well as a system programmer and architect that creates and implements such tools, algorithms and models. Prerequisite: CPTR450 or equivalent. (odd years)	
CPTR487	\$ Alt (3)	CPTR560	(3)
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. (even years)		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: 7415.7806 T297h2	
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.			

CPTR568**Alt (3)**

Functional analysis of computer hardware and supporting software systems. Includes a comparative study of past, present and proposed architectures as well as computer performance analysis and optimization. Additional topics may include parallel architectures and detailed CPU design issues. Prerequisite: CPTR465 or equivalent. (even years)

CPTR585**Alt (3)**

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. (even years)

CPTR587**Alt (3)**

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. (odd years)

CPTR625**Alt (3)**

Techniques for analyzing and designing algorithms, including average/worst case analysis, asymptotics, recurrences, empirical studies, intractability proofs (i.e., NP-Completeness) and heuristic alternatives. Application of techniques such as divide-and-conquer, graph, greedy, dynamic programming, backtracking, branch-and-bound, and probabilistic algorithms. Prerequisites: CPTR152,

and rigid bodies, with emphasis on the concept of momentum. Keplerian motion, elementary vibrations, and conservative dynamic systems. Prerequisites: ENGR185 and MATH142.

ENGR310 (3)

Convolution, analysis and spectra of continuous time domain signals, Fourier and Laplace transforms, discrete time domain signals, and the z-transform. Prerequisite: MATH215; Corequisite: MATH286.

ENGR320 (3)

Covers traditional manufacturing practices such as machining processes (abrading, coating), and forming processes (cutting, forming, and assembling). Discusses non-traditional processes such as thermal, chemical, and pressure methods and explores special processes involved with specific materials such as plastics, woods, fibers, and other materials. Prerequisite: ENGR180.

ENGR325 \$ (4)

Modeling of transistors, biasing of transistors in amplifier circuits, and amplitude and frequency limitations of transistors. Linear and switching electronic circuits with an emphasis on op-amps. Weekly: 3 hours lecture and a 3-hour lab. Prerequisite: ENGR275.

ENGR330 (3)

Introduction to the nature of energy and study of energy transport conservation in closed and flowing systems; properties and states of solids, liquids, vapors, and gases; enthalpy; meaning and production of entropy and introduction to cyclic systems. Prerequisite: PHYS242.

ENGR335 (3)

Modern digital logic families, state machines, design of digital logic circuits in FPGAs, and VHDL specification of logic circuits. Prerequisite: ENGR275.

ENGR340 (3)

Study of stresses and strain, deformations and deflections of posts, shafts, beams, columns; combined stresses; elasticity. Prerequisite: ENGR185.

ENGR350 \$ (3)

Study of temperature, mechanical, and optical sensors; sensor signal conditioning; ac, dc, and stepping motors; and the motor control requirements. Weekly: 2 lectures and a 3-hour lab. Prerequisite: ENGR275.

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.

ENGR380 \$ (2)

Introduction to typical programmable logic controllers and their applications. Emphasis on programming and interfacing to elec-

tronic systems. Weekly: 1-hour lecture and a 3-hour lab. Prerequisite: ENGR275.

ENGR385 \$ (4)

Introduction to computer organization, microprocessors, assembly language programming, memory devices, I/O devices, interfacing with e 0 9 54 146.2613 TmL7-2.4 T I/O/TT2 1 Tf9 m9F66JETBT13.86116pevippr

