ing of the mechanisms of selected chemical reactions. The focus will be on empirical methods to derive mechanisms including linear free energy relationships and reaction kinetics. Techniques to be covered include photoelectron spectroscopy (PES) and computational chemistry (CC). Prerequisite: CHM 334.

**CHM 461. SEMINAR** 1 sh

Students make presentations after they do individual library research. Student seminars are supplemented with seminars by practicing scientists. All chemistry-oriented students are encouraged to attend. Credit for junior and senior majors only or by permission of the instructor. Course is two semesters in length with 0.5 sh each semester. Students must take both semesters. Offered fall and spring.

**CHM 471-479. SPECIAL TOPICS IN CHEMISTRY** 2-4 sh

Advanced topics offered to meet the needs and interests of students include methods in nuclear chemistry, nuclear magnetic resonance, advanced organic or polymer chemistry. Prerequisites: CHM 212/214.

**CHM 481. INTERNSHIP** 1-4 sh

Students gain advanced level work experience in a chemical field. Internships are offered on an individual basis when suitable opportunities can be arranged. Prerequisite: permission of department.

**CHM 491. INDEPENDENT STUDIES** 1-4 sh

**CHM 499. RESEARCH** 1-3 sh

In collaboration with a chemistry faculty member, students undertake experimental or theoretical investigations. Prerequisite: Approval of department chair. Offered fall, winter, spring.

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**Classical Studies**

Coordinator: Professor Gill

Classical Studies is an interdisciplinary program of studies in the languages, history, culture and heritage of the ancient and early modern world. This program gives students an opportunity for concentrated study of “Classical” ideas and practices, which form an important part of Western civilization. In addition, the program examines the ways that these ideas and practices have influenced, and been modified by, later generations. A minor in Classical Studies can serve as a valuable complement to many fields, providing depth and context for a student’s other courses, encouraging analytical study of primary sources and allowing the pleasure of reading some of Western civilization’s greatest works.

A minor in Classical Studies requires the following:

Twenty semester hours taken from the list below and/or from other approved courses. At least eight of these semester hours must be at or above the 300-level. Courses must be chosen from at least three departments.

Acceptable courses in Classical Studies include:

- **ART 220** Art and History: Prehistory to the Present 4 sh
- **ART 312** Studies in Art History (depending on appropriateness of topic) 2-4 sh
- **ART 343** Renaissance Art History 4 sh
- **CLA 210** Introduction to Classical Studies 4 sh
### Classical Studies

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENG 221</td>
<td>British Literature I</td>
<td>4 sh</td>
</tr>
<tr>
<td>ENG 321</td>
<td>Classical Literature</td>
<td>4 sh</td>
</tr>
<tr>
<td>ENG 322</td>
<td>Medieval Literature</td>
<td>4 sh</td>
</tr>
<tr>
<td>ENG 323</td>
<td>Renaissance Literature</td>
<td>4 sh</td>
</tr>
<tr>
<td>FNA 265</td>
<td>Studies in Italy/ELR</td>
<td>4 sh</td>
</tr>
<tr>
<td>FNA 313</td>
<td>British Art and Architecture</td>
<td>4 sh</td>
</tr>
<tr>
<td>GRK 110</td>
<td>Beginning Greek</td>
<td>4 sh</td>
</tr>
<tr>
<td>GRK 210</td>
<td>Intermediate Greek</td>
<td>4 sh</td>
</tr>
<tr>
<td>GRK 310</td>
<td>Advanced Greek</td>
<td>4 sh</td>
</tr>
<tr>
<td>HST 111</td>
<td>Europe and the Mediterranean World to 1660</td>
<td>4 sh</td>
</tr>
<tr>
<td>MUS 315</td>
<td>The Music of Ancient Times through Mozart</td>
<td>4 sh</td>
</tr>
<tr>
<td>PHL 331</td>
<td>Ancient Philosophy</td>
<td>4 sh</td>
</tr>
<tr>
<td>PHL 332</td>
<td>Medieval Philosophy</td>
<td>4 sh</td>
</tr>
<tr>
<td>PHL 355</td>
<td>Philosophy of Religion</td>
<td>4 sh</td>
</tr>
<tr>
<td>POL 300</td>
<td>Introduction to Political Thought</td>
<td>4 sh</td>
</tr>
<tr>
<td>REL 111</td>
<td>Introduction to the Old Testament</td>
<td>4 sh</td>
</tr>
<tr>
<td>REL 112</td>
<td>Introduction to the New Testament</td>
<td>4 sh</td>
</tr>
<tr>
<td>REL 321</td>
<td>Archaeology of the Ancient Near East</td>
<td>4 sh</td>
</tr>
<tr>
<td>REL 322</td>
<td>Old Testament Prophets</td>
<td>4 sh</td>
</tr>
<tr>
<td>REL 329</td>
<td>Jesus and the Gospels</td>
<td>4 sh</td>
</tr>
<tr>
<td>REL 355</td>
<td>Philosophy of Religion</td>
<td>4 sh</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>20 sh</td>
</tr>
</tbody>
</table>

In addition to these catalog courses, occasional courses with special topics in Classical Studies will be offered. Examples include Hebrew 110, 210, 310; HST/REL 371, The Ancient World; FRE 371 and SPN 371, Special Topics, as appropriate.

### CLA 210. Introduction to Classical Studies 4 sh

Have you ever wondered why even Winnie the Pooh is translated into Latin? Or why so many public buildings sport curious pillars and columns? Still puzzling over the meaning of “numen lumen” or those weird Greek letters on frat house porches? Take this course to find out more about the Classical elements that have helped shape Western civilization. Students will study literature, art and architecture of the ancient Greek and Roman worlds. Students will also analyze how this Classical heritage – in various permutations – has affected later ages and cultures, including our own.

**Communications**

See Journalism and Communications
Computing Sciences

Chair, Department of Computing Sciences: Associate Professor Powell
Associate Professors: Heinrichs, Schuette, B. Taylor
Assistant Professors: Conklin, Hightower, Hollingsworth, Pollard, Yap
Lecturers: Ellington, Kleckner
Adjunct: Bryan

The Department of Computing Sciences at Elon University offers B.A. and B.S. degrees in Computer Science, a B.A. in Computer Information Systems, and minors in Computer Science and Computer Information Systems. A concentration area in Management Information Systems (for majors in business administration) and minors in multimedia authoring or geographical information systems are also available options.

The discipline called Computer Science emphasizes problem solving based upon mathematical logic, the analysis of alternative solutions, the use of the scientific method of hypothesis development and testing, and the link between principles, creativity and implementation techniques. The experiences, challenges, and discipline of computer science translate well into other areas and interests. The discipline is constantly changing; the student must be able to communicate well and learn new concepts throughout life. The Computer Science program at Elon is a rigorous one emphasizing the application and theory of computation. Students study programming languages, operating systems, compilers, algorithm analysis, and problem solving using computer technology.

The Computer Information Systems discipline centers on the development of systems that will improve the performance of people in organizations. Information systems are vital to problem identification, analysis, and decision making. These skills are integral parts of many fields of study. Students in information systems apply problem-solving techniques and programming skills to the design, implementation and maintenance of these information systems. Computer Information Systems at Elon is a hands-on program that gives the student a solid foundation in information systems including knowledge and skills about networks, Web publishing, database development, systems analysis and application development.

Computing Sciences students at Elon have excellent access to both faculty and equipment including a wide array of computer hardware and software. Opportunities for various work and independent learning experiences that complement classroom learning are available. Other opportunities for involvement include the student chapter of the Association for Computing Machinery (ACM), participation in regional and local programming contests and independent study and research. Graduates pursue employment in many areas of industry, business, education and government as well as continuing study at the graduate level.

A Bachelor of Arts degree in Computer Science requires the following courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC 130</td>
<td>Introduction to Computer Science</td>
<td>4 sh</td>
</tr>
<tr>
<td>CSC 230</td>
<td>Algorithm Development</td>
<td>4 sh</td>
</tr>
<tr>
<td>CSC 331</td>
<td>Algorithm Analysis</td>
<td>4 sh</td>
</tr>
<tr>
<td>CSC 335</td>
<td>Programming Languages/Paradigms</td>
<td>4 sh</td>
</tr>
<tr>
<td>CSC 342</td>
<td>Computer Organization and Architecture</td>
<td>4 sh</td>
</tr>
<tr>
<td>CSC 351</td>
<td>Theory of Computation</td>
<td>4 sh</td>
</tr>
<tr>
<td>CSC 441</td>
<td>Operating Systems</td>
<td>4 sh</td>
</tr>
<tr>
<td>CSC 461</td>
<td>Senior Seminar</td>
<td>1 sh</td>
</tr>
<tr>
<td>MTH 121</td>
<td>Calculus and Analytic Geometry I</td>
<td>4 sh</td>
</tr>
</tbody>
</table>
MTH 221  Calculus and Analytic Geometry II 4 sh
MTH 241  Discrete Structures 4 sh
A probability and/or statistics course 4 sh
One course from the following: 4 sh
  CSC 431 Introduction to Parallel Computation and Algorithms
  CSC 445 Computer Networks
  CSC 451 Compiler Design and Implementation
One course from the following: 4 sh
  MTH 311 Linear Algebra
  MTH 321 Calculus and Analytic Geometry III
  MTH/CSC 415 Numerical Analysis
  MTH 421 Differential Equations
  CSC 300-400 level elective

TOTAL 53 sh

A Bachelor of Science degree in Computer Science requires the following courses:
CSC 130  Introduction to Computer Science 4 sh
CSC 230  Algorithm Development 4 sh
CSC 331  Algorithm Analysis 4 sh
CSC 335  Programming Languages/Paradigms 4 sh
CSC 342  Computer Organization and Architecture 4 sh
CSC 351  Theory of Computation 4 sh
CSC 441  Operating Systems 4 sh
CSC 461  Senior Seminar 1 sh
MTH 121  Calculus and Analytic Geometry I 4 sh
MTH 221  Calculus and Analytic Geometry II 4 sh
MTH 241  Discrete Structures 4 sh
A probability and/or statistics course 4 sh
Two courses from the following: 8 sh
  CSC 431 Introduction to Parallel Computation and Algorithms
  CSC 445 Computer Networks
  CSC 451 Compiler Design and Implementation
  CSC 499 Research
One course from the following: 4 sh
  MTH 311 Linear Algebra
  MTH 321 Calculus and Analytic Geometry III
  MTH/CSC 415 Numerical Analysis
  MTH 421 Differential Equations
  CSC 300-400 level elective
Either: 8 sh
  CHM 111, 112, 113, 114, or
  PHY 113, 114, 117, 118, or
  BIO 111, 112, 113, 114

TOTAL 65 sh
A Bachelor of Arts in Computer Information Systems requires the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIS 114</td>
<td>Introduction to Web Site Development</td>
<td>2 sh</td>
</tr>
<tr>
<td>CIS 211</td>
<td>Management Information Systems</td>
<td>4 sh</td>
</tr>
<tr>
<td>CIS 216</td>
<td>Programming in a Visual Environment</td>
<td>4 sh</td>
</tr>
<tr>
<td>CIS 230</td>
<td>Information Systems Theory and Practice</td>
<td>2 sh</td>
</tr>
<tr>
<td>CIS 235</td>
<td>Information Technology Hardware and System Software</td>
<td>2 sh</td>
</tr>
<tr>
<td>CIS 325</td>
<td>Web Publishing Technologies</td>
<td>4 sh</td>
</tr>
<tr>
<td>CIS 330</td>
<td>Systems Analysis and Design</td>
<td>4 sh</td>
</tr>
<tr>
<td>CIS 335</td>
<td>Database Management and Analysis</td>
<td>4 sh</td>
</tr>
<tr>
<td>CIS 340</td>
<td>Systems Implementation</td>
<td>4 sh</td>
</tr>
<tr>
<td>CIS 345</td>
<td>Networks, Telecommunications and e-Commerce</td>
<td>4 sh</td>
</tr>
<tr>
<td>CIS 465</td>
<td>MIS Strategies for e-Business (capstone)</td>
<td>4 sh</td>
</tr>
<tr>
<td>PHL 115</td>
<td>Ethical Practice</td>
<td>4 sh</td>
</tr>
<tr>
<td>MTH 241</td>
<td>Discrete Structures</td>
<td>4 sh</td>
</tr>
<tr>
<td></td>
<td>Select one course beyond core math requirement</td>
<td>4 sh</td>
</tr>
<tr>
<td></td>
<td>Probability/Statistics: if core math requirement was MTH 121 then</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MTH 112 General Statistics or a probability and/or statistics course</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quantitative Analysis: if core math requirement was MTH 112 then</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MTH 116 Applied Mathematics with Calculus or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MTH 121 Calculus and Analytic Geometry 1</td>
<td></td>
</tr>
</tbody>
</table>

**Total** 50 sh

A minor in Computer Science requires the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSC 130</td>
<td>Introduction to Computer Science</td>
<td>4 sh</td>
</tr>
<tr>
<td>CSC 230</td>
<td>Algorithm Development</td>
<td>4 sh</td>
</tr>
<tr>
<td></td>
<td>Eight semester hours of 300-400 level Computer Science (CSC) courses</td>
<td>8 sh</td>
</tr>
<tr>
<td></td>
<td>One additional course from CSC or CIS at the 200 level or above</td>
<td>4 sh</td>
</tr>
</tbody>
</table>

**Total** 20 sh

A minor in Computer Information Systems requires the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIS 112</td>
<td>Spreadsheets and their Application</td>
<td>2 sh</td>
</tr>
<tr>
<td>CIS 114</td>
<td>Web Site Development</td>
<td></td>
</tr>
<tr>
<td>CIS 113</td>
<td>Introduction to Database Systems</td>
<td>2 sh</td>
</tr>
<tr>
<td>CIS 216</td>
<td>Programming in a Visual Environment</td>
<td>4 sh</td>
</tr>
<tr>
<td>CIS 330</td>
<td>Systems Analysis and Design</td>
<td>4 sh</td>
</tr>
<tr>
<td>CIS 340</td>
<td>Systems Implementation</td>
<td>4 sh</td>
</tr>
<tr>
<td></td>
<td>One course from the following:</td>
<td>4 sh</td>
</tr>
<tr>
<td></td>
<td>CIS 325 Web Publishing Technologies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CIS 335 Database Management and Analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CIS 345 Networks, Telecommunications and e-Commerce</td>
<td></td>
</tr>
</tbody>
</table>

**Total** 20 sh

Note: CIS 345 is an elective that requires prerequisites of CIS 211, CIS 230, CIS 235
Multimedia Authoring Minor: See Multimedia Authoring

Geographical Information Systems Minor: See Geographical Information Systems

Concentration in Management Information Systems: See Business Administration

Computer Information Systems

CIS 112. PROBLEM SOLVING WITH SPREADSHEET APPLICATIONS 2 sh
This course involves projects requiring quantitative reasoning. Microsoft Excel is used for what-if analysis and graphical presentation of data. Fundamental functions, worksheet database features and the use of Excel to create static and dynamic web pages are covered. Prerequisite: None. Offered: fall and spring.

CIS 113. INTRODUCTION TO DATABASE SYSTEMS 2 sh
This course uses a personal database system (Microsoft Access) to implement projects requiring the organization, manipulation and retrieval of data. Students learn how to analyze and present their data using forms, reports and views. Basic and advanced techniques for data retrieval using elementary SQL and joining multiple tables are covered. No credit for students with CIS 211. Prerequisite: None. Offered: fall and spring.

CIS 114. INTRODUCTION TO WEB SITE DEVELOPMENT 2 sh
This course develops projects which require the organization and presentation of information on Internet web sites using a high level tool (Microsoft FrontPage). Lower level tools such as HTML, DHTML, cascading style sheets, XML, VB script and active server pages will be introduced. Prerequisite: None. Offered fall and spring.

CIS 211. MANAGEMENT INFORMATION SYSTEMS 4 sh
This course provides an introduction to the fundamentals of Information Systems (IS) in organizations. The course examines the role of IS in managing Customer Relationships (CRM) and introduces the fundamentals of business-process modeling using data flow diagrams and Microsoft Visio. Database Management is introduced using Microsoft Access to implement projects requiring the organization, manipulation and retrieval of data and to design and execute forms, reports and views. Elementary SQL and query construction will be covered. The strategic and global aspects of Information Systems are reviewed. Prerequisite: None. Offered: fall and spring.

CIS 216. PROGRAMMING IN A VISUAL ENVIRONMENT 4 sh
This course utilizes a programming language with a visual development environment to implement computer applications. Common visual and data objects are incorporated into projects. Code is developed to respond to events induced on these objects by users or other code. Students design and present group and individual projects. Prerequisite: CIS 211 or CIS 112 and CIS 113 or permission of the instructor. Offered fall and spring.

CIS 220. COMPUTERS AND TEACHING 3 sh
This course is designed for students who are planning to teach at the elementary, middle or secondary level and provides an introduction to the role of technology in teaching and learning in K-12 schools. The course provides opportunities for students to develop basic skills in using technology and in selecting and applying technology appropriately to enhance teacher productivity and student learning. Prerequisite: EDU 211. Offered fall and spring.

CIS 230. INFORMATION THEORY AND PRACTICE 2 sh
This course provides an understanding of organizational systems, planning and the decision process as well as how information is used for decision support in organiza-
tions. It covers decision theory and practice essential for providing viable information to the organization. It outlines the concepts of Information Systems (IS) for competitive advantage, data as a resource, IS planning and implementation, and IS change and project management. Prerequisite CIS 211. Offered spring.

CIS 235. INFORMATION TECHNOLOGY HARDWARE AND SOFTWARE 2 sh
This course provides the hardware/system software fundamentals for various computer/network architectures used in the design, development and implementation of contemporary information systems. These concepts enable systems development personnel to explain tradeoffs in computer architecture for effective design. Topics include system architecture for single-user, central, and networked computing systems and single- and multi-user operating systems. Prerequisite CIS 230. Offered spring.

CIS 310. WEB SERVER DEVELOPMENT 4 sh
This course provides Multimedia Authoring in minors and other non-CSC/CIS majors with a complete overview of Web development, including theories of Information Architecture. Students will develop Web sites of medium complexity after learning the basics of page markup and interactive Web programming by using HTML, CSS, Javascript, XHTML, PHP and Apache. Prerequisite: None. Offered spring.

CIS 320. ENTERPRISE WEB DEVELOPMENT 4 sh
This course provides Multimedia Authoring in minors and other non-CSC/CIS majors with a knowledge of how to integrate database systems with a Web site. Students will develop Web sites of medium complexity after learning the basics of relational database design and three-tier Web programming by using HTML, PHP, Oracle and Apache. Prerequisite: None. Offered fall.

CIS 325. WEB PUBLISHING TECHNIQUES 4 sh
This course provides a complete overview of the Web site development process. Students will create complex, interactive Web sites using HTML, XHTML, CSS, Javascript, PHP, SQL, Oracle and Apache. Prerequisites: CIS 114 and either CIS 216 or CSC 130. Offered fall.

CIS 330. SYSTEMS ANALYSIS AND DESIGN 4 sh
This in-depth study of standard techniques for analyzing and designing Information Systems (IS) emphasizes effective written and oral communication as students examine a system using a realistic business scenario. Appropriate CASE tools (Visible Analyst and/or Visio) are used during the analysis phase. Visual Basic, Crystal Reports and Access are used during the implementation phase to create a simulated software application. Prerequisite: CIS 216. Offered both fall and spring.

CIS 335. DATABASE MANAGEMENT AND ANALYSIS 4 sh
This course focuses on designing, implementing and using database systems, with emphasis on relational and object-relational models. Students design and deploy relational database models using Oracle client and server tools. Students will also learn how to integrate various client front-ends and reporting tools to Oracle databases (such as MS Access using ODBC and Crystal Reports). Students will learn SQL and will be able to design complex reports and queries to answer business problems. This course also provides a short introduction to basic concepts of data analysis and data mining using simple descriptive statistics and SQL. Prerequisite: CIS 216. Offered fall.

CIS 340. SYSTEMS IMPLEMENTATION 4 sh
Project teams identify a business situation requiring information systems (IS) improvement. Concepts and tools for analysis and design methodology are applied. The team carries this design through the implementation phase using appropriate CASE tools, Visual Basic, Access and Crystal Reports. This project is more in-depth than the simulation of CIS 330. Project documentation is presented in the form of a user’s manual. Several class presentations are required throughout the semester, culminating with the final working software application. Prerequisite: CIS 330.
COMPUTING SCIENCES

CIS 345. NETWORKS, TELECOMMUNICATIONS AND E-COMMERCE 4 sh
This course focuses on concepts and technologies associated with data and voice communications. Students learn about local and wide area networks, telecommunication systems, protocols, transmissions alternatives, network architectures and design. Hardware and software, client-server computing and management issues are covered. Prerequisite: CIS 235. Offered spring.

CIS 371. SPECIAL TOPICS 1-4 sh
Topics such as decision support and expert systems, data communications and networks, and design patterns are offered when demand is sufficient.

CIS 465. MIS STRATEGIES FOR E-BUSINESS 4 sh
The MIS and CIS capstone course explores tactical and strategic management of information systems (IS) at the business unit and enterprise level. Students examine current IS issues facing specific industries: healthcare, banking and retail, and also explore management of IS on a global scale and within various countries/regions. The course involves a project focused on design and development of an e-Business software application. Prerequisites: CIS 216 and two courses from CIS 325, CIS 330 and CIS 335. Offered spring.

CIS 481. INTERNSHIP IN INFORMATION SYSTEMS 1-4 sh
Advanced work experiences in Computer Information Systems (CIS) are offered on an individual basis when suitable opportunities can be arranged. Prerequisites: CIS 340 and permission of instructor.

CIS 491. INDEPENDENT STUDY 1-4 sh
CIS 499. RESEARCH 1-4 sh
Students engage in undergraduate research under the direction of a computing sciences faculty member. Maximum of eight semester hours total credit. Prerequisite: Eligibility as determined by the undergraduate research guidelines of Elon University and approval by the department.

Computer Science

CSC 130. INTRODUCTION TO COMPUTER SCIENCE 4 sh
This introduction to programming and problem solving emphasizes applications from quantitative disciplines and incorporates weekly group lab experiences. Prerequisite: MTH 100 or its exemption. Offered fall and spring.

CSC 171. SPECIAL TOPICS 1-4 sh
Students study specialized pieces of software and programming languages. Prerequisite: CSC 130.

CSC 230. ALGORITHM DEVELOPMENT 4 sh
This course continues the study of the development of algorithms and provides an introduction to the analysis of time and space complexity. Topics include program correctness, recursion, elementary data structures, modularization and program structure. Approved for advanced-level designation. Prerequisite: CSC 130. Offered fall and spring.

CSC 331. ALGORITHM ANALYSIS 4 sh
Students analyze structures and appropriate algorithms for sorting, merging and searching in the contexts of mass storage devices, internal main memory and Artificial Intelligence (AI) applications. Topics include graph algorithms, dynamic storage allocation and garbage collection. Prerequisite: CSC 230. Offered spring.

CSC 335. PROGRAMMING LANGUAGES/PARADIGMS 4 sh
This course provides an introduction to language definition structure; data types and structures; control structures and data flow; run-time characteristics and lexical analysis
and parsing. Programming assignments involve the use of several languages. Prerequisite: CSC 230. Offered fall.

**CSC 342. COMPUTER ORGANIZATION AND ARCHITECTURE** 4 sh
Topics cover architectural levels; systems organization; digital logic; machine level; instruction formats; representation of data and computer arithmetic; assembly; linking and loading and architectural alternatives. Prerequisite: CSC 230. Offered fall.

**CSC 351. THEORY OF COMPUTATION** 4 sh
In this introduction to theoretical computer science and analysis of discrete mathematical structures which find application in computer science, topics may include predicate calculus, groups, coding theory, graphs, trees, formal languages, grammars, finite state automata, Turing machines and complexity theory. CSC 351 is the same as MTH 351. Prerequisites: (CSC 130; MTH 121, 241.) Corequisite: CSC 230. Offered fall.

**CSC 371. SPECIAL TOPICS** 1-4 sh
Topics such as computer graphics, Artificial Intelligence (AI), design of data base management systems, robotics, simulation and high performance computing are offered when demand is sufficient.

**CSC 415. NUMERICAL ANALYSIS** 4 sh
(As same course as described in MTH 415.)

**CSC 431. INTRODUCTION TO PARALLEL COMPUTATION AND ALGORITHMS** 4 sh
This course introduces the foundational concepts of parallel and distributed computation. Topics include SIMD (Single Instruction, Multiple Data) and MIMD (Multiple Instruction, Multiple Data) computation, vector processing, shared memory, concurrency issues, message passing, parallel algorithms and the complexity class NC. A large portion of the course will consist of project work, using MPI, PVM and/or Beowulf. Prerequisite: CSC 331, 342. Offered spring alternating years.

**CSC 441. OPERATING SYSTEMS** 4 sh
Students study the fundamental concepts of operating systems and their relationship to computer architecture, including such topics as concurrent programming, interrupt processing, memory management and resource allocation. Prerequisites: CSC 331, 342. Offered spring.

**CSC 445. COMPUTER NETWORKS** 4 sh
This course provides an introduction to network architecture and topology. The development of networked applications will be explored. Issues examined will include common network protocols, security, quality of service and application level protocols. Prerequisite: CSC 331, 342. Offered spring alternating years.

**CSC 451. COMPILER DESIGN AND IMPLEMENTATION** 4 sh
This introduction to basic techniques of compiler design and implementation includes specification of syntax and semantics, lexical analysis, parsing and semantic processing. Prerequisite: CSC 335. Offered spring.

**CSC 461. SENIOR SEMINAR** 1 sh
In this capstone experience for senior Computer Science majors, students will be introduced to the Computer Science Research Enterprise. Students will present independent research both in writing and orally. Prerequisites: senior standing and one 300-level CSC course. Offered fall.

**CSC 481. INTERNSHIP IN COMPUTER SCIENCE** 1-4 sh
Advanced work experiences in Computer Science are offered on an individual basis when suitable opportunities can be arranged. Prerequisites: permission of instructor.

**CSC 491. INDEPENDENT STUDY** 1-4 sh
**COOPERATIVE EDUCATION**

**CSC 499. RESEARCH**  1-4 sh

Students engage in undergraduate research under the direction of a computing sciences faculty member. Maximum of eight semester hours total credit. Prerequisite: Eligibility as determined by the undergraduate research guidelines of Elon University and approval by the department.

**Cooperative Education**

Director of Experiential Education: Assistant Professor P. Brumbaugh
Assistant Professors: Allison, Donathan, Kosusko, Lipe, Magee, Olive-Taylor, L. Rich

The Career Center offers courses designed to acquaint Elon students with the career decision-making process, to assist them in career exploration and graduate school test preparation and to prepare them for the job search.

**COE 110. EXPLORING CAREERS/MAJORS**  1 sh

This class assists students in exploring majors and careers. Topics include personal values and needs assessment, interest and skill inventories, and career decision-making skills. Recommended for freshmen and sophomores. Offered fall and spring in a half-semester format.

**COE 218. GRE PREPARATION**  2 sh

Students prepare for the test that they will need to take prior to applying to graduate school. In addition to familiarizing students with various types of questions on the test, this course will help students develop reasoning skills that they need to perform well. Students receive instruction on the basic mathematical principles that are included on this test. Recommended only for juniors and seniors. Offered first half of spring semester.

**COE 219. LSAT PREPARATION**  2 sh

Students prepare for the test that they will need to take prior to applying to law school. In addition to familiarizing students with various types of questions on the test, this course will help students develop reasoning skills that they need to perform well. Students receive instruction on the basic mathematical principles that are included on this test. Recommended only for juniors and seniors. Offered second half of spring semester.

**COE 310. SECURING A JOB**  1 sh

This course helps students prepare for internships, co-ops, summer jobs and permanent employment. Students develop strategies to achieve career goals, investigate critical issues in the workplace, develop a resume and a cover letter, learn how to network and interview effectively. Recommended for sophomores, juniors and seniors. Offered fall and spring.

The Cooperative Education Work Experience program enables qualified students to combine classroom theory with professional work experience while completing their degrees. The student may work full time or part time with an employer selected and/or approved by the university. Credit hours are based on the number of hours worked during the term — a maximum of 16 semester hours of internship/cooperative education credits may be applied to the 132 semester hours required for the A.B. and B.S. degrees. Evaluation is based on reported job performance and student reflection on that performance through papers, journals, seminars, class presentations and readings. Contact the Director of Experiential Education for more information.

**ELIGIBILITY REQUIREMENTS:** Sophomore, junior or senior standing; minimum 2.0 GPA; approval of faculty/ Experiential Education Director. COE 310 class recommended.