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COLLEGE OF ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE
BACHELOR OF SCIENCE IN COMPUTER SCIENCE
FOR STUDENTS GRADUATING IN CALENDAR YEAR 2020
123 CREDITS REQUIRED FOR GRADUATION

FALL SEMESTER FRESHMAN 2016	Credits
CHEM 1035 General Chemistry	3
CHEM 1045 General Chemistry Lab *Co: CHEM 1035*	1
ENGL 1105 First-Year Writing *Pre: None*	3
MATH 1225 Calculus of a Single Variable **(C-)** *Pre: Math Ready*	4
ENGE 1215 Foundations of Engineering **(C-)**	2
CLE (Area 2, 3, or 7)	3
TOTAL	**16**

SPRING SEMESTER FRESHMAN 2017	Credits
ENGL 1106 First-Year Writing *Pre: ENGL 1105*	3
MATH 1226 Calculus of a Single Variable *Pre: MATH 1225 (C-)*	4
PHYS 2305 Found of Physics I w/lab *Pre: MATH 1225; Co: MATH 1226*	4
ENGE 1216 Foundations of Engineering **(C-)** *Pre: ENGE 1215 (C-)*	2
CS 1114 Intro to Software Design **(C)**	3 [F, S, SI, SII]
TOTAL	**16**

FALL SEMESTER SOPHOMORE 2017	Credits
MATH 2204 Multivariable Calculus *Pre: MATH 1226*	3
MATH 2534 Introduction to Discrete Math *Pre: CS 1114 (C) (Note: Math double majors take MATH 3034)*	3 [F, S, SI]
Natural Science Elective	4
CS 1944 First Year Seminar *Pre: CS 1114 (C)*	1 [F, S]
CS 2104 Intro to Problem Solving in CS **(C)** *Pre: Pre: CS 1114 **(C)**, MATH 1225*	3 [F, S, SI]
CS 2114 Software Design & Data Structures **(C)** *Pre: CS 1114 (C)*	3 [F, S, SI, SII]
TOTAL	**17**

SPRING SEMESTER SOPHOMORE 2018	Credits
COMM 2004 Public Speaking	3
MATH 2114 Introduction to Linear Algebra *Pre: MATH 1225 (B) or MATH 1226*	3
CS 2505 Intro to Computer Organization I **(C)** *Pre: CS 2114 (C); Co: MATH 2534*	3 [F, S, SI]
CLE (Areas 2, 3, or 7)	3
CLE (Areas 2, 3, or 7)	3
TOTAL	**15**

FALL SEMESTER JUNIOR 2018	Credits
MATH 3134 Combinatorics *Pre: MATH 2534 (Note: Math double majors take MATH 3124)*	3
CS 2506 Intro to Computer Organization II **(C)** *Pre: 2505 (C), 2114 (C), MATH 2534*	3 [F, S]
CS 3114 Data Structures and Algorithms **(C)** *Pre: 2505 (C), 2114 (C), MATH 2534*	3 [F, S, SI]
CLE (Areas 2, 3, or 7)	3
Professional Writing Elective	3
TOTAL	**15**

SPRING SEMESTER JUNIOR 2019	Credits
Statistics Elective	3
CS 3214 Computer Systems *Pre: 2506 (C), 2114 (C)*	3 [F, S]
CS 3/4XXX Elective	3
CS 3604 Professionalism in Computing *Pre: 3114 (C), COMM 2004*	3 [F, S]
CLE (Areas 2, 3, or 7)	3
	15

FALL SEMESTER SENIOR 2019	Credits
CS 3304 Comparative Languages *Pre: 3114 (C)*	3 [F, S]
CS 41X4 Theory Course *Pre: 3114 (C), (MATH 3034 or MATH 3134)*	3
CS 3/4XXX Elective	3
CS Technical Elective	3
Free elective	3
TOTAL	**15**

SPRING SEMESTER SENIOR 2020	Credits
CS 4944 Senior Seminar	1 [F, S]
CS 4XXX Capstone	3
CS 4XXX Elective	3
CLE (Area 6)	3
Free Elective	4
TOTAL	**14**

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General Information about Checksheet: Superscripted annotation [F,S,SI,SII] in Credits column indicates that a course is known to be offered in the terms shown. Course offerings are subject to change and the availability of sufficient resources. Students should confirm course offerings in advance with their department.

Curriculum for Liberal Education (CLE)

Consult the CLE Alphabetical Listing at: http://www.cle.prov.vt.edu/guides/alpha.html, CLE courses need to be completed prior to graduation

CLE Area 1: Writing and Discourse (6 hrs)	**ENGL 1105**	**(3)**	**ENGL 1106**	**(3)**
CLE Area 2: Ideas, Cultural Traditions, Values Electives (6 hrs)		**(3)**		**(3)**
CLE Area 3: Society & Human Behavior electives (6 hrs)		**(3)**		**(3)**
CLE Area 4: Scientific Reasoning and Discovery (8 hrs)	Met by natural science requirements (note 2 below)	**(4)**	Met by natural science requirements (note 2 below)	**(4)**
CLE Area 5: Quantitative and Symbolic Reasoning (8 hrs)	**MATH 1225**	**(4)**	**MATH 1226**	**(4)**
CLE Area 6: Creativity & Aesthetic Experience elective (1 or 3 hr)				**(1 or 3)**
CLE Area 7: Global Issues Elective (3 hrs)				**(3)**

If a CLE course is double-counted to satisfy two different CLE areas, a free elective(s) must be taken to maintain a minimum of 123 credits.

Additional Requirements and notes:

1. **CS Non-Technical Course Requirement**. CS majors must complete 30 credits of non-technical courses. All courses are approved as non-technical courses except those in the departments of Biological Sciences, Chemistry, Geosciences, Physics, Mathematics, and Statistics, and all departments in the College of Engineering, except for engineering courses satisfying CLE Area 7. Also excluded are courses listed as CS technical electives.
2. **Natural Science Elective***
3. **Professional Writing Elective***
4. **Statistics Elective***
5. **Independent Study/Undergraduate Research**. No more than a total of 6 credits of CS Independent Study (4974) and/or CS Undergraduate Research (4994) may be used to fulfill CS degree requirements. To take Independent Study (2974 or 4974), a minimum overall and in-major GPA of 2.5 is required. To take Undergraduate Research (4994), a minimum overall GPA of 2.5 and an in-major GPA of 3.0 is required. CS 4974 and 4994 also require completion of CS 3114 with a grade of **C** or better.
6. **CS Technical Elective***
7. **Capstone Requirement***

**See checksheet page 3 for definitions of each elective and a list of approved courses for each.*

Change of Major Requirements: Please see http://www.enge.vt.edu/undergraduate-changing-majors.html

Foreign Language Requirements: Students must have had 2 years of a foreign language in high school or one year at the college level (6 credit hours) of the same language. College-level credits used to meet this requirement do not count towards the degree.

Satisfactory Progress Towards Degree: University Policy 91 outlines university-wide minimum criteria to determine if students are making satisfactory progress towards the completion of their degrees. The CS Department fully supports this policy. Specific expectations for satisfactory progress for Computer Science majors are as follows:

- Each student must meet the minimum University-wide criteria as described in Policy 91 and summarized in the Undergraduate Catalog (http://www.undergradcatalog.registrar.vt.edu/1617/academic-policies.html#22).
- Be registered in at least one 3-credit course required in the major during each on-campus semester of the regular academic year.
- Maintain an in-major GPA of 2.0 or better (calculated using all classes with a CS designator except 1004, 4004 and 4014).
- Not take any CS course required in the major more than twice, including attempts ending in course withdrawal.
- Not repeat more than 3 CS courses required in the major, including attempts ending in course withdrawal.

Statement of Prerequisites: Pre-requisites for each course are listed after the course title. The (letter grade) notation, such as (C), indicates the minimum grade students must earn in the pre-requisite course. There are no hidden pre-requisites in the program of study. Prerequisites may change from what is indicated. Be sure to consult the University Catalog or check with your advisor for the most current pre-requisites.

Graduation Requirements: To qualify for a B.S. degree in CS, a student must:

- Earn a "C" (2.0) or better in CS 1114, CS 2104, CS 2114, CS 2505, CS 2506 and CS 3114, and
- Complete at least 123 semester credit hours with a minimum overall GPA of 2.00 and a minimum in-major GPA of 2.00. (The in-major GPA is calculated using all classes with a CS designator.)

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Computer Science Electives

Note: For all elective courses, many have prerequisites that must be met to be eligible to take the course. Some courses may be restricted to majors other than CS in some semesters.

1. **Natural Science Elective**. A minimum of 12 hours of natural science is required. Of those hours, 8 hours must be in a sequence. In addition to the required CHEM 1035/45 and PHYS 2305, this requirement may be satisfied by taking (a) CHEM 1036/46), (b) PHYS 2306, or (c) an eight hour sequence in Biology: BIOL 1005-6 & 1015-6, or BIOL 1105-6 & 1115-6, or BIOL 1105-6 & 1125-6.

2. **Professional Writing Elective**. Students must take one of the following:

ENGL 3764	Technical Writing
ENGL 3804	Technical Editing and Style
ENGL 3814	Creating User Documentation
ENGL 3824	Designing Documents for Print
ENGL 3834	Intercultural Issues in Professional Writing
ENGL 3844	Writing and Digital Media
ENGL 4824	Science Writing

3. **Statistics Elective**. Students must take one of the following:

STAT 4705	Probability and Statistics for Engineers
STAT 4714	Probability and Statistics for Electrical Engineers
CMDA 2006	Integrated Quantitative Sciences

4. **Capstone Requirement.** Students must complete one 4000-level CS capstone course. Students may choose from the courses listed here, or other 4/5000-level CS courses that have received prior approval as fulfilling the capstone requirement.

CS 4284	Systems & Networking Capstone
CS 4624	Multimedia, Hypertext and Information Access
CS 4634	Design of Information
CS 4704	Software Engineering Capstone
CS 4784	Human-Computer Interaction Capstone
CS 4884	Computational Biology & Bioinformatics Capstone

5. **CS Technical Elective.** Computer Science majors must satisfy a 3 credit hour technical elective requirement. This requirement can be met in either of the following two ways:

    1. Any 3-credit CS 3/4/5000-level course not otherwise used to fulfill a Computer Science requirement can be used as a technical elective (except 3634), including both Independent Study (CS 4974) and Undergraduate Research (CS 4994).

    2. An approved 3000- or 4000-level course in another discipline that has significant technical content relevant to the science or application of computer science can be used as a technical elective.

        a. Requests to have a non-CS course approved as a technical elective are made by submitting a course syllabus to your CS advisor for review prior to enrolling in the course. This includes non-CS Independent Study (4974) and Undergraduate Research (4994) courses.

        b. Below is a listing of non-CS courses that are approved as technical electives.

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Technical Elective Courses

ACIS 4514	Database Management Systems
ACIS 4524	Applied Software Development Project
ACIS/BIT 4554	Networks & Telecommunications in Business
ACIS/BIT 4564	OO Systems Development for Business
ACIS 4684	Information Systems Security and Assurance
AOE 4434	Introduction to Computational Fluid Dynamics
ART 3704	Topics in Computer Animation
BIT 4424	Business Information Visualization & Analytics
BIT 4434	Computer Simulation in Business
BIT 4444	Web-based Decision Support Systems
BIT 4494	Network Simulation, Modeling & Analysis in Business
BIT 4514	Database Technology for Business
BIT 4544	Advanced Methods in Business Analytics
BIT 4574	Advanced Networking for Business
BIT 4614	Information Security
CMDA 3605	Mathematical Modeling: Methods and Tools I
CMDA 3606	Mathematical Modeling: Methods and Tools II
CMDA 4604	Intermediate Topics in Math Modeling
CMDA 4864	Computational Modeling & Data Analytics Capstone
COMM 4374	New Communications Technology
ECE 3504	Digital Design I (old number used through Summer 2013)
ECE 3534	Microprocessor System Design
ECE 3544	Digital Design I
ECE 3574	Applied Software Design
ECE 4510	Genetic Algorithms
ECE 4524	Artificial Intelligence and Engineering Applications
ECE 4550	Real Time Systems
ECE 4560	Computer and Network Security Fundamentals
ECE 4564	Network Application Design
ECE 4580	Digital Image Processing
ECE 4704	Principles of Robotic Systems
GEOG/GEOL 4084	Modeling with GIS
GEOG 4314	Analysis in GIS
GEOG 4324	Algorithms in GIS
MATH 4175	Cryptography I
MATH 4176	Cryptography II
MATH 4445	Introduction to Numerical Analysis
MATH 4454	Applied Mathematical Modeling
ME 4524	Robotics and Automation
MUS 3064	Digital Sound Manipulation
MUS 3065	Computer Music & Multimedia I
MUS 3066	Computer Music & Multimedia II
PHYS 4755	Intro to Computational Physics