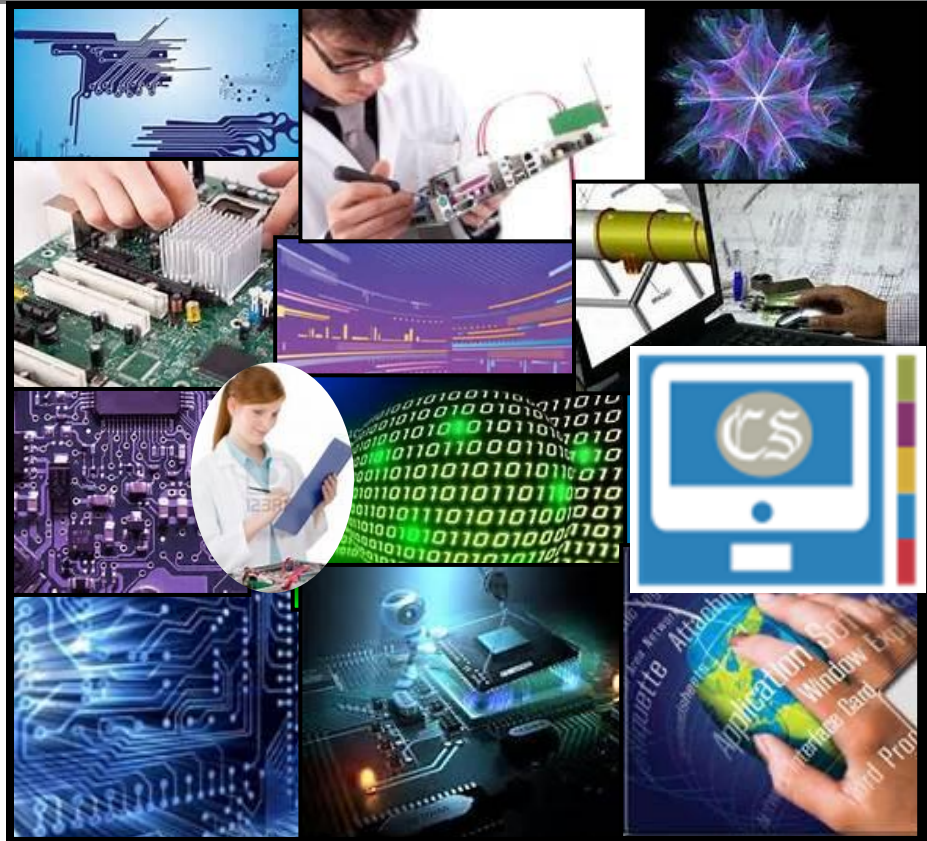


2018

Computer Science

Undergraduate Student Handbook



*Commit to EXCELLENCE,
Engage in COMMUNITY.*

Cal State L.A.

College of Engineering, Computer Science and Technology

Table of Contents

Contact Information	1
Welcome	3
I. Advisement.....	4
II. Objectives and Learning Outcomes	7
III. Useful Web Links	8
IV. General Education Requirements.....	8
V. Major Curricular Requirements.....	11
VI. Graduation Roadmaps.....	13
VII. Blended BS+MS Integrated Program	17
VII. Applying for Graduation	18
IX. Academic Standards.....	19
Appendix A: Quick Curriculum Sheet	20
Appendix B: Advisement Worksheet for CS Juniors/Transfer Students	22

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Welcome

Dear Students,

Welcome to the Department of Computer Science! In choosing this course of study, you have selected an exciting and dynamic career that uses technology to make life better for everyone — and sometimes make it more fun!

This handbook has the information and tools that you will need to navigate the requirements that will lead to graduation. I encourage you to read it and keep it handy for your reference. In addition, please know that the faculty and staff are here to help you and we encourage you to ask us for help when you need it.

The curriculum is designed to give you a well-rounded education, with flexibility in your major so that you can focus on areas that most interest you. Becoming a computer scientist will require a lot of study time and hard work. Beyond learning the theories and technical skills, you will learn to collaborate with your fellow students, communicate with diverse audiences, become aware of your environmental and social responsibilities as they relate to your field, and nurture your innovative and creative spirit.

We sincerely hope you will enjoy your time at Cal State L.A. and that you will also take advantage of all the wonderful resources available to you as a student.

Sincerely,

Dr. Raj Pamula

I. Advisement

All students must receive academic advisement to help them make informed academic choices. Computer Science majors can thus seek advisement both at the college and department level as described below:

College Undergraduate Advisement

The College of ECST Student Success Center is committed to delivering quality advising services to assist students in achieving their educational, career, and personal goals. The professional staff advisor reviews the student's degree progress data available on GET and EAB.

Advisement is mandatory every semester for the first two years and until completion of all lower division MATH/PHYS/CS 2000-level requirements. To enforce this mandatory advising policy the professional advisor places an "Advisement Hold" on GET every semester. Student are not permitted to register for the next semester until they meet with an advisor.

In addition to the one-to-one advising, ESSC also provides the following services to guide students on their pathway towards their degree:

- 1) *New Student Orientation*: working with the University New Student and Parent Program, ESSC organizes mandatory orientations for both incoming freshman and transfer students. During the Orientation, students not only learn how to navigate various University services, but also receive initial advising to register for their first semester. For Transfer Orientation, an important session is for the students to meet with their major faculty advisors to learn about major course requirements, get transfer credit evaluated for non-articulated courses and develop an academic plan accordingly.
- 2) *First-year Learning Communities*: Working with Math, Physics and English departments, ESSC helps to create cohorts of ESCT students with block scheduling and encourage students to form study groups. This small learning communities help first-year students to gain a sense of belongings and get adapted to college study easier.
- 3) *Academic Excellence Workshops*: Each semester, ESSC will run GPA query to identify students on probation or being disqualified (from freshman to senior students). The professional advisors will proactively reach out to these students and ask them to attend mandatory workshop to develop action plans to improve their academic performance. In collaboration with the major departments, this Academic Excellence Workshop provides critical intervention for at risk students.

Advisement appointments guarantee the availability of a Professional Staff Advisor or Peer Advisor. Appointment may be made either by:

- Visiting the ECST Advising Center (Engineering and Technology building, A-125),
- Calling the office Front Desk at 323-343-4574, or
- Visiting <http://www.calstatela.edu/ecst/success/academic-advising> and clicking on the "Student Success Collaborative" icon.

Department Undergraduate Advisement

Designated faculty advisors are the primary source of advising at the department level for all undergraduate students. The advisor and student go over the student's degree progress data available on CSNS and GET. Student advising in the department is considered either Open Advisement or Mandatory Advisement as described below:

Open Advisement:

- i) Advisor/Chair office visitation: Office hours for the Advisor and the Department Chair are posted in the Department Office. Students meet with their faculty advisor: to evaluate class work to date, to discuss issues (if any) impacting their present load, to resolve any GPA issues, and to plan subsequent classes.
- ii) Email advisement: Students may seek advisement via email.
- iii) CSNS Advisement Forum: Students may post questions to a Forum hosted by CSNS. Responses are provided by other students or an advisor and are monitored by the Department staff and advisor.

Mandatory Advisement:

Every student is required to meet with their advisor at least once a year. At these meetings students plan their course schedule for the upcoming semester and formulate a longer-term road map to complete all remaining requirements. Advisement meetings are scheduled first with entering first time freshman or transfer students and then with continuing students.

- i) Entering first term students: Admitted freshman and transfer students attend university-sponsored orientation sessions, which are attended by the Department chair and program advisors. Students are informed of the degree requirements, course pre-requisites, laboratory access, computer-related student clubs, and the advising process. Students are given information about the program requirements, which are also posted on the online university catalog and the Department website. Students are given an *Undergraduate Student Handbook*, which is also posted on the Department website.
- ii) Freshman level in CS 1010: Entering freshman or first year transfer students must enroll in CS 1010 during their first term. CS 1010 presents a comprehensive overview of higher education. Topics include: Skills required for the computing profession; critical thinking and lifelong learning; computer ethics; hands-on projects to explore the computing disciplines; academic success strategies; university structure, resources, policies, procedures; community engagement. Additionally, Professional Staff Advisors and the Placement Coordinator schedule class visits during the semester to provide career advising, an overview of university and college resources, and academic advising in preparation for next semester's class registration.
- iii) Sophomore level in CS 2011: CS 2011 is the first course in the programming sequence and is chosen for mandatory advisement at the sophomore level. The undergraduate faculty advisor visits all the CS 2011-CS 2013 sections for in-class advisement sessions. Students are reminded to keep pace with the General Education, Math and Physics requirements along with CS

requirements as specified in the *Undergraduate Student Handbook*. Any questions are clarified. All students are reminded of the registration “hold” and are required to make an appointment with the College Professional Advisor who checks on their GPA and guides them to take particular MATH/PHYS/CS Courses. Both the College Professional Advisor and the undergraduate advisor assist students in modifying their roadmaps.

- iv) Transfer student advisement: All incoming transfer students are required to attend a mandatory orientation session organized by the College of ECST. These students are sent a worksheet (Appendix E-B in the Student Handbook) and a questionnaire to be filled out before coming to the orientation. The intent is to expedite the transfer evaluation process. The University is committed to completing the official transfer evaluation and have it reflected in student transcripts on GET by the transfer orientation date. Transfer students are then ready to take further classes having completed the prerequisites in their transfer institution.
- v) Junior level in CS 3112: CS 3112 is chosen for mandatory advisement at the junior level. The advisor creates a group (using the EAB tool) of all students registered for any CS 3000 level course to capture all junior level students. All these students are sent a worksheet (Appendix E-B in the Student Handbook) to create an individualized roadmap and attend a mandatory advising session. Students roadmaps are checked to see if the student is on pace to take the senior design course the following year. This advising session serves as a pre-graduation check. Students make any necessary adjustments to their planner during this session. A “hold” is placed on students until they complete this task.
- vi) Senior level in CS 4961. CS 4961 is the front end of the senior design sequence. The advisor sends email with Graduation Application Information to all CS 4961 students. Students are required to schedule a one-on-one meeting with an advisor and to complete a formal graduation check, including a *Degree Completion Worksheet* and an *Undergraduate Graduation Application*. The goal is to ensure that they are on track to graduate by formulating a plan for the rest of the remaining requirements.

II. Objectives and Learning Outcomes

Objectives

Program Educational Objectives are broader statements that will describe what graduates are expected to attain within a few years of graduation.

1. Students who had entered the workforce will have established themselves as effective professionals by having solved real problems through the use of their computer science knowledge and their communication, critical thinking, and problem-solving skills.
2. Students who had continued in academia will have been successful in pursuing advanced degrees and in demonstrating their ability to master advanced areas of computer science.
3. Students will have demonstrated their ability to adapt to a rapidly changing environment by having learned and applied new knowledge and skills.

Learning Outcomes

Student Learning Outcomes are specific skills that the students will possess on completion of the degree program. Students will:

1. be able to apply concepts and techniques from computing and mathematics to both theoretical and practical problems.
2. be able to demonstrate fluency in at least one programming language and acquaintance with at least three more.
3. have a strong foundation in the design, analysis, and application of many types of algorithms.
4. have a fundamental understanding of computer systems.
5. have the training to analyze problems and identify and define the computing requirements appropriate to their solutions.
6. have the training to design, implement, and evaluate large software systems working both individually and collaboratively.
7. be able to communicate effectively orally and in writing.
8. have the knowledge, skills, and attitudes for lifelong self-development.
9. have the ability to analyze the local and global impact of computing on individuals and society.
10. have a fundamental understanding of social, professional, ethical, legal, and security issues in computing.

III. Useful Web Links

DESCRIPTION	WEB ADDRESS
University home page	http://www.calstatela.edu/
Department of Computer Science home page	http://cs.calstatela.edu/ http://www.calstatela.edu/cs
Golden Eagle Territory (GET) provides basic online student services.	http://get.calstatela.edu
Computer Science Network Services (CSNS) is used as a Learning Management System.	http://csns.calstatela.edu
Important student information	http://www.calstatela.edu/student/
University online catalog	http://ecatalog.calstatela.edu
University Library	http://www.calstatela.edu/library
Student Chapter of the Association for Computing Machinery	http://acm.calstatela.edu

IV. General Education Requirements

The total required units for the undergraduate BS degree is 120 units which is divided into General Education Requirements and Major Requirements.

General Education Requirements (48 units, of which 21 units are in the major)
Lower Division General Education Requirements (27 units)

- IHE - Introduction to Higher Education for Computer Science Majors – CS1010 (3)
- Oral Communication (3)
- Written Communication (3)
- American Institutions – US History (3)
- American Institutions - US Constitution and State/Local Govt. (3)
- Biological Sciences OR Interdisciplinary Physical-Biological Science (3)
- Arts and Humanities – Select 3 units from Arts (3)
- Social Science - Select 6 units from Social Science (6)

Upper Division General Education Requirements – (0 additional units; Met in major)

Natural Science and Quantitative Reasoning	Met by CS 3112, CS 3186
Arts & Humanities	Met by CS 4961, CS 4962
Social Sciences	Met by CS 4961, CS 4962

University Requirements

A minimum 2.0 grade average is required in (i) Overall at CSULA (ii) Major requirements and (iii) Overall at CSULA. In addition, students must check on the course designations describe below:

<i>Cl</i>	Computer Science students fulfill this requirement in the major (IHE -CS1010 and Senior Design - CS4961/CS4962).
<i>Wi</i>	Computer Science students fulfill this requirement in the major (Senior Design - CS4961/CS4962).
<i>d/re</i>	Students must complete at least one diversity course (with <i>d</i> designation), and one race and ethnicity course (with <i>re</i> designation). They should be fulfilled in the lower division General Education requirements. These courses are designated as (re) and (d) in the course listing.

Note:

- (i) “Cl” and “Wi” requirement is met by major courses;
- (ii) “d/re” requirement must be met by the General Education courses.

Lower Division GE Requirement for Computer Science Majors

Effective: Fall Semester 2016

A Basic Subjects 6 Units Total	American Institutions 6 Units Total	B Natural Sciences and Mathematics / Quantitative Reasoning 3 Units Total (B2 or B3)	C Arts and Humanities 3 Units Total	D Social Sciences 6 Units Total	E Lifelong Understanding and Self-Development 3 Units Total
A1 ORAL COMM (3 units)	U.S. HISTORY (3 units)	B1 PHYSICAL	C1 ARTS		
COMM 1100	AAAS 1500(re)	Met in Major	AAAS 2200(re)	AAAS 1400(re), 1600(d), 1700(d), 2000(d), 2100(re), 2630(re)	CS 1010(IHE)(cl)
HNRS 1100	CHS 1200(re)		ART 1011, 1012, 1013, 1500, 1520, 1550, 1590, 2090(d), 2100	ANTH 1500(d), 1700, 2300	
A2 WRITTEN COMM (3 units)	HIST 1500(re), 2010(d), 2020(d), 2050(re)	B2 BIOLOGICAL		ANTh 1500(d), 1700, 2300	
ENGL 1005B, 1010		ANTH 2600	CLS 1600(re), 2050(re), 2060(re)	BUS 2500(d)	
A3 CRITICAL THINKING AND COMPOSITION (0 unit)	PAS 1510(re)	BIOL 1010	ENGL 2070, 2260, 2800	CHDV 1400, 1410, 2250(d)	
Met in major	U.S. CONSTITUTION STATE / LOCAL GOV'T ** (3 units)	MICR 1010	HNRS 1200	CHS 1500(re), 2100(re), 2200(d), 2300(re)	
	POLS 1000	B3 INTERDISCIPLINARY PHYSICAL / BIOLOGICAL*	LBS 2340(re), 2666(d)	COUN 2020(d)	
		NSS 1100, 1200, 1300	MUS 1500, 1510, 1520, 1530, 1560, 1570	ECON 1500	
			PAS 2210(re), 2600(re)	ENGL 2100	
		B4 MATHEMATICS / QUANTITATIVE REASONING	PHIL 2400(d)	GEOG 1550(d)	
		Met in Major	TVF 2260, 2666(d)	HIST 1010(d), 1020(d), 1600(d),	
			C2 HUMANITIES	HNRS 1300(cl), 2300	
			Met in Major	LAS 1020(re), 1400(re), 1500(d), 2550(d)	
				PAS 1020(re), 1400(re), 1800(re), 2500(re)	
				POLS 2500	
				PSY 1500	
				SOC 2010(d), 2630(re)	
				TVF 2500(d)	
				URBA 1800	
				WGSS 2000(cl)(d), 2030(re)	

NOTE: Students must complete one race/ethnicity (re) course and one diversity (d) course or another race/ethnicity (re) course. These courses are designated as (re)and (d) after the course listing.

V. Major Curricular Requirements

The Computer Science core curriculum provides students with basic knowledge, training, discipline, and skills, as defined by the Computer Science Program Student Learning Outcomes. Through its lower division required courses, the curriculum provides students with the basic mathematical and science framework. Through its upper division required courses, the curriculum builds upon the fundamental principles of computer science for more advanced study. Through its upper division technical electives, students gain additional breadth and/or depth in computer science by an appropriate selection of courses.

Requirements for the Major (93 units)

A grade of "C" or better is required for all prerequisite courses in the major.

Lower Division Required Courses (39 units)

- CS 1222 Introduction to Relational Databases(3)
- CS 2011 Introduction to Programming I (3)
- CS 2012 Introduction to Programming II (3)
- CS 2013 Programming with Data Structures (3)
- CS 2148 Discrete Structures (3)
- ENGL 2030 Introduction to Technical Writing (3)
- MATH 2110 Calculus I (4)
- MATH 2120 Calculus II (4)
- MATH 2550 Introduction to Linear Algebra (3)
- PHYS 2100 General Physics I (5)
- PHYS 2200 General Physics II (5)

Upper Division Required Courses (33 units)

- CS 3035 Programming Language Paradigms (3)
- CS 3112 Analysis of Algorithms (3)
- CS 3186 Introduction to Automata Theory (3)
- CS 3220 Web and Internet Programming (3)
- CS 3337 Software Engineering (3)
- CS 3801 Societal and Ethical issues in Computing (3)
- EE 3445 Computer Organization (3)
- CS 4440 Introduction to Operating Systems (3)
- CS 4961 Software Design Laboratory I (3)
- CS 4962 Software Design Laboratory II (3)
- CS 4963 Computer Science Recapitulation (3)

Electives (21 units)

Mathematics Electives (3 units)

Select 3 units of lower division or upper division course(s) in the Mathematics area with prior approval of the Computer Science undergraduate adviser. Recommended course is in the area of Probability/Statistics.

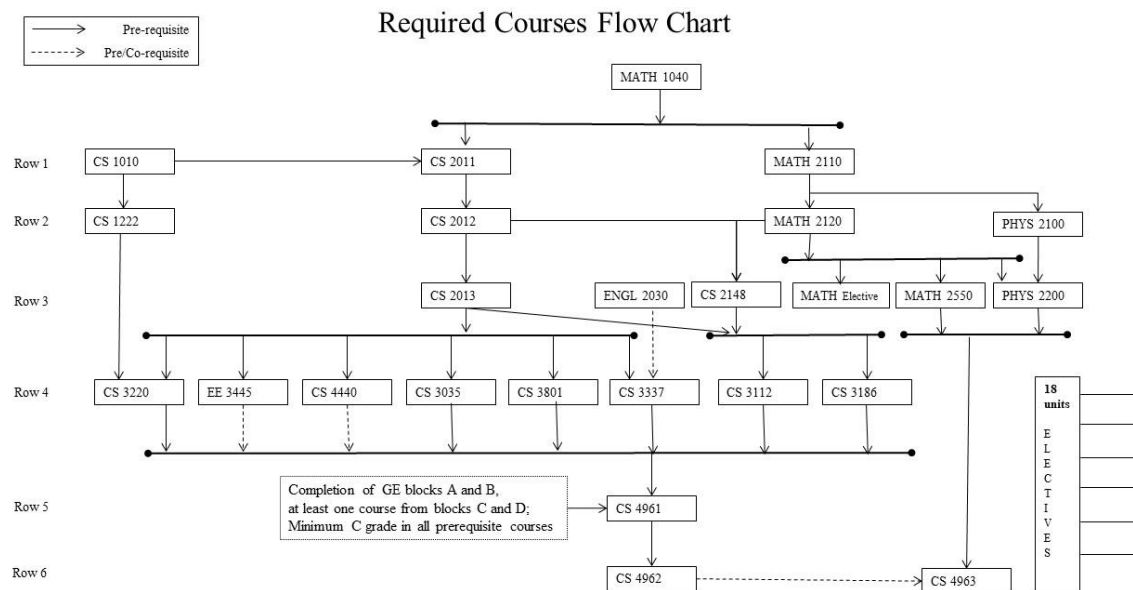
Computer Science Electives (18 units)

Select 18 units of upper division Computer Science (CS3xxx/CS4xxx) courses.

Prerequisite Flowchart

The prerequisite flowchart for the B.S. in Computer Science curriculum is depicted in the figure below. The courses are structured with the lower division requirements shown in Rows 1 – 3. The advanced required CS courses are shown in Rows 4 – 6. Elective courses should be scheduled between Rows 4 – 6.

As a general rule, students are advised to finish the courses in a particular row before progressing to the next row and follow the graduation roadmaps described in the next section.



VI. Graduation Roadmaps

Graduation roadmaps are suggested academic plans designed to inform students about the sequence of courses needed to satisfy degree requirements. The roadmaps adhere strictly to the prerequisites and scheduling patterns of the courses.

Plan 1: Freshman Roadmaps (4 Year completion taking 5 courses/term)

This roadmap is described for students who enter Cal State LA directly from high school as freshman. It assumes that the freshmen students are ready to take MATH 2100 and ENGL 1010 and do not need to take any remedial mathematics or English courses. This ideal roadmap provides a pathway for students to complete their undergraduate requirements in four years.

YEAR 1	SUMMER	FALL	SPRING
		MATH 2110	MATH 2120
		ENGL 1010	HIST 2020
		COMM 1100	POLS 1000
		GE B2/B3	CS 1222
		CS 1010	CS 2011

YEAR 2	SUMMER	FALL	SPRING
		MATH Elective	GE D1
		MATH 2550	ENGL 2030
		PHYS 2100	PHYS 2200
		CS 2012	CS 2013
		GE C1	CS 2148

YEAR 3	SUMMER	FALL	SPRING
		CS 3035	CS 3186
		CS 3112	CS 3801
		CS 3220	CS 4440
		CS 3337	CS Elective
		EE 3445	GE D2

YEAR 4	SUMMER	FALL	SPRING
		CS 4961	CS 4962
		CS Elective	CS 4963
		CS Elective	CS Elective
		CS Elective	CS Elective

Plan 2: Freshman Roadmaps (5 Year completion taking 4 courses/term)

YEAR 1	SUMMER	FALL	SPRING
		MATH 2110	MATH 2120
		ENGL 1010	HIST 2020
		COMM 1100	POLS 1000
		CS 1010	CS 1222

YEAR 2	SUMMER	FALL	SPRING
		MATH Elective	GE D1
		MATH 2550	ENGL 2030
		CS 2011	CS 2012
		GE C1	GE B2/B3

YEAR 3	SUMMER	FALL	SPRING
		CS 2013	CS 3112
		CS 2148	CS 3801
		GE D2	EE 3445
		PHYS 2100	PHYS 2200

YEAR 4	SUMMER	FALL	SPRING
		CS 3035	CS 3220
		CS 3186	CS 3337
		CS 4440	CS Elective
		CS Elective	CS Elective

YEAR 5	SUMMER	FALL	SPRING
		CS 4961	CS 4962
		CS Elective	CS 4963
		CS Elective	CS Elective

Plan 3: Roadmap for Transfer Students

This roadmap is for students who transfer to Cal State LA directly from another institute of higher education. The plan assumes that the students have entered Cal State LA with completion of all lower division GE requirements and all lower division required math, computer science and physics PHYS courses.

This ideal roadmap provides a pathway for students to complete their remaining upper division (300/400 level) undergraduate course requirements as laid out in either Plan1 or Plan2 above.

Plan 4: Roadmaps for Students Requiring Remedial Math and English

Students needing some remediation to MATH and ENGL courses are placed into remedial courses. This is likely to add up to an extra year on the roadmap. Students will then continue on and follow the roadmaps (Plan1 or Plan2) described above.

Plan 5: Individualized Roadmap

It is a fact that every student's situation is unique. Therefore, the roadmaps described above should be used as guides. Note the following two characteristics described in the roadmap plans above:

- The roadmaps describe the suggested plan of study (by year and semester term) for students assuming that a student plans for the regular fall and spring semesters. These roadmaps do not include courses during the summer sessions. This leaves the option for students to take classes during the summer session to finish earlier or to reduce the number of units per semester.
- The roadmaps are designed for individuals who are devoting full-time to their studies and thus taking a full load of 12 to 15 units per semester.

It is essential that every student should see a faculty academic advisor and complete an Individualized Advisement Plan (IAP). This should be updated if any situation changes down the road.

The blank roadmap on the next page can be used as a draft to prepare the individualized planner. Students should consult with an advisor while making any changes to the plan.

YEAR	SUMMER	FALL	SPRING

YEAR	SUMMER	FALL	SPRING

YEAR	SUMMER	FALL	SPRING

YEAR	SUMMER	FALL	SPRING

YEAR	SUMMER	FALL	SPRING

VII. Blended BS+MS Integrated Program

The Blended BS/MS program (<http://www.calstatela.edu/ecst/cs/integrated-bsms>) in computer science provides an accelerated route for academically excellent upper-division students in the BS degree program to complete the MS degree program while simultaneously completing the BS requirements. The main objectives of the program are:

- To provide an accelerated route to a graduate degree, with simultaneous awarding of both bachelor's and master's degrees.
- To provide a seamless process whereby a limited number of select students can progress from undergraduate to graduate status.

Program Features

- Simplified application process
- BS and MS coursework can be taken concurrently
- **Nine** common elective units between BS and MS programs.
- Access to graduate student facilities
- TA appointments (if available)
- The scheduling flexibility provided by the program enables students to complete the BS and MS degrees efficiently.

The eligibility requirements for admission to the Blended BS/MS program are:

- Students must have completed a minimum of 90 semester units of coursework.
- Students must have a CSULA GPA of > 3.0.
- Students must have completed all CS2000 level and the six required CS 3000-level courses in the BS degree program with a minimum grade of "B".

Eligible and interested students should contact the Academic Advisor for further information.

To apply, please discuss with the advisor.

VIII. Applying for Graduation

Students must apply for graduation to notify the university that they are ready to complete their degree program. It follows an audit process as described below:

- 1) Students take note of all the information (application deadlines, fees, diploma, commencement, transcripts, etc.), as described at http://www.calstatela.edu/sites/default/files/groups/Graduation/Docs/graduation_application_for_undergrad.pdf.
- 2) Students complete the 2-page **Degree Completion Worksheet** and 1-page **Undergraduate Graduation Application**.
 - Students will review their Academic Requirements report on GET to complete the Degree Completion Worksheet.
 - The Academic Requirements Report (an audit report generated on GET) gives a visually clear picture of the requirements; completed requirements; transfer credits etc. as shown in Figure 1.2. Students thus have a general idea of the graduating quarter and discuss the program requirements with the advisor.

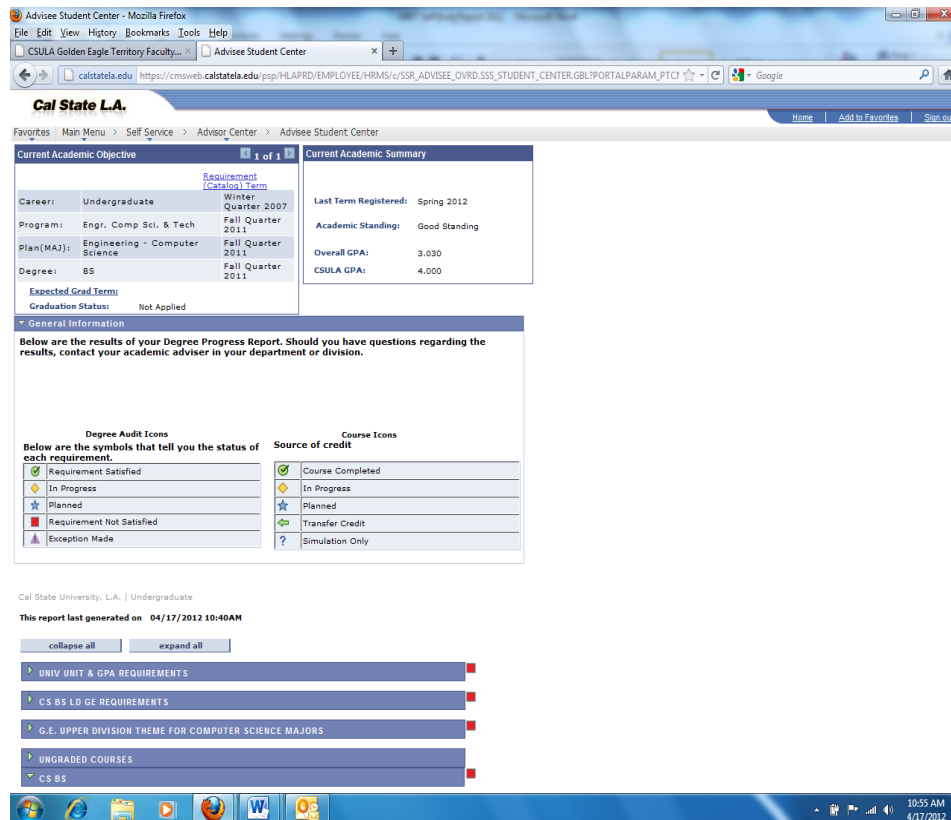


Figure 1.4: Academic Requirements Report on GET

- 3) Students make an appointment with the Advisor to discuss the Academic Requirements Report and resolve/plan out all the remaining requirements (which are indicated as RED flags). The Advisor reviews the *Degree Completion Worksheet* and the *Undergraduate Graduate Application*. Both the applications are signed off by the Advisor.

- 4) Students submit the signed Graduation Application and Degree Completion Worksheet to the Cashier's Office (ADM 128) and pay the Application (\$20) and Diploma (\$10) fees. The Cashier's Office will forward the form to the Graduation Office for processing and do the final audit.
- 5) Degree dates are posted at the end of the semester in which all requirements are met. On completion of the degree requirements, the transcripts on GET indicate the following:

Degree: Bachelor of Science

Confer Date: (date)

Plan: Computer Science

- 6) If the students do not graduate during the term declared on their **Graduation Application**, then they must file a **Request to Change Graduation Term**. The following steps have to be completed before the students will be able to register for classes beyond the previous declared graduation term.
 - Students make a graduation advising appointment with the Advisor to determine the correct term at the end of which all graduation requirements are completed.
 - Complete and sign the **Request to Change Graduation Term** form; available at <http://www.calstatela.edu/graduation>
 - Pay the \$25 late filing fee to the Cashier's Office
 - Cashier's Office will forward the form to the Graduation Office for processing.

IX. Academic Standards

As a student, you are now joining an academic community. The privilege of membership has certain obligations. Academic Integrity is very important. Cheating will not be tolerated. Cheating on any assignment or exam will be taken seriously. Failure to meet established standards may result in various penalties. In extreme cases this could result in expulsion from the University.

Please visit the Cal State LA, Judicial Affairs Office website where you will find examples of what constitutes cheating and plagiarism so that you become familiar with the guidelines, and consequences of not following them.

We hope that behavior standards never become an issue, but it is important that you prove worthy of the trust we place you in. Honesty is extremely important both for the operation of the University and for your personal development.

Appendix A: Quick Curriculum Sheet

Curriculum for B.S. Degree in Computer Science (120 units)

CALIFORNIA STATE UNIVERSITY, LOS ANGELES

(Effective Fall 2016 Semester Term)

Lower Division General Education Requirements (27 units)

BLOCK A – Basic Subjects	Written Communication (3)
	Oral Communication (3)
American Institution	United States History (3)
	United States Constitution and State/Local Government (3)
BLOCK B – Natural Sciences & Mathematics/Quantitative Reasoning	1 course from B2 or B3 (3)
BLOCK C – Arts & Humanities	1 course (3)
BLOCK D – Social Sciences	2 courses (6)
BLOCK E – Lifelong Understanding & Self-Development	CS 1010 Introduction to Higher Education for Computer Science Majors (3)

Upper Division General Education Requirements – Met in major (No extra units)

Lower Division Major Requirements (39 units)

CS 1222	Introduction to Relational Databases (3) <i>Prerequisite:</i> CS1010, Computer Literacy
CS 2011	Introduction to Programming I (3) <i>Prerequisite:</i> CS1010, MATH 1040 or consent of the instructor
CS 2012	Introduction to Programming II (3) <i>Prerequisite:</i> CS 2011, recommended MATH 2110
CS 2013	Programming with Data Structures (3) <i>Prerequisite:</i> CS 2012, recommended MATH 2120
CS 2148	Discrete Structures (3) <i>Prerequisites:</i> CS 2012, MATH 2120
ENGL 2030	Introduction to Technical Writing (3) <i>Prerequisite:</i> ENGL 1010
MATH 2110	Calculus I (4) <i>Prerequisite:</i> MATH 1040 with a minimum C grade, or MATH 1081 and MATH 1083 both with a minimum C grade
MATH 2120	Calculus II (4) <i>Prerequisite:</i> MATH 2110 with a minimum C grade
MATH 2550	Introduction to Linear Algebra (3) <i>Prerequisite:</i> MATH 2120
PHYS 2100	Mechanics and Thermodynamics (5) <i>Prerequisite:</i> High school physics or equivalent, or permission of the department, MATH 2110 or equivalent (may be taken concurrently)
PHYS 2200	Electromagnetism and Optics (5) <i>Prerequisite:</i> PHYS 2100, or co-requisite: MATH 2120

Upper Division Major Requirements (33 units)

CS 3035	Programming Language Paradigms (3) <i>Prerequisite:</i> CS 2013, CS 2148.
CS 3112	Analysis of Algorithms (3) <i>Prerequisite:</i> CS 2013, CS 2148
CS 3186	Introduction to Automata Theory (3) <i>Prerequisite:</i> CS 2013, CS 2148

- CS 3220 **Web and Internet Programming (3)** Prerequisite: CS 1222, CS 2013
- CS 3337 **Software Engineering (3)** Prerequisite: CS 2013, Prerequisite or corequisite: ENGL2030.
- CS 3801 **Societal and Ethical Issues in Computing (3)** Prerequisite: CS 2013 or permission of the instructor
- EE 3445 **Computer Organization (3)** Prerequisite: CS 2013 or permission of the instructor
- CS 4440 **Introduction to Operating Systems (3)** Prerequisite: CS 2013
- CS 4961 **Software Design Laboratory I (3)** Prerequisite: Completion of blocks A and B4, an additional course from block B, and at least one course each from blocks C and D. Minimum C grade in all courses: CS 3112, CS3220, CS3035, CS3337, CS3186, CS3801 co-requisite: CS 4440, EE 3445
- CS 4962 **Software Design Laboratory (3)** Prerequisite: CS 4961
- CS 4963 **Computer Science Recapitulation (3)** Prerequisite: MATH 2550, PHYS 2200, co-requisite: CS 4962

Program Electives (21 units)

Mathematics Electives (3 units) - *Select 3 units of lower division or upper division course(s) in the Mathematics area with prior approval of the Computer Science undergraduate adviser. A typical course is in the area of Probability/Statistics (MATH2740)*

Computer Science Electives (18 units) – *Select 6 lecture courses from the following (and any new CS3000/4000 courses). Check with the advisor*

- CS 3034 **Widely-used Programming Languages (3)** Prerequisites: CS2013, CS2148;
- CS 3660 **Complex Social and Economic Systems (3)** Prerequisite: CS2148, Corequisite: CS3112.
- CS 4075 **Concurrent and Distributed Programming (3)** Prerequisites: CS 3112, CS 3035
- CS 4112 **Competitive Programming (3)** Prerequisite: CS 3112
- CS 4188 **Compilers (3)** Prerequisites: CS 3035, CS 3112, CS 3186
- CS 4220 **Current Trends in Web Design and Development (3)** Prerequisites: CS 3112 and CS 3220
- CS 4222 **Principles of Database Systems (3)** Prerequisites: CS 1222 and CS 3112
- CS 4470 **Computer Networking Protocols (3)** Prerequisite: CS 3112
- CS 4471 **Computer Networks Configuration and Management (3)** Prerequisite: CS 4440
- CS 4540 **Special Topics in Computer Science (1-3)** *Current topics of special interest to students in computer science, as announced in Schedule of Classes*
- CS 4550 **Computer Graphics (3)** Prerequisites: CS 3112, MATH 2550
- CS 4551 **Multimedia Software Systems (3)** Prerequisite: CS 3112
- CS 4555 **Introduction to 3D Computer Game Programming (3)** Prerequisite: CS 3112
- CS 4556 **Multiplayer Online Game Design and Development (3)** Prerequisites: CS 3112 and CS 3220
- CS 4635 **Modeling and Simulation (3)** Prerequisites: CS 3112 and CS 3660
- CS 4660 **Artificial Intelligence (3)** Prerequisite: CS 3112
- CS 4661 **Introduction to Data Science (3)** Prerequisite: CS 3112
- CS 4662 **Advanced Machine Learning (3)** Prerequisite: CS 4661
- CS 4780 **Cryptography and Information Security (3)** Prerequisite: CS 3112

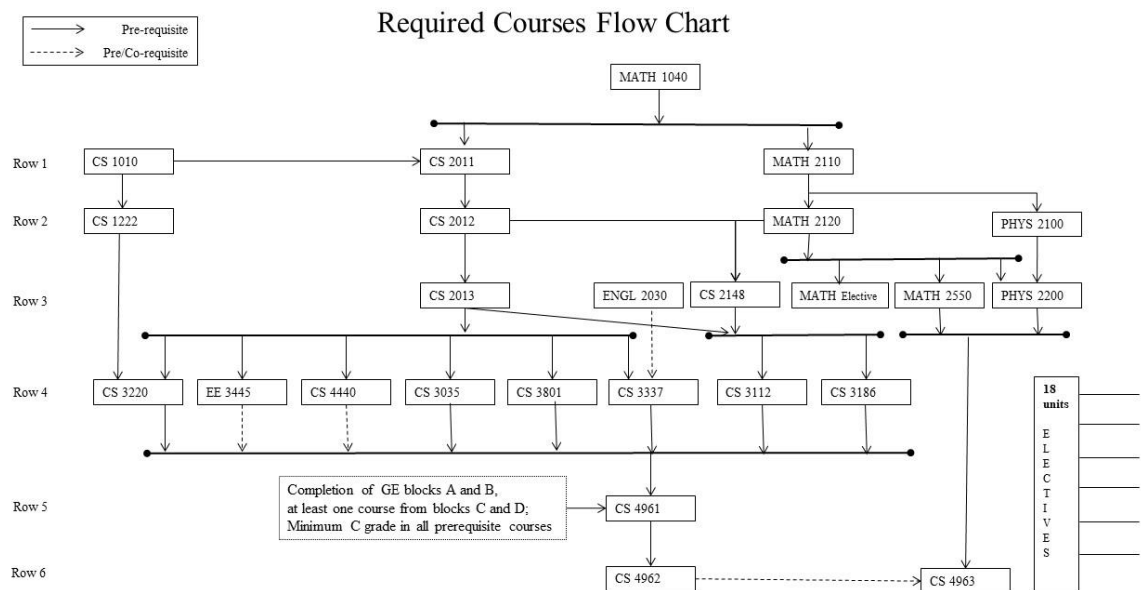
Appendix B: Advisement Worksheet for CS Juniors & Transfer Students

Step 1: Based on your Academic Requirements report on GET, **cross out** all the completed GE courses in the chart below. (i.e., these courses are shown as met in GREEN color on the report). Don't worry about the areas indicated as "Met in major"

Lower Division GE Requirement for Computer Science Majors					
Effective: Fall Semester 2016					
A Basic Subjects 6 Units Total	American Institutions 6 Units Total	B Natural Sciences and Mathematics / Quantitative Reasoning 3 Units Total (B2 or B3)	C Arts and Humanities 3 Units Total	D Social Sciences 6 Units Total	E Lifelong Understanding and Self-Development 3 Units Total
A1 ORAL COMM (3 units)	U.S. HISTORY (3 units)	B1 PHYSICAL	C1 ARTS		
COMM 1100	AAAS 1500(re)	Met in Major	AAAS 2200(re)	AAAS 1400(re), 1600(d), 1700(d), 2000(d), 2100(re), 2630(re)	CS 1010(IHE)(cl)
HNRS 1100	CHS 1200(re)		ART 1011, 1012, 1013, 1500, 1520, 1550, 1590, 2090(d), 2100	ANTH 1500(d), 1700, 2300	
A2 WRITTEN COMM (3 units)	HIST 1500(re), 2010(d), 2020(d), 2050(re)	B2 BIOLOGICAL	CLS 1600(re), 2050(re), 2060(re)	BUS 2500(d)	
ENGL 1005B, 1010	PAS 1510(re)	ANTH 2600	ENGL 2070, 2260, 2800	CHDV 1400, 1410, 2250(d)	
A3 CRITICAL THINKING AND COMPOSITION (0 unit)	U.S. CONSTITUTION	BIOL 1010	HNRS 1200	CHS 1500(re), 2100(re), 2200(d), 2300(re)	
Met in major	STATE / LOCAL GOV'T ** (3 units)	MICR 1010	LBS 2340(re), 2666(d)	COUN 2020(d)	
	POLS 1000	B3 INTERDISCIPLINARY PHYSICAL / BIOLOGICAL*	MUS 1500, 1510, 1520, 1530, 1560, 1570	ECON 1500	
		NSS 1100, 1200, 1300	PAS 2210(re), 2600(re)	ENGL 2100	
		B4 MATHEMATICS / QUANTITATIVE REASONING	PHIL 2400(d)	GEOG 1550(d)	
		Met in Major	TVF 2260, 2666(d)	HIST 1010(d), 1020(d), 1600(d)	
			C2 HUMANITIES	HNRS 1300(cl), 2300	
			Met in Major	LAS 1020(re), 1400(re), 1500(d), 2550(d)	
				PAS 1020(re), 1400(re), 1800(re), 2500(re)	
				POLS 2500	
				PSY 1500	
				SOC 2010(d), 2630(re)	
				TVF 2500(d)	
				URBA 1800	
				WGSS 2000(cl)(d), 2030(re)	

NOTE: Students must complete one race/ethnicity (re) course and one diversity (d) course or another race/ethnicity (re) course. These courses are designated as (re) and (d) after the course listing.

- Step 2:** Based on your Academic Requirements report on GET, mark the flow chart as described below
- (i) **Cross out** all the completed courses (including currently enrolled in Fall 2017). (shown as met in GREEN)
 - (ii) **Cross out and write the** transfer course that meets the requirement (shown in RED, which should be GREEN)
 - (iii) Indicate any completed MATH Elective and CS Electives



Step 3: Make a tentative plan and list the courses for the next two years starting this Fall semester Refer to the Graduation Road Maps in Section

YEAR 2017- 2018		FALL 2XXX (CURRENT)	SPRING 2XXX

YEAR 2018- 2019	SUMMER 2XXX	FALL 2XXX	SPRING 2XXX