

Department of Information and Computer Sciences

# ACADEMIC PLAN

## 2015-2016

### Department Contact

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Department of Information and Computer Sciences

College of Natural Sciences

University of Hawai'i at Mānoa

3/20/2015

## **Why you should consider Computer Science or Information and Computer Sciences as your major?**

If you see yourself designing and creating software systems – then computer science might be the right course of study for you. If you are thinking of becoming a manager or administrator to a technical enterprise, a degree in computer science or information and computer sciences could provide you with the background needed to achieve your goals. If you are thinking about becoming a researcher in a technical field, information and computer sciences, could provide you with the skills and knowledge necessary to succeed.

Computer sciences is a dynamic and rapidly growing area that has become an integral part in the world that we live in today. Having a degree in this field will provide you with a deep understanding in the theories and emerging technologies allowing you to develop cutting edge solutions that address today's challenges. When applied in an interdisciplinary fashion, students can also draw on their other areas of interests such as biology, business, cyber security, economics, information assurance, languages and linguistics, mathematics, physics, public policy, etc. to address a wider range of complex issues.

### **About this program**

The University of Hawai'i at Mānoa, the Department of Information and Computer Sciences focuses on the study of the description and representation of information and the theory, design, analysis, implementation, and the application of algorithmic processes that transform information. This discipline draws on a solid foundation in mathematics, computer science theory, scientific principles and experience gained through practice as it applies to software engineering and research. Students are challenged in a problem based learning environment that allows them to develop their knowledge in such areas as algorithms, artificial intelligence, computer security, database systems, high performance computing, information assurance, networking, and software engineering. If you select to study in this field you will learn to develop and use computer systems that can be applied to all professions.

The Department of Information and Computer Sciences offers several programs to meet the interest of students. The Bachelor of Sciences degree in Computer Science is a traditional computer science program. Students are introduced to the subject, learn the theory and scientific principles to this field and later focus in an area of interest within computer science. The Bachelor of Arts in Information and Computer Sciences is an interdisciplinary program. It builds the same foundation as the Bachelor of Science program, but allows the students to apply computer science to an area of concentration that can be outside of this field. Within the Bachelor of Arts program are the Bioinformatics, and Information Technology focuses that also may be of interest to you.

To be admitted into the undergraduate program, first-year students entering the University of Hawai'i at Mānoa directly from high school must first be admitted into the Colleges of Arts and Sciences. Once accepted students can then declare Computer Science or Information and Computer Sciences as their major. For continuing and transfer students, a cumulative GPA of at least 2.00 on a 4.00 scale is required for admissions. Please note that for those entering the Bachelor of Arts in Information and Computer Sciences, a proposal is also required when declaring this major. These students should make an appointment to talk an ICS Academic Adviser to go over the program requirements.

### **Bachelor of Science (BS) in Computer Science (CS) Requirements**

The BS in CS degree offers a solid foundation in computer science. This degree provides students the opportunity to focus in an area of concentration within the computer science field.

Students must complete the following courses (50 credits):

- ICS 111, ICS 141, ICS 211, ICS 212, ICS 241,
- ICS 311, ICS 312 or ICS 331, ICS 313 or ICS 361, ICS 314, ICS 321, and ICS 332
- At least five ICS or other approved courses at the 400 level or above.

Substitutions are permitted with the written approval of a faculty adviser. Waiver of certain requirements, such as by Advanced Placement CS exam, must be approved by an ICS faculty adviser. All students wishing to enroll in ICS courses above ICS 211 except ICS 241 must meet the prerequisite grade requirement of B (not B-) or higher in ICS 111 and ICS 211 prior to registering for the course.

### **Bachelor of Science (BS) in Computer Science Security Science (CS SecSci)**

The BS in CS SecSci degree offers a solid foundation in computer science with a focus in cyber security. This degree provides students that opportunity to focus in this area of concentration within the computer science field.

Students must complete the following courses:

- ICS 111, ICS 141, ICS 211, ICS 212, ICS 241,
- At least five of the six courses from the following list: ICS 314, ICS 321, ICS 332, ICS 355 and ICS 315 or ICS 351;
- At least five electives from the following list: ICS 423, ICS 455 and moreover one from each of the following pairs:
  - ICS 414 or ICS 464
  - ICS 425 or ICS 426
  - ICS 491, or ICS 495

## **Bachelor of Science Degree Plan Process**

**1st Semester:** ICS 111, ICS 141

**2nd Semester:** ICS 211, ICS 241

**3rd Semester:** ICS 212, and one of ICS 311, ICS 312, ICS 314, ICS 321 and ICS 332

**4th Semester:** Take two to three of remaining five of ICS 300-level courses needed, i.e. ICS 311, ICS 312 or ICS 331, ICS 313, ICS 314, ICS 321, and ICS 332

In your fifth semester continue taking your remaining ICS 300-level courses. It is advised to take two or three ICS courses per semester. Note that after you start taking ICS 3xx level courses, you should look at which ICS 4xx level courses are being offered the following semester(s). If there is an ICS 4xx course that you are interested in and you have completed all of the prerequisites for that course, then you should strongly consider taking it the next semester rather than waiting. Many ICS 4xx courses are only offered every second or third semester; so if you wait, you may graduate before it is offered again.

If you have considerable computer experience you should not delay taking ICS 111. In order to do the work in ICS 111, you must know how to do simple file operations like locating, copying, deleting, and downloading files. You must be able to do basic word processing, know how to use email and how to use the internet, including searching. It is expected that you know how to do these operations in ICS 111 and they will not be taught in that class. ICS101B covers these topics and considerably more, including spreadsheets, presentation software (PowerPoint), and some experience with media files (photos and video). There is no reason why you should not take ICS 101B and ICS111 concurrently if you are not prepared for ICS 111.

ICS has a course, ICS 110-Introduction to Programming Through 3D Animations that introduces programming in a simpler environment than ICS 111. It is aimed at two types of students, 1) students who are not Computer Science majors and want an exposure to the concepts of computer science, and 2) students who are considering majoring in Computer Science but have very little background. Taking ICS 110 should make ICS 111 easier.

Ideally you should take ICS 111 and ICS 141 the first semester and then ICS 211 and ICS 241 the second semester. There isn't much flexibility here. If you took ICS 111 but not ICS 141, it is recommend that you take ICS 211 and ICS 141 concurrently, and then take ICS 241, and ICS 212 or ICS 215 the next semester.

ICS 211 is a gateway course for all of the ICS programs. It is the prerequisite course for ICS 212, ICS 311, ICS 312, ICS 314, ICS 321, and ICS 332. (If you take ICS 312 before ICS 212, you must take ICS 212 concurrently.) These are all difficult courses that present a lot of new material and programming. You are strongly advised not to take three or more of those courses in one semester.

## **Bachelor of Arts (BA) in Information and Computer Sciences (ICS) Requirements**

There are four BA degree options you can choose from the ICS department. The first is the general BA in ICS. This degree offers a firm foundation in computer science and allows students to apply computer science to an area of concentration. The second option is a BA in ICS with an IT Focus. This program puts less emphasis on programming and more on using computer systems, networks and information assurance. Third, is the BA in ICS with a Bioinformatics Focus. It provides strength in both the computer science and biology disciplines to prepare students for work in this exciting new area dealing with nucleotide and amino acid sequences.

Students pursuing these degrees are required to submit a short proposal listing the courses they intend to take to complete for their ICS major. An ICS faculty adviser must approve this proposal in writing. Samples of course proposals are available at the ICS department Office. As in the Bachelor of Science degree in Computer Science, all students wishing to enroll in ICS courses above ICS 211 except ICS 241 must meet the prerequisite grade requirement of B (not B-) or higher in ICS 111 and ICS 211 prior to registering for the course

### **General Bachelor of Arts (BA) in Information and Computer Sciences (ICS) Requirements**

Students must complete the following courses (52 credits):

- ICS 111, ICS 141, ICS 211, ICS 212, ICS 241,
- ICS 311, ICS 312 or ICS 331, ICS 313 or ICS 361, ICS 321, and ICS 332
- At least three ICS courses at the 400-level or above,
- Four upper division (300-level or above) courses in some area of concentration. The area of concentration courses DO NOT have to be from the same department. Note that they may include ICS courses and need to have a minimum total of 12 credit hours, but not ICS 390.

### **Bachelor of Arts (BA) in Information and Computer Sciences (ICS) Information & Technology (IT) Focus Requirements**

Students must complete the following courses (52 credits):

- ICS 111, ICS 141, ICS 211, ICS 212 or ICS 215,
- ICS 314, ICS 315, ICS 321, ICS 332, ICS 351,
- ICS 414, ICS 425, ICS 426, and ICS 464,
- At least four additional ICS courses at the 300-level or above, totaling a minimum of 12 credits hours, but not ICS 390.

## **Bachelor of Arts (BA) in Information and Computer Sciences (ICS) Bioinformatics Focus Requirements**

Students must complete the following courses (52 credits):

- ICS 111, ICS 141, ICS 211, ICS 212, ICS 241, ICS 311, ICS 312 or ICS 331, ICS 313 or ICS 361, ICS 321, ICS 332, ICS 475, ICS 476, and ICS 499,
- Biology BIOL 171/171L, BIOL 172/172L, BIOL 265, BIOL 275/275L, and BIOL 375,
- Three more biology classes above the 300 level chosen from a list of approved courses totaling nine credit hours. Please note that some of these courses may require BIOL 265L and BIOL 375L

## **Bachelor of Arts in Information and Computer Sciences Security Science (SecSci) Focus Requirements**

Students must complete the following courses:

- ICS 111, ICS 141, ICS 211, ICS 212 or ICS 215, ICS 241,
- Five of the following six: ICS 311 or ICS 314, ICS 321, ICS 332, ICS 355, ICS 351,
- ICS 414, ICS 455 and one from each of the following sets:
  - ICS 415 or ICS 423
  - ICS 425, ICS 426, ICS 491 or ICS 495
  - ICS 441 or ICS 451

## **General Bachelor of Arts Degree Plan Process**

If you choose the BA degree, you are required to take 12 credits above 300 in a related field. The 12 3xx-level or higher credits for the BA area concentration can be in any field(s) including ICS. The only requirement is that those courses along with the three (3) ICS 4xx electives must form a coherent plan of study. You are required to make a written plan and have it approved by a faculty member. There are precedents for almost any reasonable plan. The courses that you select now are not set in stone and you are free to change the courses in your proposal at any time simply by submitting a revised proposal and getting it approved by an ICS advisor. This is often necessary because the courses that that you first selected may not be available at the time you need them or other courses that are more suitable to your area of concentration may come along (e.g., a 491 Special Topics course or a new course in the chosen area). You are even free to choose a totally different area with completely different courses for the BA by submitting a new proposal. The reason why a proposal is initially required rather than waiting is so that you will know that the selected pre-approved courses will meet the BA in ICS requirements. Also, most 3xx level courses will have 1xx and/or 2xx level prerequisites that you will have to take before you can take those 3xx level courses. So when you are taking only two ICS courses/semester (e.g., 111 & 141 or 211 & 241), it is advised that you also take the prerequisite courses for the area

concentration.

If you have transfer credits or non-trivial questions about the general requirements for the degree, it is best to see an Arts and Sciences advisor in the Queen Li'liuokalani Center for Student Services, Room 113. These advisors take notes on the advice that they give and keep them in your official file until you graduate.

With respect to counting transfer credits toward the major requirements, be sure that an advisor evaluates and approves. Don't assume that they will be OK, unless a record of transfer credits shows a specific ICS course equivalent.

Undergraduate students may take graduate courses. If you are considering this, you need permission. The ICS department requires that the student have a B average in the ICS major as well as your overall GPA, the prerequisites for the course, and permission from the instructor. The instructor can process the necessary overrides for you to register for the course.

### **Minor Requirements**

A cumulative GPA of at least 2.00 and a grade of B (not B-) or higher in ICS 111 in are required for admission.

Students must complete ICS 111 and ICS 211 with a grade of B (not B-) in both classes; ICS 141, 212, and 241 with a C (not C-) or higher grade; and three ICS 300-level and above courses with a C (not C-) or higher grade. Note ICS 390 will not count toward these three classes.

### **Backtracking**

"Backtracking" is not permitted. This means that any additional credit and grade is not awarded for lower-level classes if they are taken after or concurrently to an advanced course for which they are explicitly or implicitly a prerequisite." (See UHM Catalog) In other words, if you take course A first and concurrently or later take course B that is listed as a prerequisite for course A, you will not get credit for course B toward the requirement 120 credits needed towards graduation. Note that if course B is required for the major, you will still have to take it and may need to take an addition course to meet the required credit hours.

### **Discrete Mathematics Substitution**

Math 301-Introduction to Discrete Mathematics and Math 371-Elementary Probability Theory may be substituted for ICS141 and ICS241. If you are going to double major in math, or minor in math, these math courses are the better choice. You need to ask your ICS advisor whether he/she are willing to waive both ICS141 and 241, if you take both Math 301 and 371 and count them towards the math program.

If you wish to double major with a BS in ICS and BS in Mathematics, then there is a requirement for math, for 24 credits in a field related to math (See UHM catalog). There is a special arrangement whereby the ICS 400-level courses can be counted double--both to meet the ICS requirement for 400-level courses and the math requirement for courses related to math. If you like math and can do well in it; this combination can be very valuable in many areas of computer science. It is especially true for working in the area of bioinformatics.

### **ICS 100 to 300-level Course Overviews**

All students wishing to enroll in ICS courses above 211 (except ICS241) must meet the prerequisite grade requirement of B (not B-) or higher in ICS 111 and 211 prior to registering for the course.

ICS courses below the 400 level that are required in at least one of the above programs is listed below:

**ICS 111 Introduction to Computer Science I (4)** Pre: Recommended: computer experience. ICS 110 is recommended, if students do not have any experience with computers.

**ICS 141-Discrete Mathematics for Computer Science I (3)**

**ICS 211-Introduction to Computer Science II (4)** Pre: grade of "B" (not "B-") or higher in 111 or consent.

**ICS 212-Program Structure (3)** Pre: grade of "B" (not "B-") or higher in 211 or consent.

**ICS 215-Introduction to Scripting (3)** Pre: 211 (or concurrent), or consent.

**ICS 241-Discrete Mathematics for Computer Science II (3)** Pre: 141 or consent.

**ICS 311-Algorithms (4)** Pre: grade of "B" (not "B-") or higher in 211 and 241, or consent.

**ICS 312-Machine-Level and Systems Programming (3)** Pre: 212 (or concurrent), or consent.

**ICS 313 Programming Language Theory (3)** Pre: 212 and 241, or consent.

**ICS 314-Software Engineering I (3)** Pre; grade of "B" (not "B-") or higher in 211, or consent.

**ICS 315-Web Design and Management (3)** Pre: 215 or consent.

**ICS 321-Data Storage and Retrieval (3)** Pre: grade of "B" (not "B-") or higher in 211, or consent.

**ICS 331-Logic Design and Microprocessors (4)** Pre: 212 or consent.

**ICS 332-Operating Systems (3)** Pre: grade of "B" (not "B-") or higher in 211.

**ICS 355-Security and Trust I: Resource Protections (3)** Pre ICS 241 or (Math 301 and Math 371) or consent.

**ICS 351-Network Design and Management (3)** Pre: 141 and grade of "B" (not "B-") or higher in 211, or consent.

**ICS 361-Introduction to Artificial Intelligence Programming (3)** Pre 241 and (212 or 215), or consent.

## ICS 400-level Course Overviews

The list provided below of ICS 400-level courses are intended to further provide students with topics of study in the major areas of computer science with an emphasis on software engineering, computer networks, artificial intelligence, human-computer interaction, and bioinformatics.

- ICS 414-Software Engineering II (3)** Pre: 314.
- ICS 415-Introduction to Programming for the Web (3)** Pre: 311 or consent.
- ICS 419-The Science, Psychology and Philosophy of Systems Design (3)** Pre: two ICS 300-level courses with a grades B or better, or consent.
- ICS 421 Database Systems (3)** Pre: 311 and 321, or consent.
- ICS 423 Computer Security (3)** Pre: 311 and 312, or consent
- ICS 425 Computer Security and Ethics (3)** Pre: At least two ICS 300-level courses or consent.
- ICS 426-Computer System Security (3)** Pre: ICS 351 or ICS 451 or consent.
- ICS 431-Computer Architecture (3)** Pre: 331, or consent.
- ICS 432-Concurrent and High-Performance Programming (3)** Pre: 311, or consent.
- ICS 435-Machine Learning Fundamentals (3)** Pre: 311 or consent.  
Recommended; MATH 307.
- ICS 441-Theory of Computation (3)** Pre: 313.
- ICS 442-Analytical Models and Methods (3)** Pre: 311 or consent.
- ICS 451-Data Networks (3)** Pre: 212 and 311, or consent.
- ICS 452-Software Design for Robotics** Pre: 331 or consent. Recommended 312 and 313.
- ICS 455-Security and Trust II: Information Assurance (3)** Pre: ICS 355 or consent.
- ICS 461-Artificial Intelligence (3)** Pre: 311 or consent.
- ICS 462-Artificial Intelligence for Games (3)** Pre: ICS 212 and (ICS 314 or ICS 361) and (PHYS 151 or PHYS 170), or consent.
- ICS 464-Human Computer Interaction (3)** Pre: 311 or consent.
- ICS 465-Introduction to Hypermedia (3)** Pre: 311 or consent.
- ICS 466-Design for Mobile Devices (3)** Pre: 311 or consent.
- ICS 469-Cognitive Science (3)** Pre: 311 or consent.
- ICS 471-Probability, Statistics, and Queuing (3)** Pre: 241 and 311, or consent.
- ICS 475-Introduction to Bioinformatics Sequences and Genomes Analysis (3)** Pre: 311 or consent.
- ICS 476- Bioinformatics Algorithms and Tool Development** Pre: ICS 475 or consent.
- ICS 481-Introduction to Computer Graphics (3)** Pre: 311 and either MATH 216, MATH 242, or MATH 252A; or consent.
- ICS 483-Computer Vision (3)** Pre: 212 and 311, or consent.
  
- ICS 484-Data Visualization (3)** Pre: At least two ICS 300-level courses or consent.
- ICS 491-Special Topics (3)** Pre: at least two 300-level ICS classes or consent.

(Depending on the topic.)

**ICS 495-Special Security Topics (3)** Pre: At least two ICS 300-level courses or consent.

**ICS 499-Computer Project (V)** Pre: Consent.

### **Epilogue**

The faculty collectively has a great deal of valuable experience and knowledge. You are encouraged to learn as much as you can from each faculty member. You will very likely find that some of the things that you were not enthusiastic about as a student will prove to be valuable to you later. You are encouraged to ask around about instructors' reputations and be selective when possible. Don't hesitate to ask for help and advice. It is the ICS faculty's job to provide students a good education. The faculty takes that responsibility seriously. It is what they want to do.

**Sample  
BS and BA  
Schedules**

# Sample Schedule: B.S. in Computer Science

(for students on the 2014-2015 Arts & Sciences College Program Requirements and are declared CS majors)

Attached is a sample schedule for a student seeking a Bachelor of Science (BS) in Computer Science. Please note the following important points:

- **This schedule is only a starting point.** The sample schedule was created to assist you when meeting with your advisor(s) to plan coursework, and does not include all the coursework required for a degree as you are able to “double-dip” some of your requirements. It is more a “point of departure” than a “road map,” and should not be considered a substitute for meeting with your advisor(s) and devising a 4 year plan that matches your interests and goals. You may also attend summer session as a means of getting ahead or completing the coursework shown in the schedule.
- **The sample schedule is only a planning aid. It does not include all the requirements for a degree.** UHM students have an exceptional amount of freedom in crafting their own college experience, choosing from breadth of academic fields, and fulfilling degree requirements using a wide range of course offerings. This freedom invites students to explore connections between fields, engage in co-curricular activities, and develop unique combinations of majors, minors, and certificates. Because of this, it is impossible to provide you with a “one-size-first-all” schedule. Nevertheless, if used wisely, it can provide you with an excellent starting point for your own, individualized academic plan.
- **You should meet regularly with ICS Department faculty advisors and A&S academic advisors for specific details on the various requirements.** Students must be active partners in the advising process. This responsibility includes researching curricular and co-curricular opportunities, creating educational plans, and discussing those plans with your advisors. You are strongly encouraged to meet with advisors on a yearly basis to confirm that you are still on track.
- **Additional information on CS major requirements that appear on the sample schedule:**
  - The Bachelor of Science (BS) degree offers a solid foundation in computer science and provides students the opportunity to focus in an area of concentration within the computer science field.
  - **Approved substitutions for the calculus, and physics requirements:**
    - MATH 241: Math 215, or Math 251
    - MATH 242: Math 216, or Math 252
    - PHYS 151/151L, or Phys 170/170L
    - PHYS 152/152L, or Phys 272/272L
  - **Junior/Senior Electives:**
    - ICS 400+ electives: five ICS (or approved) 400-level courses, including at most three credits of ICS 499 and six credits of ICS 491.

# Bachelor of Science (BS) in Computer Science

Program Sheet 2015-2016

Min. Total Credits: 120 (108 in core & major + 12 in electives)

UHM General Education Core Requirements
<b>Foundations</b>
<input type="checkbox"/> FW
<input type="checkbox"/> FS
<input type="checkbox"/> FG (A / B / C)
<input type="checkbox"/> FG (A / B / C)
<b>Diversification</b>
<input type="checkbox"/> DA / DH / DL
<input type="checkbox"/> DA / DH / DL
<input type="checkbox"/> DB
<input type="checkbox"/> DP
<input type="checkbox"/> DY
<input type="checkbox"/> DS
<input type="checkbox"/> DS
<i>* See degree, college and major requirements for courses that can also fulfill these.</i>
UHM Graduation Requirements
<b>Focus</b>
<input type="checkbox"/> H
<input type="checkbox"/> E (300+)
<input type="checkbox"/> O (300+)
<input type="checkbox"/> W
<input type="checkbox"/> W
<input type="checkbox"/> W
<input type="checkbox"/> W (300+)
<input type="checkbox"/> W (300+)
<b>Hawaiian / Second Language</b>
<input type="checkbox"/> 101
<input type="checkbox"/> 102
<input type="checkbox"/> 201
<input type="checkbox"/> 202
<b>Credit Minimums</b>
• 120 total applicable
• 30 in residence at UHM
• 60 non-introductory
<b>Grade Point Average</b>
• 2.0 cumulative or higher ( <i>Note: Other GPAs may be required.</i> )
• Good academic standing

Degree Requirements
<b>Bachelor of Science Requirements</b>
<input type="checkbox"/> MATH 215*FS or 241*FS
<input type="checkbox"/> MATH 216 or 242
<input type="checkbox"/> DB course
<input type="checkbox"/> CHEM 161*DP / <input type="checkbox"/> 161L*DY
<input type="checkbox"/> CHEM 162*DP / <input type="checkbox"/> 162L*DY
<input type="checkbox"/> PHYS 151*DP or 170*DP / <input type="checkbox"/> 151L*DY or 170L*DY
<input type="checkbox"/> PHYS 152*DP or 272*DP / <input type="checkbox"/> 152L*DY or 272L*DY
<b>College Requirements</b>
<b>A &amp; S Options - Complete at least one option</b>
See degree requirements above.
<b>Credit Maximums</b>
• 8 KRS activity
• 9 Directed Reading / Research
• 12 Practicum / Internship

*This program sheet was prepared to provide information and does not constitute a contract.*

*See back for major requirements.*

*Meet regularly with your major advisor.*

**Major Requirements for BS in Computer Sciences**

Admission: Open

Application: NA

Min. major credits: BS = 50

Min. B (not B-) grade in ICS 111 and 211; min. C grade (not C-) in all other courses

**Requirements****ICS Core Courses (33 credits)** ICS 111 minimum "B" (not "B-") grade or higher to advance ICS 141\*FS ICS 211 minimum "B" (not "B-") grade or higher to advance ICS 212 ICS 241\*FS ICS 311 ICS 312 or ICS 331 ICS 313 or ICS 361 ICS 321 ICS 332 **BS only (18 credits)** ICS 314 ICS 400+ ICS 400+ ICS 400+ ICS 400+ ICS 400+**Notes**

Information and Computer Sciences Department: POST 317; (808) 956-7420; icsinfo@hawaii.edu; www.ics.hawaii.edu

ICS Undergraduate Advisor: Gerald Lau; POST 303A; (808) 956-5428; glau@hawaii.edu

[http://www.advising.hawaii.edu/artsci/pages/resources/lib\\_art\\_degrees/majorskills/majorskills\\_ics.asp#ICS\\_SCHED](http://www.advising.hawaii.edu/artsci/pages/resources/lib_art_degrees/majorskills/majorskills_ics.asp#ICS_SCHED)

# University of Hawai'i at Mānoa – Four-Year Academic Plan 2015-2016

## Bachelor of Science (BS) in Computer Sciences

This is a sample academic plan. You should meet with an academic advisor prior to registration to formulate your own plan.

Year 1			Year 2			Year 3			Year 4		
Fall			Fall			Fall			Fall		
	ICS 111	4	NI	ICS 212	3	NI	ICS 313 or 361	3	NI	ICS 400+ Elective	3
	ICS 141	3	NI	ICS 311	4	NI	ICS 314	3	NI	ICS 400+ Elective	3
NI	MATH 241 (FS)	4		CHEM 161 (DP)	3		DA/DH/DL	3		PHYS 151 or PHYS 170	3
	FW	3		CHEM 161L (DY)	1	NI	HSL 201	3		PHYS 151L or PHYS 170L	1
				FG (A/B/C)	3		Elective 300+	3	NI	Elective 300+	3
				HSL 101	3				NI	Elective 300+	3
Credits		14	Credits		17	Credits		15	Credits		16
Spring			Spring			Spring			Spring		
NI	ICS 211	4	NI	ICS 312 or 331	3	NI	ICS 332	3	NI	ICS 400+ Elective	3
NI	ICS 241	3	NI	ICS 321	3	NI	ICS 400+ Elective	3	NI	ICS 400+ Elective	3
NI	MATH 242	4		CHEM 162	3		DS	3		PHYS 152 or PHYS 272	3
	FG (A/B/C)	3		CHEM 162L	1		DB	3		PHYS 152L or PHYS 272L	1
	DS	3		DA/DH/DL	3	NI	HSL 202	3		Elective	3
				HSL 102	3						
Credits		17	Credits		16	Credits		15	Credits		13
Summer			Summer			Summer			Summer		
Credits		0	Credits		0	Credits		0	Credits		0
<b>Total Credits</b>		<b>31</b>	<b>Total Credits</b>		<b>64</b>	<b>Total Credits</b>		<b>94</b>	<b>Total Credits</b>		<b>121</b>

**Notes:**

- Students must take placement exams to be able to register for CHEM 161 and MATH 215 or 241.
- CHEM 425/425L (Inorganic Chemistry) is offered only in the Fall; CHEM 445/445L (Organic Chemistry) is offered only in the Spring.
- Students must incorporate all focus requirements into this plan.
- 60 non-introductory credits are required for A&S Natural Sciences majors.

# Sample Schedule: General B.A. in Information & Computer Sciences

(for students on the 2014-2015 Arts & Sciences College Program Requirements and are declared ICS majors)

Attached is a sample schedule for a student seeking a Bachelor of Arts (B.A.) in Information & Computer Sciences. Please note the following important points:

- **This schedule is only a starting point.** The sample schedule was created to assist you when meeting with your advisor(s) to plan coursework, and does not include all the coursework required for a degree as you are able to “double-dip” some of your requirements. It is more a “point of departure” than a “road map,” and should not be considered a substitute for meeting with your advisor(s) and devising a 4 year plan that matches your interests and goals. You may also attend summer session as a means of getting ahead or completing the coursework shown in the schedule.
- **The sample schedule is only a planning aid. It does not include all the requirements for a degree.** UHM students have an exceptional amount of freedom in crafting their own college experience, choosing from breadth of academic fields, and fulfilling degree requirements using a wide range of course offerings. This freedom invites students to explore connections between fields, engage in co-curricular activities, and develop unique combinations of majors, minors/certificates and their coursework in general. Because of this, it is impossible to provide you with a “one-size-fits-all” schedule. Nevertheless, if used wisely, it can provide you with an excellent starting point for your own, individualized academic plan.
- **You should meet regularly with ICS Department faculty advisors and A&S academic advisors for specific details on the various requirements.** Students must be active partners in the advising process. This responsibility includes researching curricular and co-curricular opportunities, creating educational plans, and discussing those plans with your advisors. You are strongly encouraged to meet with advisors on a yearly basis to confirm that you are still on track.
- **Additional information on ICS major requirements that appear on the sample schedule:** The intent of the Bachelor of Arts degree is to allow computer science to be combined with another discipline. Students seeking a BA should write a short (one page or less) proposal specifying the seven courses they will use for their ICS and area concentration electives. The proposal should explain how these courses form a coherent plan of study combining computer science with another field. This course proposal must be approved by an ICS undergraduate advisor and can be modified later with written approval to account for availability of courses or changes in the student's interests (which may require a new proposal and rationale).
- **Junior/Senior Electives:**
  - ICS 400+ electives: complete three ICS (or approved) 400-level courses, including at most three credits of ICS 499 and three credits of ICS 491.
  - Area concentration electives: complete four upper division (300-level or above) courses in some area of concentration (e.g., art, business, music, education).
  - All seven electives must be approved by an ICS advisor.

# General Bachelor of Arts (BA) in Information & Computer Sciences

## Program Sheet 2015-2016

Min. Total Credits: 120 (101 in core & major + 19 in electives)

UHM General Education Core Requirements
<b>Foundations</b>
<input type="checkbox"/> FW
<input type="checkbox"/> FS
<input type="checkbox"/> FG (A / B / C)
<input type="checkbox"/> FG (A / B / C)
<b>Diversification</b>
<input type="checkbox"/> DA / DH / DL
<input type="checkbox"/> DA / DH / DL
<input type="checkbox"/> DB
<input type="checkbox"/> DP
<input type="checkbox"/> DY
<input type="checkbox"/> DS
<input type="checkbox"/> DS
<i>* See degree, college and major requirements for courses that can also fulfill these.</i>
UHM Graduation Requirements
<b>Focus</b>
<input type="checkbox"/> H
<input type="checkbox"/> E (300+)
<input type="checkbox"/> O (300+)
<input type="checkbox"/> W
<input type="checkbox"/> W
<input type="checkbox"/> W
<input type="checkbox"/> W (300+)
<input type="checkbox"/> W (300+)
<b>Hawaiian / Second Language</b>
<input type="checkbox"/> 101
<input type="checkbox"/> 102
<input type="checkbox"/> 201
<input type="checkbox"/> 202
<b>Credit Minimums</b>
• 120 total applicable
• 30 in residence at UHM
• 60 non-introductory credits
<b>Grade Point Average</b>
• 2.0 cumulative or higher <i>(Note: Other GPAs may be required.)</i>
• Good academic standing

Degree Requirements
<b>Bachelor of Arts Requirement (Can also fulfill FS)</b>
<input type="checkbox"/> MATH 100, 112, 140, 161, 203, 215, 241, 251A; PHIL 110, 111; BUS 250; ICS 141, 241; NREM 203; or SOCS 150
<b>Credit Maximums</b>
• 8 KRS activity
• 9 Directed Reading / Research
• 12 Practicum / Internship

*This program sheet was prepared to provide information and does not constitute a contract.  
 See back for major requirements.  
 Meet regularly with your major advisor.*

**Major Requirements for General BA in Information and Computer Sciences**

Admission: Open

Application: NA

Min. major credits: BA = 52

Min. B (not B-) grade in ICS 111 and 211; min. C grade (not C-) in all other courses

**Requirements****ICS Core Courses (33 credits)** ICS 111 minimum "B" (not "B-") grade or higher to advance ICS 141\*<sup>FS</sup> ICS 211 minimum "B" (not "B-") grade or higher to advance ICS 212 (or ICS 215 for IT Focus) ICS 241\*<sup>FS</sup> ICS 311 ICS 312 or ICS 331 ICS 313 or ICS 361 ICS 321 ICS 332

Courses differ for students pursuing the IT focus.

 **BA only (21 credits)** ICS 400+ ICS 400+ ICS 400+

Courses differ for students pursuing the IT or Bioinformatics focus. Students interested in either option are referred to an ICS advisor.

**Four upper-division electives in an area of concentration (12 credits):** 300+ 300+ 300+ 300+

A proposal identifying upper-division elective courses and how they form a coherent plan of study must be approved by an ICS advisor.

**Notes**Information and Computer Sciences Department: POST 317; (808) 956-7420; [icsinfo@hawaii.edu](mailto:icsinfo@hawaii.edu); [www.ics.hawaii.edu](http://www.ics.hawaii.edu)ICS Undergraduate Advisor: Gerald Lau; POST 303A; (808) 956-5428; [glau@hawaii.edu](mailto:glau@hawaii.edu)[http://www.advising.hawaii.edu/arts/pages/resources/lib\\_art\\_degrees/majorskills/majorskills\\_ics.asp#ICS\\_SCHED](http://www.advising.hawaii.edu/arts/pages/resources/lib_art_degrees/majorskills/majorskills_ics.asp#ICS_SCHED)

## University of Hawai'i at Mānoa – Four-Year Academic Plan 2015-2016 General Bachelor of Arts (BA) in Information and Computer Sciences

This is a sample academic plan. You should meet with an academic advisor prior to registration to formulate your own plan.

Year 1		Year 2		Year 3		Year 4					
<b>Fall</b>		<b>Fall</b>		<b>Fall</b>		<b>Fall</b>					
ICS 111	4	NI	ICS 212	3	NI	ICS 313 or 361	3	NI	ICS 400+	3	
ICS 141 (FS)	3	NI	ICS 311	4	NI	ICS 400+	3	NI	Major 300+	3	
FW	3		HSL 102	3	NI	HSL 202	3	NI	Major 300+	3	
FG (A/B/C)	3		DA/DH/DL	3		DA/DH/DL	3		Elective	3	
Elective	3		Elective	3		DS	3		Elective	3	
Credits		16	Credits		16	Credits		15	Credits		15
<b>Spring</b>		<b>Spring</b>		<b>Spring</b>		<b>Spring</b>					
NI	ICS 211	4	NI	ICS 321	3	NI	ICS 400+	3	NI	ICS 400+	3
NI	ICS 241	3	NI	ICS 312 or 331	3	NI	ICS 332	3	NI	Major 300+	3
	FG (A/B/C)	3	NI	HSL 201	3	NI	Major 300+	3	NI	Elective 300+	3
	HSL 101	3		DS	3		DB	3	NI	Elective 300+	3
	Elective	3		Elective	3		DP	3		Elective	3
							DY	1			
Credits		16	Credits		15	Credits		16	Credits		15
<b>Summer</b>		<b>Summer</b>		<b>Summer</b>		<b>Summer</b>					
Credits		0	Credits		0	Credits		0	Credits		0
<b>Total Credits</b>		<b>32</b>	<b>Total Credits</b>		<b>63</b>	<b>Total Credits</b>		<b>94</b>	<b>Total Credits</b>		<b>124</b>

**Notes:**

- Students need to have a degree proposal approved by an ICS advisor prior to declaring ICS.
- Students must incorporate all focus requirements into this plan.
- 60 non-introductory credits are required for A&S Natural Sciences majors.

# Sample Schedule: B.A. in Information & Computer Sciences IT Focus

(for students on the 2014-2015 Arts & Sciences College Program Requirements and are declared ICS majors)

Attached is a sample schedule for a student seeking a Bachelor of Arts (B.A.) in Information & Computer Sciences. Please note the following important points:

- **This schedule is only a starting point.** The sample schedule was created to assist you when meeting with your advisor(s) to plan coursework, and does not include all the coursework required for a degree as you are able to “double-dip” some of your requirements. It is more a “point of departure” than a “road map,” and should not be considered a substitute for meeting with your advisor(s) and devising a 4 year plan that matches your interests and goals. You may also attend summer session as a means of getting ahead or completing the coursework shown in the schedule.
- **The sample schedule is only a planning aid. It does not include all the requirements for a degree.** UHM students have an exceptional amount of freedom in crafting their own college experience, choosing from breadth of academic fields, and fulfilling degree requirements using a wide range of course offerings. This freedom invites students to explore connections between fields, engage in co-curricular activities, and develop unique combinations of majors, minors/certificates and their coursework in general. Because of this, it is impossible to provide you with a “one-size-fits-all” schedule. Nevertheless, if used wisely, it can provide you with an excellent starting point for your own, individualized academic plan.
- **You should meet regularly with ICS Department faculty advisors and A&S academic advisors for specific details on the various requirements.** Students must be active partners in the advising process. This responsibility includes researching curricular and co-curricular opportunities, creating educational plans, and discussing those plans with your advisors. You are strongly encouraged to meet with advisors on a yearly basis to confirm that you are still on track.
- **Additional information on ICS major requirements that appear on the sample schedule:** The intent of the Bachelor of Arts degree is to allow computer science to be combined with another discipline. Students seeking a BA should write a short (one page or less) proposal specifying the seven courses they will use for their ICS and area concentration electives. The proposal should explain how these courses form a coherent plan of study combining computer science with another field. This course proposal must be approved by an ICS undergraduate advisor and can be modified later with written approval to account for availability of courses or changes in the student's interests (which may require a new proposal and rationale).
- **Junior/Senior Electives:**
  - ICS 400+ electives: complete three ICS (or approved) 400-level courses, including at most three credits of ICS 499 and three credits of ICS 491.
  - Area concentration electives: complete four upper division (300-level or above) courses in some area of concentration (e.g., art, business, music, education).
  - All seven electives must be approved by an ICS advisor.

# Bachelor of Arts (BA) in Information & Computer Sciences / IT Focus

## Program Sheet 2015-2016

Min. Total Credits: 120 (101 in core & major + 19 in electives)

UHM General Education Core Requirements
<b>Foundations</b>
<input type="checkbox"/> FW
<input type="checkbox"/> FS
<input type="checkbox"/> FG (A / B / C)
<input type="checkbox"/> FG (A / B / C)
<b>Diversification</b>
<input type="checkbox"/> DA / DH / DL
<input type="checkbox"/> DA / DH / DL
<input type="checkbox"/> DB
<input type="checkbox"/> DP
<input type="checkbox"/> DY
<input type="checkbox"/> DS
<input type="checkbox"/> DS
<i>* See degree, college and major requirements for courses that can also fulfill these.</i>
UHM Graduation Requirements
<b>Focus</b>
<input type="checkbox"/> H
<input type="checkbox"/> E (300+)
<input type="checkbox"/> O (300+)
<input type="checkbox"/> W
<input type="checkbox"/> W
<input type="checkbox"/> W
<input type="checkbox"/> W (300+)
<input type="checkbox"/> W (300+)
<b>Hawaiian / Second Language</b>
<input type="checkbox"/> 101
<input type="checkbox"/> 102
<input type="checkbox"/> 201
<input type="checkbox"/> 202
<b>Credit Minimums</b>
• 120 total applicable
• 30 in residence at UHM
• 60 non-introductory credits
<b>Grade Point Average</b>
• 2.0 cumulative or higher ( <i>Note: Other GPAs may be required.</i> )
• Good academic standing

Degree Requirements
<b>Bachelor of Arts Requirement (Can also fulfill FS)</b>
<input type="checkbox"/> MATH 100, 112, 140, 161, 203, 215, 241, 251A; PHIL 110, 111; BUS 250; ICS 141, 241; NREM 203; or SOCS 150
<b>Credit Maximums</b>
• 8 KRS activity
• 9 Directed Reading / Research
• 12 Practicum / Internship

*This program sheet was prepared to provide information and does not constitute a contract.*

*See back for major requirements.*

*Meet regularly with your major advisor.*

**Major Requirements for BA in Information and Computer Sciences / IT Focus**

Admission: Open

Application: NA

Min. major credits: BA = 52

Min. B (not B-) grade in ICS 111 and 211; min. C grade (not C-) in all other courses

**Requirements****ICS Core Courses (31 credits)** ICS 111 minimum "B" (not "B-") grade or higher to advance ICS 141\*FS ICS 211 minimum "B" (not "B-") grade or higher to advance ICS 212 or ICS 215 ICS 314 ICS 315 ICS 321 ICS 332 ICS 351 ICS 414 ICS 425 ICS 426 ICS 464 **BA only (12 credits)** ICS 300 or 400+ ICS 300 or 400+ ICS 300 or 400+ ICS 300 or 400+

Courses differ for students pursuing the IT or Bioinformatics focus. Students interested in either option are referred to an ICS advisor.

A proposal identifying upper-division elective courses and how they form a coherent plan of study must be approved by an ICS advisor.

**Notes**

Information and Computer Sciences Department: POST 317; (808) 956-7420; [icsinfo@hawaii.edu](mailto:icsinfo@hawaii.edu); [www.ics.hawaii.edu](http://www.ics.hawaii.edu)

ICS Undergraduate Advisor: Gerald Lau; POST 303A; (808) 956-5428; [glau@hawaii.edu](mailto:glau@hawaii.edu)

[http://www.advising.hawaii.edu/artsci/pages/resources/lib\\_art\\_degrees/majorskills/majorskills\\_ics.asp#ICS\\_SCHED](http://www.advising.hawaii.edu/artsci/pages/resources/lib_art_degrees/majorskills/majorskills_ics.asp#ICS_SCHED)

## University of Hawai'i at Mānoa – Four-Year Academic Plan 2015-2016 Bachelor of Arts (BA) in Information and Computer Sciences / IT Focus

This is a sample academic plan. You should meet with an academic advisor prior to registration to formulate your own plan.

Year 1		Year 2			Year 3			Year 4				
<b>Fall</b>		<b>Fall</b>			<b>Fall</b>			<b>Fall</b>				
	ICS 111	4	NI	ICS 212 or 215	3	NI	ICS 321	3	NI	ICS 426	3	
	ICS 141 (FS)	3	NI	ICS 314	3	NI	ICS 332	3	NI	ICS 300+	3	
	FW	3		HSL 102	3	NI	HSL 202	3	NI	ICS 300+	3	
	FG (A/B/C)	3		DA/DH/DL	3		DA/DH/DL	3		Elective	3	
	Elective	3		Elective	3		DS	3		Elective	3	
Credits		16	Credits			15	Credits		15	Credits		15
<b>Spring</b>		<b>Spring</b>			<b>Spring</b>			<b>Spring</b>				
NI	ICS 211	4	NI	ICS 414	3	NI	ICS 351	3	NI	ICS 300+	3	
	FG (A/B/C)	3	NI	ICS 315	3	NI	ICS 425	3	NI	ICS 300+	3	
	HSL 101	3	NI	HSL 201	3	NI	ICS 464	3	NI	Elective 300+	3	
	Elective	3		DS	3		DB	3	NI	Elective 300+	3	
	Elective	3		Elective	3		DP	3		Elective	3	
							DY	1				
Credits		16	Credits			15	Credits		16	Credits		15
<b>Summer</b>		<b>Summer</b>			<b>Summer</b>			<b>Summer</b>				
Credits		0	Credits			0	Credits		0	Credits		0
<b>Total Credits</b>		<b>32</b>	<b>Total Credits</b>			<b>62</b>	<b>Total Credits</b>		<b>93</b>	<b>Total Credits</b>		<b>123</b>

**Notes:**

- Students need to have a degree proposal approved by an ICS advisor prior to declaring ICS.
- Students must incorporate all focus requirements into this plan.
- 60 non-introductory credits are required for A&S Natural Sciences majors.

## **Assistance**

### **Admissions and Records**

[www.manoa.hawaii.edu/admissions/undergrad/](http://www.manoa.hawaii.edu/admissions/undergrad/)

### **Office of Admissions**

Queen Lili'uokalani Center for Student Services,  
Rm. 001  
808.956.8975, 800.823.9771  
808.956.7943 for Text (V/T)

### **Office of the Registrar/Records Office**

[www.manoa.hawaii.edu/records/](http://www.manoa.hawaii.edu/records/)  
Queen Lili'uokalani Center for Student Services,  
Rm. 010  
808.956.8010

### **Athletics**

[www.hawaiiathletics.com](http://www.hawaiiathletics.com)

### **Bookstore**

[www.bookstore.hawaii.edu/manoa](http://www.bookstore.hawaii.edu/manoa)  
800.842.6657

### **Cashier's Office**

Queen Lili'uokalani Center for Student Services,  
Rm. 105  
808.956.7554

### **Financial Aid / Scholarships**

[www.hawaii.edu/fas](http://www.hawaii.edu/fas)  
Queen Lili'uokalani Center for Student Services,  
Rm. 112  
808.956.7251

### **Health Services**

[www.hawaii.edu/shs](http://www.hawaii.edu/shs)  
1710 East-West Road  
Honolulu, HI 96822  
808.956.8965

### **Housing Services**

[www.manoa.hawaii.edu/housing](http://www.manoa.hawaii.edu/housing)  
2569 Dole Street, Frear Hall  
Honolulu, HI 96822  
808.956.8177

### **Information and ID card**

[www.manoa.hawaii.edu/onecard/](http://www.manoa.hawaii.edu/onecard/)  
Campus Center, Rm. 212  
808.956.7235, 808.956.7236

### **International Student Services**

[www.hawaii.edu/issmanoa](http://www.hawaii.edu/issmanoa)  
Queen Lili'uokalani Center for Student Services, Rm. 206  
808.956.8613

### **Kokua Program (Disability and Special Needs Services)**

[www.hawaii.edu/kokua](http://www.hawaii.edu/kokua)  
Queen Lili'uokalani Center for Student Services, Rm. 013  
808.956.7511, V/T 808.956.7612

### **Manoa Advising Center (Academic Advising)**

[www.manoa.hawaii.edu/undergrad/mac/](http://www.manoa.hawaii.edu/undergrad/mac/)  
Queen Lili'uokalani Center for Student Services, Rm. 101  
808.956.7273

### **New Student Orientation**

[www.hawaii.edu/nso](http://www.hawaii.edu/nso)  
Campus Center, Rm. 208  
808.956.3667, 888.700.5420

### **Parking Office**

[www.hawaii.edu/parking](http://www.hawaii.edu/parking)  
Queen Lili'uokalani Center for Student Services, Rm. 014  
808.956.8899

### **Security (24-hour Assistance)**

[www.hawaii.edu/security](http://www.hawaii.edu/security)  
1951 East-West Road  
Honolulu, HI 96822  
808.956.6911

### **Manoa Career Center (On or Off Campus Jobs)**

[www.manoa.hawaii.edu/careercenter](http://www.manoa.hawaii.edu/careercenter)  
Queen Lili'uokalani Center for Student Services, Rm. 212  
808.956.7007

### **Placement Examinations and Course Placement**

[www.manoa.hawaii.edu/records/register/place\\_exams/index.html](http://www.manoa.hawaii.edu/records/register/place_exams/index.html)

### **University Operator – Switchboard**

808.956.8111

