## California State University Channel Islands

## Program Modification

Program modifications must be submitted by October 15, 2010, and finalized by the end of the fall semester for catalog production. Enter data in YELLOWED areas.

Date (Change date if modified and update the file name with the new date): 9/12/11 REV 9/26/11
Program Area: COMPUTER SCIENCE
Semester /Year First affected: FALL 2012
Instructions: Please use this Program Modification form for changes to existing program requirements, units, outcomes, emphases or options, or for other programmatic concerns. For minor changes (faculty or address changes, additions of approved electives, minor editing for clarity, and other minor updates) use the Program Update form, available at the Curriculum website.

Paste the latest approved version of your entire program in the left AND right boxes below. Make your deletions in the LEFT column by using the strikeout feature in Word or underlining, and highlight. Insert new language or other changes to the program on the RIGHT and highlight in YELLOW for easy identification. If possible, please align the two columns so that changes appear side-by-side with the original text.

CURRENTLY APPROVED PROGRAM

## COMPUTER SCIENCE

Programs Offered

- Bachelor of Science in Computer Science
- Minor in Computer Science
- Minor in Computer Game Design \& Development (see Computer Game Design and Development)
- Minor in Robotics Engineering
- Master of Science in Computer Science
- Bachelor of Science in Information Technology (see Information Technology)

The Computer Science degree offers the latest cutting edge education for various industrial and applied fields. Students are given a strong background in computer hardware and software, as well as a substantial amount of "hands-on" experience. The program stresses interdisciplinary applications in other sciences and business

## PROPOSED PROGRAM

## COMPUTER SCIENCE

Programs Offered

- Bachelor of Science in Computer Science
- Minor in Computer Science
- Minor in Computer Game Design \& Development (see Computer Game Design and Development)
- Minor in Robotics Engineering
- Master of Science in Computer Science
- Bachelor of Science in Information Technology (see Information Technology)

The Computer Science degree offers the latest cutting edge education for various industrial and applied fields. Students are given a strong background in computer hardware and software, as well as a substantial amount of "hands-on" experience. The program stresses interdisciplinary applications in other sciences and business

## and prepares students for graduate studies.

## Careers

The program prepares students for careers in high-tech, computer and Internetdriven industries, where interdisciplinary, dynamic and innovative professionals trained in the latest technologies are increasingly sought.

## Program Learning Outcomes

Students graduating from the Computer Science program will be able to:

- Demonstrate critical thinking and problem solving skills by identifying, evaluating, analyzing and presenting fundamental software solutions and their applications;
- Demonstrate the knowledge of current computing practices and broad technology use in industry and society, including a working knowledge of software development techniques;
- Be cognizant of emerging new technologies and industrial practices connected to the computer industry;
- Demonstrate communication, research and cooperation skills by working effectively with others in interdisciplinary group settings - both inside and outside the classroom; and
- Demonstrate a sense of exploration that enables them to pursue rewarding careers in high-tech and bio-tech industries with life-learning.


## Faculty

William J. Wolfe, Ph.D.
Professor of Computer Science
Bell Tower West, Room 2225
(805) 437-8985
william.wolfe@csuci.edu
Peter Smith, Ph.D.
Professor of Computer Science
Interim Chair, Computer Science Program
Academic Advisor
Bell Tower West, Room 2265
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peter.smith@csuci.edu
Andrzej A. J. Bieszczad, Ph.D.
Associate Professor of Computer Science
Director of the Masters Program

## and prepares students for graduate studies

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## Contact Information

http://compsci.csuci.edu

## Bachelor of Science in Computer Science - (123 units)

## Special Grade Requirement

A grade of C - or better is required in all pre-requisite courses in the major Lower Division Required Major Courses ..................... 42
Upper Division Required Major Courses ...................... 29
Upper Division Elective Major Courses......................... 12
Elective Courses................................................................
General Education
s Requirement.......................... 28

American Institutions Requirement ................................ 6
total $\qquad$ 123 units

Note: General Education Included in Major Requirements 14
Lower Division Requirements - 42 units
COMP 150 Object-Oriented Programming, GE B4.. 4
COMP 151 Data Structures and Program Design ... 4
COMP 162 Computer Architecture and
Assembly Language $\qquad$
COMP 232 Programming Languages ..................... 3
COMP 262 Computer Organization and Architecture3
MATH 150 Calculus I, GE B3.................................. 4
MATH 151 Calculus II.............................................. 4
MATH 230 Logic and Mathematical Reasoning, GE A3, B3 $\qquad$
MATH 240 Linear Algebra........................................ 3

## Science

Choose either:
a. Physics 200 General Physics I (4), Physics 201 General Physics II (4) and a course from GE section B2 (3). or
b. Physics 200 General Physics I (4), Biology 200 Principles

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ai.bieszczad@csuci.edu

## Contact Information

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## Bachelor of Science in Computer Science - (123 units)

## Special Grade Requirement

A grade of C - or better is required in all pre-requisite courses in the major

$$
\text { Lower Division Required Major Courses ...................... } 42
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Upper Division Required Major Courses ..... 29
Upper Division Elective Major Courses . ..... 12
Elective Courses. ..... 6
General Education ..... 28
American Institutions Requirement .....  6
TOTAL

$\qquad$
123 units

Note: General Education Included in Major Requirements 14

## Lower Division Requirements - 42 units

COMP 150 Object-Oriented Programming, GE B4.4
COMP 151 Data Structures and Program Design ... 4
COMP 162 Computer Architecture and
Assembly Language $\qquad$
$\qquad$
Programming Languages 3$\begin{array}{lll}\text { COMP } & 262 & \text { Computer Organization and Architecture3 } \\ \text { MATH } & 150 & \text { Calculus I, GE B3.......................... } 4\end{array}$
MATH 151 Calculus II
4
MATH 230 Logic and Mathematical Reasoning,GE A3, B3 3
MATH 240 Linear Algebra. .....  3

## Science

Choose either:
a. Physics 200 General Physics I (4), Physics 201 General Physics II (4) and a course from GE section B2 (조).
or
b. Physics 200 General Physics I (4), Biology 200 Principles
of Organismal and Population Biology (4), Biology 212
Neurobiology and Cognitive Science (3) GE B1 and B2
Upper Division Requirements - 41 units

| Major Requirements - 29 units |  |  |
| :---: | :---: | :---: |
| COMP 3 | 350 | Introduction to Software Engineering .... 3 |
| COMP 3 | 362 | Operating Systems ............................ 4 |
| COMP | 447 | Societal Issues in Computing, <br> GE B4, D, INTD...................................... 3 |
| COMP | 454 | Automata, Languages and Computation.... 3 |
| COMP 4 | 491 | Capstone Preparation ........................ 1 |
| COMP 4 | 499 | Capstone Project............................... 3 |
| MATH 300 | 300 | Discrete Mathematics ......................... 3 |
| MATH | 352 | Probability and Statistics ...................... 3 |
| MATH 35 | 354 | Analysis of Algorithms........................ 3 |
| Choose three units from the following: |  |  |
| COMP | 420 | Database Theory and Design.............. 3 |
| COMP 4 | 464 | Computer Graphic Systems and Design I ......................................... 3 |
| Electives - 12 units |  |  |
| Choose 12 Elective units from: |  |  |
| COMP 3 | 345 | Digital Image Processing, $\qquad$ (MATH/PHYS) GE B1, B4, INTD |
| COMP 3 | 351 | Distributed Computing ........................ 3 |
| COMP 42 | 420 | Database Theory and Design.............. 3 |
| COMP | 421 | Unix for Programmers........................ 3 |
| COMP | 424 | Computer System Security .................. 3 |
| COMP | 425 | Computer Game Programming ............ 3 |
| COMP | 429 | Computer Networks ........................... 3 |
| COMP | 445 | Image Analysis \& Pattern Recognition, (MATH/PHYS), GE B1, B4, INTD.......... 3 |
| COMP 4 | 451 | Advanced Object Oriented Programming3 |
| COMP | 452 | Computational Bioinformatics (MATH) .. 4 |
| COMP 46 | 462 | Embedded Systems........................... 3 |
| COMP 4 | 464 | Computer Graphic Systems and Design I |
| COMP 4 | 469 | Artificial Intelligence/Neural Nets .......... 3 |
| COMP | 490 | Topics in Computer Science................ 3 |
| COMP 492 | 492 | Internship....................................... 1-3 |
| COMP 4 | 494 | Independent Research..................... 1-3 |

of Organismal and Population Biology (4), Biology 212
Neurobiology and Cognitive Science (3) GE B1 and B2
Upper Division Requirements - 41 units
Major Requirements - 29 units
COMP 350 Introduction to Software Engineering .... 3
COMP 362 Operating Systems ............................... 4
COMP 447 Societal Issues in Computing,
GE B4, D, INTD ..................................... 3
COMP 454 Automata, Languages and Computation.... 3
COMP 491 Capstone Preparation............................ 1
COMP 499 Capstone Project ................................... 3
MATH 300 Discrete Mathematics ............................ 3
MATH 352 Probability and Statistics........................ 3
MATH 354 Analysis of Algorithms............................ 3
Choose three units from the following: COMP 420 Database Theory and Design................ 3
COMP 464 Computer Graphic Systems
and Design I3

Electives - 12 units
Choose 12 Elective units from:
COMP 345 Digital Image Processing, ...................... 3
(MATH/PHYS) GE B1, B4, INTD
COMP 351 Distributed Computing 3

COMP 420 Database Theory and Design................ 3
COMP 421 Unix for Programmers............................ 3
COMP 424 Computer System Security.................... 3
COMP 425 Computer Game Programming ............. 3
COMP 429 Computer Networks ............................... 3
COMP 445 Image Analysis \& Pattern Recognition,
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COMP 451 Advanced Object Oriented Programming3
COMP 452 Computational Bioinformatics (MATH).. 4
COMP 462 Embedded Systems .............................. 3
COMP 464 Computer Graphic Systems and Design I 3
COMP 469 Artificial Intelligence/Neural Nets ........... 3
COMP 490 Topics in Computer Science.................. 3
COMP 492 Internship.............................................1-3
COMP 494 Independent Research .......................1-3

| COMP 497 | Directed Studies ............................... 3 | COMP 497 | Directed Studies ............................... 3 |
| :---: | :---: | :---: | :---: |
| ENGL 482 | Technical Writing............................... 3 | ENGL 482 | Technical Writing................................ 3 |
|  |  | IT 380 | Web programming.... .................... 3 |
|  |  | IT 400 | eCommerce............................... 3 |
|  |  | IT 402 | Advanced Web Programming...... .... 3 |
| MATH 429 | Operations Research .......................... 3 | MATH 429 | Operations Research.......................... 3 |
| MATH 448 | Scientific Computing, GE B3, B4, INTD 3 | MATH 448 | Scientific Computing, GE B3, B4, INTD 3 |
| Proposed Course of Study |  | Proposed Course of Study |  |
| Freshman Year - 31 units |  | Freshman Year - 31 units |  |
| COMP 150 | Object-Oriented Programming, GE B4.. 4 | COMP 150 | Object-Oriented Programming, GE B4 . 4 |
| COMP 151 | Data Structures and Program Design ... 4 | COMP 151 | Data Structures and Program Design ... 4 |
| COMP 162 | Computer Architecture and Assembly Language $\qquad$ . 3 | COMP 162 | Computer Architecture and Assembly Language $\qquad$ 3 |
| ENGL 105* | Composition and Rhetoric, GE A2........ 3 | ENGL 105* | Composition and Rhetoric, GE A2 ........ 3 |
| MATH 150 | Calculus I, GE B3.............................. 4 | MATH 150 | Calculus I, GE B3.............................. 4 |
| MATH 151 | Calculus II......................................... 4 | MATH 151 | Calculus II........................................ 4 |
| MATH 230 | Logic and Mathematical Reasoning, | MATH 230 | Logic and Mathematical Reasoning, |
|  | GE A3, B3 ........................................ 3 |  | GE A3, B3 ........................................ 3 |
|  | GE Section A or C.............................. 3 |  | GE Section A or C.............................. 3 |
| * or ENGL 102 and 103 ................................................. 6 |  | * or ENGL 102 and 103................................................ 6 |  |
| Sophomore Year - 23-24 units |  | Sophomore Year - 23-24 units |  |
| COMP 232 | Programming Languages ................... 3 | COMP 232 | Programming Languages ................... 3 |
| COMP 262 | Computer Organization \& Architecture.. 3 | COMP 262 | Computer Organization \& Architecture . 3 |
| MATH 240 | Linear Algebra................................... 3 | MATH 240 | Linear Algebra................................... 3 |
| MATH 300 | Discrete Mathematics ......................... 3 | MATH 300 | Discrete Mathematics ......................... 3 |
| Science |  | Science |  |
| Choose either: |  | Choose either: |  |
| a. Physics 200 General Physics I (4), Physics 201 General Physics II (4) and a course from GE section B2. |  | b. Physics 200 General Physics I (4), Physics 201 General Physics II (4) and a course from GE section B2. |  |
| b. Physics 200 General Physics I (4), Biology 200 |  | b. Physics 200 General Physics I (4), Biology 200 |  |
| Principles of Organismal and Population Biology (4), |  | Principles of Organismal and Population Biology (4), |  |
| Biology 212 Neurobiology and Cognitive Science (3)GE B1 and B2 |  | Biology 212 Neurobiology and Cognitive Science (3) |  |
|  |  | GE B1 and |  |
| Junior Year - 19 units + GE |  | Junior Year - 19 units + GE |  |
| COMP 350 | Introduction to Software Engineering .... 3 | COMP 350 | Introduction to Software Engineering .... 3 |
| COMP 362 | Operating Systems............................. 4 | COMP 362 | Operating Systems ............................ 4 |
| COMP 421 | Unix for Programmers........................ 3 | COMP 421 | Unix for Programmers........................ 3 |
| COMP 454 | Automata, Languages, \& Computation . 3 | COMP 454 | Automata, Languages, \& Computation. 3 |



## Requirements 20-23 units

## Lower Division Requirements

## 11-14 units

COMP 105 Computer Programming Introduction.... 3
*This course is waived for students with equivalent programming experience
COMP 150 Object Oriented Programming .............. 4
COMP 151 Data Structures and Program Design ... 4
COMP 162 Computer Architecture and Assembly... 3

## Upper Division Requirements - 9 units

Three upper-division courses from the CS program approved by the advisor.

## Minor in Robotics Engineering <br> (23 units)

After completing the courses in the minor, students will be able to explain the interaction between hardware and software. They will be able to describe the role of an operating system in managing the resources of a computer. On the hardware side they will be able to build, test and use analog and digital circuits. They will be able to demonstrate the role of electronics in data acquisition, metrology and control of devices. On the software side they will be able to design, implement and test algorithms in both C and a representative assembly language. They will build one or more robotics systems, directly experiencing the challenges and solutions such an implementation requires.

Requirements 23 units
Required Courses (17 units)

| COMP | 162 | Computer Architecture and Assembly ... 3 |
| :--- | :--- | :--- |
| COMP | 362 | Operating Systems ......................... 4 |
| PHYS | 310 | Electronics ............................... 3 |

## Requirements 20-23 units

## Lower Division Requirements

## 11-14 units

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\text { COMP } 105 \text { Computer Programming Introduction.... } 3
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*This course is waived for students with equivalent programming experience
COMP 150 Object Oriented Programming .............. 4
COMP 151 Data Structures and Program Design ... 4
COMP 162 Computer Architecture and Assembly... 3

## Upper Division Requirements - 9 units

Three upper-division courses from the CS program approved by the advisor.

## Minor in Robotics Engineering

(23 units)

After completing the courses in the minor, students will be able to explain the interaction between hardware and software. They will be able to describe the role of an operating system in managing the resources of a computer. On the hardware side they will be able to build, test and use analog and digital circuits. They will be able to demonstrate the role of electronics in data acquisition, metrology and control of devices. On the software side they will be able to design, implement and test algorithms in both C and a representative assembly language. They will build one or more robotics systems, directly experiencing the challenges and solutions such an implementation requires.

## Requirements 23 units

Required Courses (17 units)

| COMP | 162 | Computer Architecture and Assembly ... 3 |
| :---: | :---: | :---: |
| COMP | 362 | Operating Systems ......................... 4 |
| PHYS | 310 | Electronics ................................... 3 |


| COMP | 462 | Embedded Systems |
| :---: | :---: | :---: |
| COMP | 491 | Capstone Preparation |
| COMP | 499 | Capstone |

## Elective Courses (6 units)

Choose two courses from

| MATH | 437 | Mathematics for Games, Simulations and Robotics <br> GE B3, INTD ........................................... 3 |
| :---: | :---: | :---: |
| COMP | 445 | Image Analysis \& Pattern Recognition, <br> (MATH/PHYS), GE B1, B4, INTD........................ 3 |
| COMP | 469 | Artificial Intelligence and Neural Nets .............. 3 |

## Master of Science in <br> Computer Science

## (Offered through CI Extended University Program)

The MS in Computer Science prepares students for advanced careers in high-tech, computer-driven industries, including applications to business, aerospace
education, military, and government where interdisciplinary, dynamic and innovative professionals trained in latest technologies are increasingly sought. Students develop a strong background in computer theory, software and hardware, as well as skills to conduct applied research. The program stresses interdisciplinary applications while preparing students for a wide range of industry, academic, and research positions.

## Admission

Students seeking admission are expected to have an undergraduate degree in Computer Science. Applicants will be evaluated according to the program guidelines which will consider the applicants in the context of the total applicant poo using our general admission standards, including all academic work, GPA,
standardized test scores (such as GRE), personal statement of purpose, reference letters, relevant work experience, and other factors that may have a bearing on the individual's potential for success.
Candidates with undergraduate degrees from other disciplines will be considered on a case-by-case basis and may be provisionally accepted. The conditions will usually

| COMP | 462 | Emb |
| :---: | :---: | :---: |
| COMP | 491 | Capstone Preparation |
| COMP | 499 | Capstone |

## Elective Courses (6 units)

Choose two courses from

| MATH | 437 | Mathematics for Games, Simulations and Robotics <br> GE B3, INTD .......................................... 3 |  |
| :---: | :---: | :---: | :---: |
|  | Image Analysis \& Pattern Recognition, |  |  |
| COMP | 445 | (MATH/PHYS), GE B1, B4, INTD..................... 3 |  |
| COMP | 469 | Artificial Intelligence and Neural Nets ............. 3 |  |

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The MS in Computer Science prepares students for advanced careers in high-tech, computer-driven industries, including applications to business, aerospace,
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Candidates with undergraduate degrees from other disciplines will be considered on a case-by-case basis and may be provisionally accepted. The conditions will usually
include a selection of foundation Computer Science and Math courses as determined by the admission committee.
The current guidelines and admission procedures are described in detail on the program Web pages at http://compsci.csuci.edu.

## Graduation

To obtain the degree, the student must complete each course with a minimum grade of B, and successfully defend a thesis before an examination committee. NOTE: Any remedial courses are in addition to the following graduation requirements.

Required Coursework - 32 units
Graduate Seminar ......................................................... 2
Master Thesis .................................................. 6
Master Thesis ................................................................. 6
Required Courses - 8 units
COMP 599 Graduate Seminar................................. 1
COMP 597 Master Thesis..................................... 1-3
Electives - 24 units
COMP 510 Advanced Image Analysis Techniques
(PHYS) ................................................. 3
COMP 520 Advanced Database Systems ............... 3
COMP 524 Security................................................... 3
COMP 529 Network Computing ............................... 3
COMP 546 Pattern Recognition (PHYS) ........... 3
COMP 549 Human-Computer Interaction................ 3
COMP 550 Advanced Software Engineering ........... 3
COMP 554 Algorithms (MATH)................................. 3
COMP 566 Geometry and Computer Graphics ....... 3
COMP 569 Artificial Intelligence................................ 3
COMP 571 Biologically Inspired Computing............. 3
COMP 572 Neural Networks..................................... 3
COMP 575 Multi-agent Systems .............................. 3
COMP 578 Data Mining ........................................... 3
COMP 581 Mathematical Methods in
Artificial Intelligence (MATH).................. 3
COMP 590 Special Topics in Computer Science..... 3
To accommodate the need to acquire multidisciplinary experience and knowledge beneficial to their research, MSCS students may take up to 6 units of any other course upon obtaining authorization from the MSCS program director in
include a selection of foundation Computer Science and Math courses as determined by the admission committee.
The current guidelines and admission procedures are described in detail on the program Web pages at http://compsci.csuci.edu.

## Graduation

To obtain the degree, the student must complete each course with a minimum grade of B, and successfully defend a thesis before an examination committee. NOTE: Any remedial courses are in addition to the following graduation requirements.

Required Coursework - 32 units
Graduate Seminar ........................................................... 2
Master Thesis .6

Electives ..... 24
Required Courses - 8 units
COMP 597 Master Thesis .....  1

Electives - 24 units
COMP 510 Advanced Image Analysis Techniques
(PHYS) .................................................. 3

COMP 520 Advanced Database Systems ............... 3
COMP 524 Security ................................................. 3
COMP 529 Network Computing ............................... 3
COMP 546 Pattern Recognition (PHYS) .......... 3
COMP 549 Human-Computer Interaction................ 3
COMP 550 Advanced Software Engineering........... 3
COMP 554 Algorithms (MATH) ................................ 3
COMP 566 Geometry and Computer Graphics ....... 3
COMP 569 Artificial Intelligence ............................... 3
COMP 571 Biologically Inspired Computing ............ 3
COMP 572 Neural Networks .................................... 3
COMP 575 Multi-agent Systems ............................. 3
COMP 578 Data Mining ........................................... 3
COMP 581 Mathematical Methods in
Artificial Intelligence (MATH) ................. 3
COMP 590 Special Topics in Computer Science .... 3
To accommodate the need to acquire multidisciplinary experience and knowledge beneficial to their research, MSCS students may take up to 6 units of any other course upon obtaining authorization from the MSCS program director in

## consultation with the Master Thesis advisor

Graduate students may also get credit for taking 400-level courses under some exceptional circumstances. Permission to take such a course has to be granted by the program director in consultation with the Master Thesis advisor and the course instructor prior to enrolling into the course. No more than 9 units can be credited in this way.

## Graduate Writing Assessment Requirement

Writing proficiency prior to the awarding of the degree is demonstrated by successful completion of COMP 597 Masters Thesis with a grade of $B$ or higher.

## Continuous Registration Requirement

A student, who is not on an Academic Leave of Absence, must register every semester until graduating. If all other course requirements have been satisfied, a student should register in one unit of COMP 597 to satisfy the requirement.
consultation with the Master Thesis advisor
Graduate students may also get credit for taking 400-level courses under some exceptional circumstances. Permission to take such a course has to be granted by the program director in consultation with the Master Thesis advisor and the course instructor prior to enrolling into the course. No more than 9 units can be credited in this way.

## Graduate Writing Assessment Requirement

Writing proficiency prior to the awarding of the degree is demonstrated by successful completion of COMP 597 Masters Thesis with a grade of $B$ or higher.

## Continuous Registration Requirement

A student, who is not on an Academic Leave of Absence, must register every semester until graduating. If all other course requirements have been satisfied, a student should register in one unit of COMP 597 to satisfy the requirement.

## SUMMARY OF CHANGES

Adding additional electives to the course modification already approved for Fall 2012.

## JUSTIFICATION

Course modifications in the BSIT make them appropriate electives for the BSCS

| Peter Smith | 9/26/11 |
| :--- | :--- |
| Proposer of Program Modification | Date |

Program: COMPUTER SCIENCE


