

College of Science
Department of Mathematics and Computer Science

Assessment Plan
Computer Science and Computer Networks

Programs:

Computer Science offers the following instructional programs:

1. Bachelor of Science in Computer Science
2. Bachelor of Science in Computer Science with Computer Engineering Option
3. Bachelor of Science in Computer Science with Networking and Data Communications Option
4. Bachelor of Science in Computer Science with Software Engineering Option
5. Master of Science in Computer Science
6. Master of Science in Computer Networks

Institutional Learning Outcomes (ILOs):

Graduates of CSUEB will be able to:

1. think critically and creatively and apply analytical and quantitative reasoning to address complex challenges and everyday problems
2. communicate ideas, perspectives, and values clearly and persuasively while listening openly to others
3. apply knowledge of diversity and multicultural competencies to promote equity and social justice in our communities
4. work collaboratively and respectfully as members and leaders of diverse teams and communities
5. act responsibly and sustainably at local, national, and global levels
6. demonstrate expertise and integration of ideas, methods, theory and practice in a specialized discipline of study

Program Learning Outcomes (PLOs):

Bachelor of Science in Computer Science

Students graduating with a Bachelor of Science in Computer Science will be able to:

1. apply knowledge of mathematics and computational theory to appropriate problems in computer science

2. analyze a problem, and identify and define the resources and requirements needed for its solution
3. design and implement a program to meet stated needs
4. develop and maintain computer-based systems, processes, and platforms
5. recognize and distinguish the mechanisms, components and architecture of computing systems
6. employ current techniques, skills, and tools necessary for computing practice
7. identify professional, ethical, legal, and security issues and responsibilities and the impact of computing on individuals, organizations, and society
8. perform successfully on teams to accomplish a common goal, and communicate effectively in written and oral form

ILO #1 is addressed by PLOs #1, #2, #3, #4, #5 and #6

ILO #2 is addressed by PLOs #2, #3, #6 and #8

ILO #3 is addressed by PLOs #7 and #8

ILO #4 is addressed by PLO #8

ILO #5 is addressed by PLOs #6, #7 and #8

ILO #6 is addressed by PLOs #1, #2, #3, #4, #5, #6, #7 and #8

Students taking one of the Options for the Bachelor in Computer Science receive focused emphasis on particular PLOs as follows:

- The Computer Engineering Option emphasizes PLOs #4, #5 and #6 above.
- The Networking and Data Communications Option emphasizes #1, #3, and #4 above.
- The Software Engineering Option emphasizes #1, #2, #3 and #6 above.

Master of Science in Computer Science

Students graduating with a Master of Science in Computer Science will be able to:

1. apply advanced computer science theory to computational problems
2. demonstrate advanced understanding of the mechanisms, components and architecture of current computing systems
3. apply emerging technologies and advanced algorithmic design
4. critique, plan and produce complex software applications
5. research and analyze current computer science literature

ILO #1 is addressed by PLOs #1, #2, #3, #4, and #5

ILO #2 is addressed by PLOs #1 and #5

ILO #4 is addressed by PLO #4

ILO #5 is addressed by PLO #5

ILO #6 is addressed by PLOs #1, #2, #3, #4, and #5

Master of Science in Computer Networks

Students graduating with a Master of Science in Computer Networks will be able to:

1. exhibit mastery of advanced computer science theory as applied to the field of computer networks
2. employ current techniques, skills, tools, and coding practices necessary for application and system development
3. apply critical thinking and problem solving skills by analyzing problems, designing solutions, and evaluating results
4. demonstrate communication skills in both written and oral form, and work in a team environment
5. independently acquire new computer related skills through analysis of current computer science literature and industrial practices

ILO #1 is addressed by PLOs #1, #2, #3, #4, and #5

ILO #2 is addressed by PLO #4

ILO #3 is addressed by PLO #4

ILO #4 is addressed by PLO #4

ILO #5 is addressed by PLO #2 and #5

ILO #6 is addressed by PLOs #1, #2, #3, #4, and #5

Degree Maps (Course by Program):

There is a great deal of course overlap between the Bachelor of Science in Computer Science, the Master of Science in Computer Science, and the Master of Science in Networks. The curricular map below indicates which courses are required for each degree program, and shows (by color) which program has primary control over each course and administers its assessment.

SEE APPENDIX I

Curricular Maps (Course by PLO):

Bachelor of Science in Computer Science

SEE APPENDIX II

Bachelor of Science in Computer Science with Computer Engineering Option

SEE APPENDIX III

Bachelor of Science in Computer Science with Networking and Data Communications Option

SEE APPENDIX IV

Bachelor of Science in Computer Science with Software Engineering Option

SEE APPENDIX V

Master of Science in Computer Science
SEE APPENDIX VI

Master of Science in Computer Networks
SEE APPENDIX VII

APPENDIX I

Assessed through Computer Science B.S. program
Assessed through Computer Science M.S. program
Assessed through Computer Networking M.S. program
Assessed by Engineering (these courses are dual-listed with Computer Engineering)
Assessed by other programs, or a service course

KEY:

R	course is required by the program
C	course is in the program's concentration
B	course is in the program's breadth requirement
*	course is an elective in the program
-	course is a restricted or limited elective option

	B.S. in Computer Science Options				Graduate Programs	
	General	Computer Engineering	Networking	Software Engineering	Computer Science	Computer Networks
CS 1020 Introduction to Computers	service course for non-majors					
CS 1160 Introduction to Computer Science I	R	R	R	R		
CS 1162 Introduction to Computer Science I Lab	R	R	R	R		
CS 2020 Introduction to Web Design and Technology	service course for non-majors					
CS 2360 Introduction to Computer Science II	R	R	R	R		
CS 2370 Introduction to Computer Science III	R	R	R	R		
CS 2430 Computer Organization and Assembly Language	R	R	R	R		
CS 3120 Programming Language Concepts	R	R	R	R		
CS 3240 Data Structures and Algorithms	R	R	R	R		
CS 3340 Introduction OOP and Design	R	R	R	R		
CS 3430 Computer Architecture	R	R	R	R		
CS 3432 Digital Design Lab	*	C			-	-
CS 3434 Microprocessor Lab	*	C			-	-
CS 3520 Web Site Development	*		*	*	-	-
CS 3560 Introduction to Systems Programming	C	*		C	-	-
CS 3590 Data Communications and Networking	C	C	R	C	-	-
CS 3752 Introduction to Digital Signal Processing	*				-	-
CS 3860 Computer Music Programming	*					
CS 3898 Cooperative Education	*					
CS 4020 Computers and Social Responsibility	*				-	-
CS 4110 Compiler Design	C		C	C	-	-
CS 4170 Theory of Automata	C		C	C	*	
CS 4245 Analysis of Algorithms	C		C	C	*	
CS 4310 Software Engineering I	C	*	C	R	-	-
CS 4311 Software Engineering II	*			R	-	-
CS 4320 Testing and Quality Assurance	*			R	-	-
CS 4330 Building Secure Software	*			*		
CS 4432 VLSI Circuit Design	*	C			-	-
CS 4435 Computer Architecture II	*	C			-	-

CS 4521 Mobile and Topics in Web Programming	*				-	-
CS 4525 Principles of Network Security	*		*		-	-
CS 4526 Security in Wireless and Mobile Computing	*					
CS 4560 Operating Systems	R	R	R	R		
CS 4590 Computer Networks	*	*	R		-	-
CS 4592 Network Operations and Administration	*		*			
CS 4594 Broadband Networks and Communications	*	*	*			B
CS 4596 Wireless and Mobile Networking	*	*	*			
CS 4660 Database Architecture	*		C	*	-	-
CS 4665 Database Operations and Administration	*					
CS 4810 Artificial Intelligence	*					
CS 4835 Human-Computer Interaction	*			*		
CS 4840 Computer Graphics	*	*		*	-	-
CS 4848 Computer Animation Programming	*				-	-
CS 4849 Game Programming	*				-	-
CS 4865 Graphical User Interface Programming	*			*		
CS 6000 Research Methods					R	*
CS 6110 Theory and Design of Compilers					B	*
CS 6140 Language Design					B	*
CS 6170 Automata and Formal Languages					B	*
CS 6260 Computation and Complexity					R	*
CS 6310 Advanced Software Engineering					B	*
CS 6320 Software Engineering and Web-Based Systems					B	B
CS 6330 Secure Software Development					*	*
CS 6430 Computer System Architecture					B	*
CS 6432 VLSI Systems Design					B	*
CS 6520 Cryptography and Data Security					B	*
CS 6522 Advanced WWW Software Development					B	B
CS 6525 Network Security					B	B
CS 6526 Security in Wireless and Mobile Computing					*	*
CS 6560 Operating Systems Design					R	R
CS 6570 Distributed Computation					B	*
CS 6575 Parallel Programming					B	*
CS 6580 Distributed Systems					B	R
CS 6591 Communication Networks Analysis and Design					*	R
CS 6592 Network Management					*	B
CS 6594 Broadband and Multimedia Networks					*	*
CS 6596 Wireless and Mobile Network Architecture					*	*
CS 6660 Database Systems					B	*
CS 6665 Database Systems Administration					B	*
CS 6715 Data Compression					B	B
CS 6752 Digital Signal Processing					B	*
CS 6810 Artificial Intelligence					B	*
CS 6820 Machine Learning					B	*
CS 6825 Computer Vision					B	*
CS 6835 Statistical Pattern Recognition					B	*

CS 6865 Topics in Graphical User Interface Programming					*	*
CS 6870 Computer Simulation					B	*
CS 6899 Project						R
CS 6901 Graduate Capstone					R	

As applied mathematical disciplines, the Bachelor of Science in Computer Science, the Master of Science in Computer Science, and the Master of Science in Networks require coursework in other programs such as Mathematics and Engineering as shown below.

Degree Components Not Offered Through Computer Science

	B.S. in Computer Science Options				Graduate Programs	
	General	Computer Engineering	Networking	Software Engineering	Computer Science	Computer Networks
ENGR 3280 Electronics	*					
MATH 1304 Calculus I	R	R	R	R		
MATH 1305 Calculus II	R	R	R	R		
MATH 2101 Linear Algebra	R	R	R	R		
MATH 2150 Discrete Structures	R	R	R	R		
MATH 3151 Combinatorics	*				*	
MATH 3750 Numerical Analysis I	C		C	C	B	
MATH 4151 Graph Theory	*					
MATH 6750 Topics in Numerical Analysis					*	*
PHIL 3002 Modern Logic	*				*	
PHYS 2702 Heat, Sound, Electricity and Magnetism		C				
STAT 3401 Introduction to Probability Theory	R	R	R	R		

APPENDIX II

Assessed through Computer Science B.S. program
Assessed through Computer Science M.S. program
Assessed through Computer Networking M.S. program

B.S. in Computer Science

I = PLO is Introduced

D = PLO is Developed

M = PLO is Mastered

	1	2	3	4	5	6	7	8
CS 1160 Introduction to Computer Science I			I			I		
CS 1162 Introduction to Computer Science I Lab			I			I		
MATH 1304 Calculus I	I							
MATH 1305 Calculus II	I							
MATH 2101 Linear Algebra	I							
MATH 2150 Discrete Structures	I					I		
CS 2360 Introduction to Computer Science II		I	I			I		
CS 2370 Introduction to Computer Science III		I	I			I		
CS 2430 Computer Organization and Assembly Language				I	I			
PHIL 3002 Modern Logic	I							
CS 3120 Programming Language Concepts	I		D					
MATH 3151 Combinatorics	D	D						
CS 3240 Data Structures and Algorithms		D	D			D		
ENGR 3280 Electronics				D	D			
CS 3340 Introduction to OOP and Design		D	D			D		
STAT 3401 Introduction to Probability Theory	D	D						
CS 3430 Computer Architecture				D	D			
CS/ENGR 3432 Digital Design Lab				D	D			
CS/ENGR 3434 Microprocessor Lab				D	D			
CS 3520 Web Site Development				D		D		
CS 3560 Introduction to Systems Programming		D	D		D			
CS 3590 Data Communications and Networking	D			D	D			
MATH 3750 Numerical Analysis I	D	D				D		
CS/ENGR 3752 Introduction to Digital Signal Processing				D	D			
CS 3860 Computer Music Programming		D	D					
CS 3898 Cooperative Education						D		I
CS 4020 Computers and Social Responsibility							I	I
CS 4110 Compiler Design	D	M	D					
MATH 4151 Graph Theory	M	M						
CS 4170 Theory of Automata	M	M						
CS 4245 Analysis of Algorithms	M	M				M		
CS 4310 Software Engineering I		M	D					D
CS 4311 Software Engineering II		M	M					

CS 4320 Testing and Quality Assurance						M	D	
CS 4330 Building Secure Software			M				D	
CS/ENGR 4432 VLSI Design				M	M			
CS/ENGR 4435 Computer Architecture II				M	M			
CS 4521 Mobile and Topics in Web Programming		M			M			M
CS 4525 Principles of Network Security					M		M	M
CS 4526 Principles of Wireless Security					M		M	M
CS 4560 Operating Systems				M	M			
CS 4590 Computer Networks	M			M	M			
CS 4592 Network Operations and Administration				M	M	M		
CS 4594 Broadband Networks and Communications		M		M	M			
CS 4596 Wireless and Mobile Networking	M			M		M		
CS 4660 Database Architecture				M		M		
CS 4665 Database Operations and Administration				M		M		
CS 4810 Artificial Intelligence	M		M				M	
CS 4835 Human-Computer Interaction						M	M	
CS 4840 Computer Graphics		M				M		
CS 4848 Computer Animation Programming		M	M					
CS 4849 Game Programming		M	M					
CS 4865 Graphical User Interface Programming			M			M		

APPENDIX III

Assessed through Computer Science B.S. program
Assessed through Computer Science M.S. program
Assessed through Computer Networking M.S. program

B.S. in Computer Science Computer Engineering Option

I = PLO is Introduced

D = PLO is Developed

M = PLO is Mastered

	1	2	3	4	5	6	7	8
CS 1160 Introduction to Computer Science I			I			I		
CS 1162 Introduction to Computer Science I Lab			I			I		
MATH 1304 Calculus I	I							
MATH 1305 Calculus II	I							
MATH 2101 Linear Algebra	I							
MATH 2150 Discrete Structures	I					I		
CS 2360 Introduction to Computer Science II		I	I			I		
CS 2370 Introduction to Computer Science III		I	I			I		
CS 2430 Computer Organization and Assembly Language				I	I			
PHYS 2702 Heat, Sound, Electricity and Magnetism	I			I	I			
CS 3120 Programming Language Concepts	I		D					
CS 3240 Data Structures and Algorithms		D	D			D		
CS 3340 Introduction to OOP and Design		D	D			D		
STAT 3401 Introduction to Probability Theory	D	D						
CS 3430 Computer Architecture				D	D			
CS/ENGR 3432 Digital Design Lab				D	D			
CS/ENGR 3434 Microprocessor Lab				D	D			
CS 3560 Introduction to Systems Programming		D	D		D			
CS 3590 Data Communications and Networking	D			D	D			
CS 4310 Software Engineering I		M	D					D
CS/ENGR 4432 VLSI Design				M	M			
CS/ENGR 4435 Computer Architecture II				M	M			
CS 4560 Operating Systems				M	M			
CS 4590 Computer Networks	M			M	M			
CS 4594 Broadband Networks and Communications		M		M	M			
CS 4596 Wireless and Mobile Networking	M			M		M		
CS 4840 Computer Graphics		M				M		

APPENDIX IV

Assessed through Computer Science B.S. program
Assessed through Computer Science M.S. program
Assessed through Computer Networking M.S. program

B.S. in Computer Science Networking and Data Communications Option

I = PLO is Introduced

D = PLO is Developed

M = PLO is Mastered

	1	2	3	4	5	6	7	8
CS 1160 Introduction to Computer Science I			I			I		
CS 1162 Introduction to Computer Science I Lab			I			I		
MATH 1304 Calculus I	I							
MATH 1305 Calculus II	I							
MATH 2101 Linear Algebra	I							
MATH 2150 Discrete Structures	I					I		
CS 2360 Introduction to Computer Science II		I	I			I		
CS 2370 Introduction to Computer Science III		I	I			I		
CS 2430 Computer Organization and Assembly Language				I	I			
PHIL 3002 Modern Logic	I							
CS 3120 Programming Language Concepts	I		D					
CS 3240 Data Structures and Algorithms		D	D			D		
CS 3340 Introduction to OOP and Design		D	D			D		
STAT 3401 Introduction to Probability Theory	D	D						
CS 3430 Computer Architecture				D	D			
CS 3520 Web Site Development				D		D		
CS 3590 Data Communications and Networking	D			D	D			
MATH 3750 Numerical Analysis I	D	D				D		
CS/ENGR 3752 Introduction to Digital Signal Processing				D	D			
CS 4110 Compiler Design	D	M	D					
CS 4170 Theory of Automata	M	M						
CS 4245 Analysis of Algorithms	M	M				M		
CS 4310 Software Engineering I		M	D					D
CS 4521 Mobile and Topics in Web Programming		M			M			M
CS 4525 Principles of Network Security					M		M	M
CS 4560 Operating Systems				M	M			
CS 4590 Computer Networks	M			M	M			
CS 4592 Network Operations and Administration				M	M	M		
CS 4594 Broadband Networks and Communications		M		M	M			
CS 4596 Wireless and Mobile Networking	M			M		M		
CS 4660 Database Architecture				M		M		

APPENDIX V

Assessed through Computer Science B.S. program
Assessed through Computer Science M.S. program
Assessed through Computer Networking M.S. program

B.S. in Computer Science Software Engineering Option

I = PLO is Introduced
D = PLO is Developed
M = PLO is Mastered

	1	2	3	4	5	6	7	8
CS 1160 Introduction to Computer Science I			I			I		
CS 1162 Introduction to Computer Science I Lab			I			I		
MATH 1304 Calculus I	I							
MATH 1305 Calculus II	I							
MATH 2101 Linear Algebra	I							
MATH 2150 Discrete Structures	I					I		
CS 2360 Introduction to Computer Science II		I	I			I		
CS 2370 Introduction to Computer Science III		I	I			I		
CS 2430 Computer Organization and Assembly Language				I	I			
PHIL 3002 Modern Logic	I							
CS 3120 Programming Language Concepts	I		D					
CS 3240 Data Structures and Algorithms		D	D			D		
CS 3340 Introduction to OOP and Design		D	D			D		
STAT 3401 Introduction to Probability Theory	D	D						
CS 3430 Computer Architecture				D	D			
CS 3520 Web Site Development				D		D		
CS 3560 Introduction to Systems Programming		D	D		D			
CS 3590 Data Communications and Networking	D			D	D			
CS 4110 Compiler Design	D	M	D					
CS 4170 Theory of Automata	M	M						
CS 4245 Analysis of Algorithms	M	M				M		
CS 4310 Software Engineering I		M	D					D
CS 4311 Software Engineering II		M	M					
CS 4320 Testing and Quality Assurance						M	D	
CS 4330 Building Secure Software			M				D	
CS 4560 Operating Systems				M	M			
CS 4660 Database Architecture				M		M		
CS 4835 Human-Computer Interaction						M	M	
CS 4840 Computer Graphics		M				M		
CS 4865 Graphical User Interface Programming			M			M		

APPENDIX VI

Assessed through Computer Science B.S. program
Assessed through Computer Science M.S. program
Assessed through Computer Networking M.S. program

M.S. in Computer Science

	1	2	3	4	5
I = PLO is Introduced					
D = PLO is Developed					
M = PLO is Mastered					
CS 3120 Programming Language Concepts	I				
CS 3240 Data Structures and Algorithms				I	
CS 3340 Introduction to OOP and Design				I	
STAT 3401 Introduction to Probability Theory	I				
CS 3430 Computer Architecture		I			
CS 4110 Compiler Design	I		I	I	
CS 4245 Analysis of Algorithms	I		I		
CS 4650 Operating Systems		I	I		
CS 6000 Research Methods		D			D
CS 6110 Theory and Design of Compilers	D	D	D		
CS 6140 Language Design		D	D		
CS 6170 Automata and Formal Languages	D		D		
CS 6260 Computation and Complexity	D		D		
CS 6310 Advanced Software Engineering		D		D	
CS 6320 Software Engineering and Web-Based Systems		D		D	
CS 6330 Secure Software Development			D		
CS/ENGR 6430 Computer System Architecture		D			
CS/ENGR 6432 VLSI Systems Design		D			
CS 6520 Cryptography and Data Security	D		D		
CS 6522 Advanced WWW Software Development		D		M	
CS 6525 Network Security		D		M	
CS 6526 Security in Wireless and Mobile Computing		D			M
CS 6560 Operating Systems Design		D	D		
CS 6570 Distributed Computation		D	D		
CS 6575 Parallel Programming		D	D		
CS 6580 Distributed Systems		D	D		
CS 6591 Communication Networks Analysis and Design		D			
CS 6592 Network Management		D			M
CS 6594 Broadband and Multimedia Networks		D			M
CS 6596 Wireless and Mobile Network Architecture		D			
CS 6660 Database Systems		D	D		
CS 6665 Database Systems Administration		D			
CS 6715 Data Compression	D	D			

MATH 6750 Topics in Numerical Analysis	D		D	D	
CS/ENGR 6752 Digital Signal Processing	D		D		
CS 6810 Artificial Intelligence	D		D		
CS 6820 Machine Learning	D		D		
CS 6825 Computer Vision	D		D		
CS 6835 Statistical Pattern Recognition	D		D		
CS 6865 Topics in Graphical User Interface Programming	D		D		
CS 6870 Computer Simulation		D		M	
CS 6901 Graduate Capstone	M	M	M		

APPENDIX VII

Assessed through Computer Science B.S. program
Assessed through Computer Science M.S. program
Assessed through Computer Networking M.S. program

M.S. in Computer Networks

	1	2	3	4	5
I = PLO is Introduced					
D = PLO is Developed					
M = PLO is Mastered					
CS 3240 Data Structures and Algorithms	I		I		
STAT 3401 Introduction to Probability Theory		I	I		
CS 3560 Introduction to Systems Programming		I	I		
CS 3590 Data Communications and Networking	I		I		
CS/ENGR 4435 Computer Architecture II	I		I		
CS 4560 Operating Systems	I		I		
CS 4590 Computer Networks	I		I		
CS 6110 Theory and Design of Compilers	D	D	D		
CS 6140 Language Design	D		D		
CS 6170 Automata and Formal Languages	D		D		
CS 6260 Computation and Complexity	M		M		
CS 6310 Advanced Software Engineering		D	D		
CS 6320 Software Engineering and Web-Based Systems		D	D		
CS 6330 Secure Software Development	D		D		
CS/ENGR 6430 Computer System Architecture	D	D			
CS/ENGR 6432 VLSI Systems Design	D	D			
CS 6520 Cryptography and Data Security	D	D			
CS 6522 Advanced WWW Software Development		D	M		
CS 6525 Network Security	D			D	D
CS 6526 Security in Wireless and Mobile Computing	D			D	D
CS 6560 Operating Systems Design	M		D		M
CS 6570 Distributed Computation	D		D		
CS 6575 Parallel Programming	D		D		
CS 6580 Distributed Systems	D		D		
CS 6591 Communication Networks Analysis and Design	D	M		D	
CS 6592 Network Management	D		D	D	
CS 6594 Broadband and Multimedia Networks	D			D	D
CS 6596 Wireless and Mobile Network Architecture	D		D	D	
CS 6660 Database Systems	D	D			
CS 6665 Database Systems Administration	D	D			
CS 6715 Data Compression	D		D	D	
CS/ENGR 6752 Digital Signal Processing	D		D		
CS 6810 Artificial Intelligence	D		D		
CS 6820 Machine Learning	D		D		
CS 6825 Computer Vision	D		D		

CS 6835 Statistical Pattern Recognition	D		D		
CS 6865 Topics in Graphical User Interface Programming		D	D		
CS 6870 Computer Simulation	D		D		
CS 6899 Project			M	M	M