Advanced Dual Degree Program
B.S. Computer Science/M.S. Bioinformatics

Academic Program Guide for **New First-Year Students** (Effective 2019)
Department of Computer Science (computerscience@rowan.edu)

Students who entered Rowan University prior to Fall 2018 should follow the guide for their program and start year in consultation with their advisor.

Rowan University Graduation Requirements for all Majors / Degrees

- Students must complete at least 120 semester hours (sh) of coursework that apply to their Rowan University degree.
- Students must have a cumulative GPA of at least 2.0 in Rowan University coursework. (Transfer courses/credit do not count toward the RU GPA.)
- A minimum of 30 sh of coursework must be completed at/through Rowan University.
- Only grades of "D-" or above may apply to graduation/degree requirements. (Some programs may set higher minimums.)
- Students must meet the Rowan Core and Rowan Experience Requirements.
  - An individual course can potentially satisfy one Rowan Core literacy and/or multiple Rowan Experience attributes.
  - Rowan Core & Rowan Experience designations are listed in course details in Section Tally (www.rowan.edu/registrar) and may also be searched on that site under "Attributes." A list of Rowan Core courses is here: https://confluence.rowan.edu/display/AS/Rowan+Core+Course+List.
- Students must apply for graduation and should do so for the term in which they will complete all program requirements.

Program-Specific Graduation Requirements for this Major / Degree

- A grade of C- or better in Calculus I, Discrete Structures, Introduction to Object Oriented Programming, Object Oriented Programming/Data Abstraction, Computer Organization, and Data Structures and Algorithms is required for graduation and to take any course that have the above courses as a prerequisite. This policy applies whether these courses are taken locally or transferred.
- Graduate courses may be counted as restricted electives when takes as senior privilege or part of the accelerated BS/MS degree program.

Rowan Core Requirements[1]

*Students must satisfy all **six** Rowan Core Literacies. A minimum total of 3 sh of coursework is required to satisfy each Literacy.*
With the exception of the 9 sh counted here for Communicative Literacy, credits attached to the courses in this section will apply elsewhere.

◯ (COML) Communicative Literacy: *Must be met by the following three courses or their official equivalents:*
◯ COMP 01111 College Composition I (3 sh) ◯ COMP 01112 College Composition II (3 sh) ◯ CMS 04205 Public Speaking (3 sh)*
***CMS 04205 is required as pre-requisite for one or more major courses in this program. Therefore, CMS 04205 or its transferred equivalent must be taken to fulfill this degree**

◯ (ARTL) Artistic Literacy *Recommendation from major:*
◯ (GLBL) Global Literacy *Recommendation from major:*
◯ (HUML) Humanistic Literacy *Recommendation from major:* INTR 01265 (3 sh counted under non-program)
◯ (QNTL) Quantitative Literacy *Recommendation from major:* MATH 01130 (4 sh counted under non-program)
◯ (SCIL) Scientific Literacy *Recommendation from major:* BIOL 01104, CHEM 06100 or PHYS 00220 (4 sh counted under non-program)

Subtotal of credits counted in this section: 9 sh

Rowan Experience Requirements

Students must satisfy all three Rowan Experience attributes. Credits attached to the courses in this section will apply elsewhere.

◯ (LIT) Broad-Based Literature Attribute *Recommendation from major:*
◯ (WI) Writing Intensive Attribute *Recommendation from major:* WA 01302 Technical Writing (3 sh counts under non-program)
◯ (RS) Rowan Seminar Attribute[2] *Recommendation from major:*

Non-Program Courses (minimum 18 sh)

Courses in this section cannot be in the major department.

Course #	Course Name	Course Attributes / Notes	Sem/Yr	Grade	Credits
INTR 01265	Computers and Society	Satisfies Humanistic Literacy			3
MATH 01130	Calculus I	Satisfies Quantitative Literacy			4
BIOL 01104, CHEM 06100 or PHYS 00220	Introduction to Evolution and Scientific Inquiry, Chemistry I or Introductory Mechanics	Satisfies Scientific Literacy			4
WA 01302	Technical Writing				3
	Authorized Lab Science course for CS majors	See list at end of program guide			4
				Subtotal:	18 sh

[1] The Rowan Core requirements are waived for transfer students with an earned A.A. or A.S. degree from a NJ community/county college.
[2] The Rowan Seminar requirement is waived for all students transferring 24 or more approved credits into Rowan University at the time of initial entry.

Major Requirements (64 sh)

Summary of Major Requirements

- 33 sh of Foundational Courses
- 19 sh of Upper-Level and Capstone Courses
- 12 sh of Computer Science Restricted Electives
- 64 sh total

Foundational Courses

Course #	Course Name	Course Attributes / Notes	Sem/Yr	Grade	Credits
CS 00100	Computer Science Learning Community				1
CS 01205	Computer Lab Techniques				3
MATH 03160	Discrete Structures				3
MATH 01131	Calculus II				4
MATH 01210	Linear Algebra				3
STAT 02290	Probability and Statistical Inference for Computing Systems				3
CS 04113	Introduction to Object-Oriented Programming	students must be ready for MATH 01130			4
CS 04114	Object-Oriented Programming & Data Abstraction				3
CS 04222	Data Structures and Algorithms				4
CS 06205	Computer Organization				3
CS 07210	Foundations of Computer Science				3
				Subtotal:	33

Upper-Level and Capstone Courses

Course #	Course Name	Course Attributes / Notes	Sem/Yr	Grade	Credits
CS 04315	Programming Languages				3
CS 04390	Operating Systems				3
CS 04400	Senior Project				3
CS 07321	Software Engineering I - WI				4
CS 07340	Design and Analysis of Algorithms				3
CS 07351	Cybersecurity: Fundamentals, Principles, and Applications				3
				Subtotal:	19

Computer Science Restricted Electives

Choose 12 credits from the courses in Banks 1 and 2 below.

Bank One ***(at least one Restricted Elective must be selected from this bank of courses)***

	Course #	Course Name	Course Attributes / Notes	Sem/Yr	Grade	Credits
○	CS 04394	Distributed Systems				3
○	CS 04430	Database Systems: Theory and Program				3
○	CS 06410	Data Communications and Networking				3
○	CS 06440	Cloud Computing and the Internet of Things				3
○	CS 07480	Intro to Data Mining				3

Bank Two

	Course #	Course Name	Course Attributes / Notes	Sem/Yr	Grade	Credits
○	CS 01395	Topics in Computer Science	multiple sections of this course with different topics can be taken.			3
○	CS 01400	Independent Study	can be counted as a single 3-hour restricted elective with the approval of the student's mentor/course advisor.			3
○	CS 02421	Big Data Tools and Techniques				3
○	CS 04301	Bioinformatics - Computational Aspects				3
○	CS 04305	Web Programming				3
○	CS 04350	Blockchain Programming				3
○	CS 04372	Advanced Android Programming				3
○	CS 04376	Advanced IOS Programming				3
○	CS 04380	Object Oriented Design				3
○	CS 04391	Concurrent Programming				3
○	CS 04392	System Programming and OS Internals				3
○	CS 04401	Compiler Design				3
○	CS 04440	Data Warehousing				3
○	CS 04471	Topics in Mobile Programming				3
○	CS 06310	Principles of Digital Computers				3
○	CS 06390	Introduction to Systems Simulation and Modeling				3
○	CS 06412	Advanced Computer Architecture				3
○	CS 06415	Wireless Networks, Protocols and Apps.				3
○	CS 06416	TCP/IP and Internet Protocols and Tech.				3
○	CS 06417	Principles of Network Security				3
○	CS 06420	Embedded Systems Programming				3
○	CS 06447	Introduction to IoT Upper Stack				3
○	CS 06470	Cyber Operations				3
○	CS 07310	Robotics				3
○	CS 07322	Software Engineering II				3
○	CS 07350	Computer Cryptography				3
○	CS 07353	Security of Mobile Devices				3
○	CS 07360	Introduction to Computer Graphics				3
○	CS 07370	Introduction to Information Visualization				3
○	CS 07380	Introduction to Computer Animation				3
○	CS 07390	Intro to Computer Game Design and Development				3
○	CS 07422	Theory of Computing				3
○	CS 07430	Human Computer Interaction				3
○	CS 07450	Artificial Intelligence				3
○	CS 07455	Machine Learning				3
○	CS 07460	Computer Vision				3
○	CS 07485	Web and Text Mining				3
○	CS 99300	Computer Field Experience	Permission of instructor required. Field experience may be from 3 to 12 credits; however only 3 credits can apply to the program requirements			3
○	CS 99310	Advanced Learning Asst Experience in CS	Permission of instructor required.			3
○	CS 99490	Computer Science Research II				3
					Subtotal	12

Summary of Graduation Requirements

- 64 sh of Program Requirements
- 27 sh of Rowan Core and Rowan Experience
- 29 sh of Free Electives
- 120 sh total

Free Electives for this Major/Degree (29 sh)

Students should choose Free Electives that satisfy any Rowan Core or Rowan Experience requirements that are not fulfilled by Major or Non-Program courses.

Course #	Course Name	Course Attributes / Notes	Sem/Yr	Grade	Credits
				Subtotal: 29 sh	

Total Program Credits Required for this Major / Degree: 120 SH

Authorized Lab Science Courses for Computer Science Majors

(4 sh counted under Non-Program Courses)

	Course #	Course Name	Course Attributes / Notes	Sem/Yr	Grade	Credits
○	ASTR 11220	Observational Astronomy				4
○	ASTR 11230	Introductory Astronomy and Astrophysics				4
○	BIOL 01104	Introduction to Evolution & Scientific Inquiry				4
○	BIOL 01106	Introduction to Genetics				4
○	BIOL 01203	Introduction to Cell Biology				4
○	BIOL 10210	Human Anatomy and Physiology I				4
○	BIOL 10212	Human Anatomy and Physiology II				4
○	BINF 07250	Introduction to Bioinformatics				4
○	MCB 01101	Foundations in Biology for Biomedical Sciences I				4
○	PHYS 00220	Introductory Mechanics				4
○	PHYS 00221	Intro. Thermodynamics, Fluids, Waves, & Optics				4
○	PHYS 00222	Introductory Electricity and Magnetism				4
○	PHYS 00300	Modern Physics				4
○	PHYS 00325	Electric Circuits				4
○	PHYS 00340	Optics and Light				4
○	CHEM 06100	Chemistry I				4
○	CHEM 06101	Chemistry II				4
○	CHEM 09250	Quantitative Analysis				4
○	CHEM 07200	Organic Chemistry I				4

M.S. in Bioinformatics

Curriculum

The M.S. in Bioinformatics program consists of 30 semester hours (s.h.). Both a thesis and a non-thesis track are available.

Notes:

- In each of the final two semesters of the undergraduate portion of the CADP program, students should take two 3 credit graduate courses from either the Required Courses bank below or the Department of Computer Science elective bank.
- These 12 credits will count towards the 30 credits required by the M.S. in Bioinformatics as well as the 120 credits required for the B.A. and B.S. programs.
- Students in the CADP programs are still required to fulfill the requirements of the undergraduate degree by the completion of their final undergraduate year including the four undergraduate program restricted electives.
- Only courses from the Department of Computer Science elective bank can count as undergraduate program restricted electives.
- If a student reverts back to the undergraduate major and does not fulfill the requirements of the MS program, they would need to fulfill the requirements of the undergraduate degree to graduate.

The following courses make up the M.S. in Bioinformatics program:

Required Courses

Course #	Course Name	Course Attributes / Notes	Sem/Yr	Grade	Credits
CHEM 07595	Bioinformatics: Advanced Biochemical Applications				3
BINF 05555	Bioinformatics: Advanced Biological Applications				3
CS 01541	Bioinformatics: Advanced Computational Aspects				3
BINF 07500	Bioinformatics Seminar				3
				Subtotal: 12 sh	

Remaining Credits

Students are required to complete 18 additional credits to complete the MS Degree. All students, including CADP students, can elect a thesis track or a non-thesis track. Degree completion options are limited to the following:

- 18 credits of elective course work
- 9 credits of thesis work (BINF 07501 MS Thesis Research 1, BINF 07502 MS Thesis Research 2 and BINF 07503 MS Thesis Research 3) and 9 credits of elective course work
- 12 credits of thesis work (BINF 07501 MS Thesis Research 1, BINF 07502 MS Thesis Research 2, BINF 07503 MS Thesis Research 3 and BINF 07504 MS Thesis Research 4) and 6 credits of elective course work

A. *ELECTIVE COURSE BANK*

Department of Chemistry and Biochemistry

Course #	Course Name	Course Attributes / Notes	Sem/Yr	Grade	Credits
CHEM 07531	Special Topics in Biochemistry				3
CHEM 07570	Organic Spectroscopy				3
CHEM 07568	Medicinal Chemistry				3
CHEM 07557	Chemical Biology				3
CHEM 07560	Advanced Biochemistry Lecture				3
CHEM 09510	Instrumental Analysis				4
CHEM 07592	Advanced Pharmaceutical Chemistry				3
CHEM 08505	Advanced Biophysical Chemistry				3
CHEM 07590	General Aspects of Pharmacology				3
CHEM 08510	Advanced Survey of Molecular Modeling Methods				3

Department of Molecular & Cellular Biosciences

Course #	Course Name	Course Attributes / Notes	Sem/Yr	Grade	Credits
MCB 01538	Graduate Immunology				4
MCB 01506	Graduate Translation Cell Biology				3
MCB 01521	Graduate Cell Culture Techniques				4
MCB 01550	Graduate Molecular Genetics				4

Department of Computer Science

Course #	Course Name	Course Attributes / Notes	Sem/Yr	Grade	Credits
CS 45530	Advanced Data Systems: Theory and Programming				3
CS 07523	Advanced Software Engineering				3
CS 07540	Advanced Design and Analysis of Algorithms				3
CS 07570	Information Visualization				3
MIS 02599	Special Topics in Management Information Systems				3
CS 07556	Machine Learning				3
CS 02505	Data Mining I				3
DA 02510	Visual Analytics				3
CS 02605	Data Mining II				3
CS 03505	Data Quality and Web/Text Mining				3

B. *THESIS COURSES*

Thesis Coursework

Course #	Course Name	Course Attributes / Notes	Sem/Yr	Grade	Credits
BINF 07501	MS Thesis Research 1				3
BINF 07502	MS Thesis Research 2				3
BINF 07503	MS Thesis Research 3				3
BINF 07504	MS Thesis Research 4				3

Required for the Graduate Degree: 30 SH

Total Completed SH for this Accelerated Undergrad / Graduate Dual Degree 138 SH
(12 credits count for both BS and MS)