

2+2 Articulation Agreement for Carroll Community College and Towson University

Associate's Degree: A.S. in Physical Sciences, Physics Concentration

Bachelor's Degree: B.S. in Physics, Computational Physics Concentration

Effective Term: Fall 2019

Choosing the Right Physics Pathway

The following information will guide students in selecting the best 2+2 pathway for their career and education goals:

Students intending to pursue graduate studies in physics or astrophysics should follow the pathway for either the General Physics or Astrophysics concentration. The pathway for the Applied Physics concentration is recommended for students who plan to pursue fundamental or applied research and development in industrial or government laboratories. The Computational Physics Concentration is designed to provide students with strong scientific, technical and computational skills necessary for employment in a STEM profession; it is not recommended if students wish to pursue graduate studies in physics.

Section 1: Course Completion Plan for Carroll Community College

This section outlines the courses to take for the Carroll Community College general education and program requirements in order to complete both Carroll Community College and TU degrees within a total of 4 years and 120 credits. The following tables do not include any nontransferable or prerequisite coursework outside of the curriculum.

Table 1: General Education Courses Applied to TU Core Curriculum

Carroll CC Requirement	Carroll CC Course to Take	Credit	Towson University Equivalent Course
English Composition	ENGL 101 College Writing	3	ENGL 102 Writing for a Liberal Education
Mathematics	MATH 135 Calculus of a Single Variable I	4	MATH 273 Calculus I
Arts & Humanities	Any Arts & Humanities course	3	Equivalency will vary by course.
Arts & Humanities	Any Arts & Humanities course	3	Equivalency will vary by course.
Social & Behavioral Sciences	Any Social & Behavioral Sciences course	3	Equivalency will vary by course.
Social & Behavioral Sciences	Any Social & Behavioral Sciences course	3	Equivalency will vary by course.
Biological & Physical Sciences	CHEM 105 Principles of General Chemistry I	4	CHEM 131 & 131 L General Chemistry I Lecture & Lab
Biological & Physical Sciences	PHYS 111 Physics I for Scientists & Engineers	4	PHYS 241 General Physics I Calculus Based
General Education Elective	PHYS 212 Physics II for Scientists & Engineers	4	PHYS 242 General Physics II Calculus Based
English Literature	ENGL 102 Writing About Literature	3	ENGL TLL English Elective

Total general education applied to the TU Core Curriculum: 34 credits

Completing the courses in Table 1 will satisfy the general education program at Carroll CC. Upon transferring to TU, students will receive a core package that satisfies most of the TU Core Curriculum without the need for course-by-course placement in specific Core Curriculum requirements. Students will only need to complete two Core Curriculum requirements at TU: Advanced Writing Seminar (Core 9) and Ethical Perspectives (Core 14). If an ethics course is taken as one of the Arts & Humanities requirements at Carroll CC, students will complete a different requirement than Core 14.

Table 2: Program Requirements and Electives Applied to TU Degree

Carroll CC Requirement	Carroll CC Course to Take	Credit	Towson University Equivalent Course
Concentration Requirement	MATH 136 Calculus of a Single Variable II	4	MATH 274 Calculus II
Concentration Requirement	MATH 205 Multivariable Calculus	4	MATH 275 Calculus III
Concentration Requirement	MATH 215 Differential Equations	4	MATH T74 Differential Equations
Concentration Requirement	CHEM 106 Principles of Gen Chemistry II	4	CHEM 132 & 132L General Chemistry II Lecture & Lab
Concentration Requirement	PHYS 213 Physics III for Scientists & Engineers	4	PHYS 243 General Physics III
Program Elective	MATH 210 Linear Algebra	4	MATH 265 Elementary Linear Algebra
Program Elective	Any elective course	2	Equivalency will vary by course.

Total program requirements applied to the TU degree: 26 credits

Total transferred to TU: 60 credits

Students may transfer a maximum of 64 credits. If students do not adhere to the courses outlined above, they are not guaranteed completion of the bachelor's degree in 2 years. Refer to section 2 for specific course details and transfer planning information.

Section 2: Carroll Community College Course Selection Details

This section explains any specific course selections made in section 1 and details about how required Carroll CC courses will apply to the TU Physics major. If students do not complete the courses outlined in this agreement, they will be required to complete outstanding requirements at TU.

GENERAL EDUCATION

Students must note the following information when completing their general education requirements:

- It is recommended that all students complete both a mathematics and English course within their first 12 credits.
- **General Education Mathematics:** MATH 135 will satisfy the requirement for MATH 273 in the major at TU. Students who require precalculus may end up taking over 60 credits for the associate degree.
- **General Education Biological & Physical Sciences:** CHEM 105 will satisfy the non-physics requirement for CHEM 131 & 131L in the Computational Physics concentration. PHYS 111 will satisfy the major requirement for PHYS 241.
- **General Education Elective:** PHYS 212 satisfies the requirement for PHYS 242 in the major at TU.
- Students should select courses that appeal to their personal or professional interests to satisfy **Arts and Humanities** and **Social & Behavioral Science** requirements. All courses that satisfy these general education categories at Carroll will transfer and apply to TU's Core Curriculum. Courses for which TU does not have a direct equivalency will be assigned a lower level elective in the same discipline (e.g. COMM TLL).

PROGRAM REQUIREMENTS

Completion of the following requirements will satisfy TU major requirements:

- **Program Requirement:** MATH 136 satisfies the requirement for MATH 274 in the major at TU.
- **Program Requirement:** MATH 205 satisfies the non-physics requirement for MATH 275 in the Computational Physics concentration at TU. Students must note that Carroll CC only offers this course in the fall term.
- **Program Requirement:** MATH 215 satisfies the non-physics requirement for MATH 374 in the Computational Physics concentration at TU. This course will transfer to TU as MATH T74 (see "Lower-Level Equivalents of Upper-Level Courses"). Students must note that Carroll CC only offers this course in the spring term.
- **Program Requirement:** CHEM 106 satisfies the non-physics requirement for CHEM 132 & 132L in the Computational Physics concentration at TU.
- **Program Requirement:** PHYS 213 satisfies the requirement for PHYS 243 in the major at TU.

PROGRAM ELECTIVES

Students must take **MATH 210 Linear Algebra** to satisfy the non-physics requirement for MATH 265 in the Computational Physics concentration at TU.

Section 3: Degree Requirements to Be Completed at TU

This section outlines the remaining degree requirements for students transferring into the Computational Physics concentration of the Physics major. Refer to section 4 for university-wide degree requirements.

CORE CURRICULUM REQUIREMENTS: 6 UNITS

Core 9 Advanced Writing Seminar

Core 14 Ethical Issues and Perspectives

REQUIRED PHYSICS COURSES FOR ALL PHYSICS MAJORS: 22 UNITS

PHYS 185 Introductory Honors Seminar in Physics (1 unit)

PHYS 270 Computers in Physics (4 units)

PHYS 307 Introductory Mathematical Physics (3 units)

PHYS 311 Modern Physics I (3 units)

PHYS 341 Intermediate Physics Laboratory I (3 units)

PHYS 351 Mechanics (4 units)

PHYS 354 Electricity & Magnetism (4 units)

COMPUTATIONAL PHYSICS CONCENTRATION – ADVANCED PHYSICS COURSES: 6 UNITS

PHYS 337 Digital Electronics (4 units)

PHYS 385 Physics Seminar (1 unit)

PHYS 486 Physics Seminar II (1 unit)

COMPUTATIONAL PHYSICS CONCENTRATION – NON-PHYSICS REQUIREMENTS: 22 UNITS

COSC 236 Introduction to Computer Science I (4 units)

COSC 237 Introduction to Computer Science II (4 units)

COSC 290 Principles of Computer Organization (4 units)

COSC 336 Data Structures and Algorithm Analysis (4 units)

MATH 263 Discrete Mathematics (3 units)

MATH 435 Numerical Analysis I (3 units)

GENERAL ELECTIVES: 4 UNITS

COSC 175 General Computer Science (4 units) – This course is required as a prerequisite to enroll in COSC 236.

Section 4: Additional Requirements for TU Degree Completion

BACHELOR'S DEGREE REQUIREMENTS FOR ALL STUDENTS:

- A C (2.0) or higher is required in all major courses and prerequisites.
- A cumulative grade point average (GPA) of 2.0 is required.
- 32 units of the bachelor's degree must be completed at the upper level (courses numbered 300 or above).

Degree Completion Summary

TOTAL UNITS REQUIRED FOR B.S. DEGREE	120 UNITS
Carroll Community College A.S. Degree in Physical Sciences – Physics Concentration	60
Completion of Core Curriculum at TU	6
Physics Major – Computational Physics Concentration Coursework at TU	50
General Electives Taken at TU	4