



COLLEGE OF SCIENCE
INTEGRATED SCIENCE
CURRICULUM
VIRGINIA TECH™

2019-2020

**ISC Student
Handbook**



INTEGRATED SCIENCE
CURRICULUM

The Integrated Science Curriculum

Are you passionate about science and math?

Do you seek to understand the big picture as well as all the really cool pieces?

Do you want to help solve the world's most pressing and complex problems through the power of science?

Designed for students seeking an in-depth understanding of 21st century science, the **Integrated Science Curriculum (ISC)** provides a novel, integrated scientific foundation for any degree program in the College of Science. It employs a collaborative, active-learning environment emphasizing teamwork, skills acquisition, independent thought, and creativity. ISC prepares the scientists of the future by having students learn and work as do the most successful scientists of today.

Modern science is becoming increasingly interdisciplinary and collaborative in nature. A generation ago, the classic scientific disciplines (biology, chemistry, and physics) could stand independently in a way no longer possible. This is due to the increasingly complex scientific questions that we are asking; Questions that require knowledge stemming from all traditional scientific fields. If science majors want to sustain successful careers in a world where the pace of change will only accelerate, they need to be immersed in the new and evolving ways of thinking about and doing science. The ISC presents the foundations of physical, mathematical and life sciences in an integrated, active-learning mode so to produce students with a fundamental understanding of the connections between the traditional sciences.

The recent evolution of science, in no small measure driven by the rapid increase in computational power, has brought with it the emergence of important, new scientific fields. The ISC is an excellent entry path for the traditional bachelor's degrees in the College of Science (biological sciences, biochemistry, chemistry, economics, geosciences, mathematics, physics, psychology, and statistics), as well as for the new degree programs in computational modeling and data analytics, nanoscience, neuroscience, and systems biology.

Importantly, **the ISC is not just a repackaging of traditional courses. The ISC presents knowledge and techniques from traditional sciences as complements to one another, providing the means to understand large-scale societal problems, including the areas of food, energy, health, water, the environment, and more.** The ISC raises broad questions about these complex Earth systems that do not fall into a single scientific box. To address these questions, the ISC introduces and/or increases exposure to

advanced scientific topics not typically covered in introductory courses, such as organic chemistry, biochemistry, linear algebra, differential equations, numerical methods, and stochastic processes. Through this approach, ISC students come to understand the interrelationships of the sciences in a way that is not possible with a more conventional course structure.

The ISC is structured around the big issues and questions being asked around the world today. These questions require the integration of ideas and methods from all scientific discipline. The basic organizing themes and questions of the ISC include:

- 1) What is Life?
- 2) What is Matter?
- 3) What is Energy?
- 4) What is Motion?
- 5) What is Information?

Administratively speaking, the ISC is not a degree program. It is a freshman-sophomore course sequence that provides an alternative entry to any major in the College of Science. Students who enroll in the ISC will still choose a major field of study, and in addition to the ISC course and lab will take courses specific to their chosen major.

How is the ISC structured?

The ISC is a 30 credit, two-year course sequence that covers the fundamentals of college-level chemistry, physics, and biology integrated with each other and with calculus, linear algebra, and statistics. In each of the four semesters the ISC course is worth 6 credits and meets every day for seventy-five minutes. In the first year the laboratory course is worth 2 credits and meets twice a week for 2.5 hours. In the second year the laboratory course is worth 1 credit and meets once a week for 2.5 hours. Example 2-year course schedules are shown here for the most common ISC majors. Please note that **these are examples only**. Your personal schedule will vary based on your AP and IB scores and any dual enrollment classes you have taken. Your ISC advisor and your major advisor will work closely with you to create your personalized schedule.

Example ISC 2-year course schedules

To find example two-year sample plans of study, please visit the ISC Current Students and Advisors webpage below.

<https://www.ais.science.vt.edu/isc/current-students.html>

If you would like to compare these ISC schedules with more traditional schedules, you can find the graduation requirements for all Virginia Tech majors here:

<https://registrar.vt.edu/graduation-multi-brief/index1.html>

What traditional classes does ISC cover?

After completing the two-year ISC program, students will have earned *equivalences* of the following traditional courses:

- BIOL 1105 Principles of Biology
- BIOL 1115-1116 Principles of Biology Lab
- CHEM 1035-1036 General Chemistry
- CHEM 1045-1046 General Chemistry Lab
- PHYS 2305-2306 Foundations of Physics
- MATH 1114 Elementary Linear Algebra
- MATH 1025-1026 Elementary Calculus
-

Do I learn Honors credit through the ISC Program?

Yes! ISC 1106 and ISC 2106 are honors designated courses (you will see an “H” on the Timetable) and will count towards your required credits for the Honors College. If you are not an Honors student, you can still participate in the ISC program and will still take the Honors designated ISC courses.

State-of-the-art pedagogy in class and lab

The ISC is taught in the modern Student-Centered Active Learning Environment with Upside-down Pedagogies (SCALE-UP) classroom. This classroom is specifically designed for group work and hands-on assignments and activities. There is no instructor's lectern and no "front" and "back" to the classroom. Instead, there are round tables that seat 9 students each where students work and interact in groups. Instructors are free to roam around the classroom answering questions, sending one group to help another, or asking why a certain conclusion was reached. The primary goal of the SCALE-UP classroom is to establish a highly collaborative, hands-on, interactive learning environment. For more information on this state-of-the-art classroom, please visit:

<https://lib.vt.edu/spaces/classrooms-meeting-spaces/scale-up.html>

<https://www.youtube.com/watch?v=pUFud6MoHMo>

The ISC labs are taught in a state of the art teaching laboratory in the New Classroom Building. In the laboratory, data collection is seamlessly integrated with methods of data analysis, discovery and interpretation. ISC aims for laboratory experiences that are closely integrated with lecture material, making them mutually supportive pieces of the learning experience.

What students are saying about ISC:

“At the end of the day, we are going to leave this program with a different perspective than a majority of the people at this university. I think that will give us a very distinct advantage in the future. It will help us with jobs. It will help us understand the world around us.”

- Grant Shively, Biochemistry major

“ISC focuses on team work, which is great because in the real world we all must work with others. Doctors must communicate with other doctors, researchers collaborate, and in any field you are going to be working with people with different strengths and weaknesses. Our teams consisted of different majors within the team, which allowed me to learn different perspectives from my team members.”

-Kristen Fisher, Biological Sciences major

“This innovative program efficiently prepared me for research and developed my critical thinking ability. It gave me many opportunities and experiences some underclassmen would not be able to have. It teaches science in a way that it is being used in modern research and this is how it prepares students to succeed in research and graduate school.”

-Shaan Sharma, Neuroscience major

“Modern advanced fields of science, such as nanoscience and neuroscience, are rapidly moving away from the traditional uni-topic discipline such as biology, chemistry, or physics, toward an overlap between the three. The predominant strength of ISC and what separates this program from traditional teaching resides in how professors from different fields come together in a single classroom to break the walls separating the traditional disciplinary barriers. As a result, the material is taught in a way that emphasizes the common base of the three classical disciplines.”

-Kevin Tran Huu, Nanoscience major

“Not only has ISC provided a meaningful way to understand the how and why behind science, but it has also helped me surround myself with people who have the same goals as me. Being surrounded by people similar to me has made me work harder and have a stronger base to rely on for continued support.”

-Karthik Dhanireddy, Microbiology major

Textbook Information

Currently, students need the following four textbooks for the two-year ISC program:

1) Physics Book:

- Physics for Scientists and Engineers: A Strategic Approach with Modern Physics (4th edition), ISBN-13 (9780134083148) by Knight – 24 month subscription

	Includes Pearson eText?	Access Length (Subscription)	Bookstore ISBN(s)	Price To Bookstore	Instant Access
Mastering	Y	24 Months	9780134083148	\$105.41	\$115.95
Mastering + Loose Leaf Text	Y	24 Months	9780134100098	\$178	\$0
Mastering + Print Text	Y	24 Months	9780133953145	\$248.35	\$0

2) Biology Book:

- Biology (11th edition), ISBN-13 (9781259188138) by Raven et al.

3) Chemistry and Biocalculus Books:

- Zumdahl, Chemical Principles, 8e. with OWLv2 Access
- Biocalculus : Calculus, Probability, and Statistics for the Life Sciences, Stewart and Day, 1e with WebAssign Access

You can choose to access the Chemistry and Biocalculus books through Cengage Unlimited— **a subscription that provides access to ALL Cengage ebooks and digital learning products for \$119.99 per term (extended subscriptions also available)**. One Cengage Unlimited subscription can be used across all courses where Cengage products are assigned, at no added cost. A free print rental is available, but you will have to pay \$7.99 for shipping.

Start at the bookstore: Check the bookstore first when purchasing Cengage Unlimited. If it's not sold there, it can be purchased at cengage.com/unlimited

	Cengage Unlimited Subscription
Price	\$119.99 for 4-month access \$179.99 for 1-year access \$239.99 for 2-year access
What's Included	Your required course materials +entire Cengage catalog of 20,000+ ebooks, digital learning platforms and more

How/when ISC students earn equivalencies for traditional courses

ISC covers the topics in BIOL 1105, BIOL 1115-1116, CHEM 1035-1036, CHEM 1045-1046, MATH 1025-1026, MATH 1114, and PHYS 2305-2306. Through ISC, students earn *equivalent credit* for these courses, but the ISC courses are not a one for one substitution. Below, you will see when all of the topics from the respective classes have been completely covered in your Integrated Science Curriculum courses.

After 1 semester:

MATH 1025

It is also possible to get equivalence for PHYS 2305 if you take the thermal physics module (PHYS 2324) for transfer students in the following fall term and successfully pass the written exam. In order for you to not lose a full year due the fact that the module for transfer students will only be offered in Fall semesters, the Physics Department will allow you to enroll in PHYS 2306 in the Spring semester of your first year even though at this time you will not yet have received the equivalence for PHYS 2305.

After 2 semesters:

CHEM 1035

CHEM 1045

MATH 1026

PHYS 2305

After 3 semesters:

BIOL 1105

BIOL 1115

BIOL 1116

MATH 1114

It is also possible to get equivalence for PHYS 2306 if you take the two modules on optics (PHYS 2344) and waves and sound (PHYS 2334) for transfer students in the following fall term and successfully pass the written exams.

After 4 semesters:

CHEM 1036

CHEM 1046

PHYS 2306

Who is involved with ISC?

The following people keep the ISC program running. Please feel free to contact any of us with questions!

Name	Title	Email	Phone
Academy of Integrated Science (AIS)			
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WE HOPE YOU JOIN ISC!

Since it started, the ISC program has been a great success at Virginia Tech. Students complete the program well prepared to face complex scientific questions that cannot be confined to a single scientific discipline. ISC students know how to think and work like scientists instead of simply being good at absorbing material presented in lecture. If you enjoy approaching science from many different angles and tackling large scale scientific challenges facing society today, then ISC is for you! We hope that you will join us on our journey to change the way students and professors learn and teach science.



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