**New York City College of Technology  
Interdisciplinary Committee**

**Criteria for an Interdisciplinary Course**

1. **Interdisciplinary Studies Definition**

Interdisciplinary studies involve two or more academic disciplines or fields of study organized around synthesizing distinct perspectives, knowledge, and skills. Interdisciplinary study focuses on questions, problems, and topics too complex or too broad for a single discipline or field to encompass adequately; such studies thrive on drawing connections between seemingly exclusive domains. Usually theme-based, interdisciplinary courses intentionally address issues that require meaningful engagement of multiple academic disciplines. Pedagogical strategies focus on, but are not limited to, inquiry or problem-based learning.

Although many academic disciplines, such as African American Studies and Engineering, are inherently interdisciplinary, to be considered an interdisciplinary course at City Tech the course must be team-taught[[1]](#footnote-1) by more than one faculty member from two or more departments[[2]](#footnote-2) in the College. An interdisciplinary course, by definition, has an interdisciplinary theme as its nucleus. In its essence, such a course brings the analytic methods of two or more academic disciplines to bear on a specific problem or question. Thus, a course in Music History is not likely to be considered interdisciplinary, but a course in Music History from an economist’s perspective might very well lead to such a course. The application of different methods and concepts is the key to assessing whether a course is or is not interdisciplinary. The term interdisciplinary is occasionally used to identify individual projects or assignments, but these, though possibly commendable, fall short in the necessary scope for learning experiences that demand in-depth exposure to the methodologies of distinct intellectual disciplines, and the creative application of these methodologies to specific problems.

Studies show that interdisciplinary courses improve student learning (Elrod & Roth, 2012; Klein, 2010; Lattuca, 2001; Lattuca, Voigt, & Fath, 2004; Project Kaleidoscope, 2011). To foster interdisciplinary learning, the Interdisciplinary Committee has identified goals and outcomes that students taking interdisciplinary courses should be able to achieve.

**Learning Outcomes of Interdisciplinary Courses**

Students will be able to:

* Purposefully connect and integrate across-discipline knowledge and skills to solve problems
* Synthesize and transfer knowledge across disciplinary boundaries
* Comprehend factors inherent in complex problems
* Apply integrative thinking to problem-solving in ethically and socially responsible ways
* Recognize varied perspectives
* Gain comfort with complexity and uncertainty
* Think critically, communicate effectively, and work collaboratively
* Become flexible thinkers

**New York City College of Technology**

**Interdisciplinary Committee**

**Application for Interdisciplinary Course Designation**

**Date**  February 12, 2017

**Submitted by**  Oleg Berman, Roman Kezerashvili, Darya Krym, Giovani Ossola,

**Department(s)**  Physics

1. **Proposal to Offer an Interdisciplinary Course**

1. Identify the course type and title:  
     
   🗹 An existing course Modern Physics PHYS2443   
     
   🞎 A new course \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

🞎 A course under development \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Provide a course description:

Discoveries of 20th century physics caused numerous paradigm shifts, in science, philosophy, and society. Topics covered include quantum theory, including the wave/particle duality of light and particles and uncertainty principle, and the example of light diffraction and interference, relationship to quantum chemistry, quantum entanglement and relationship to quantum computing, lasers, holography, quantum mechanics of solids and application to electronics, the structure of the atom and the nucleus, including the basis of nuclear energy production, social implications of nuclear power, relativity and the nature of time, and astrophysics and the fate of the universe.

1. How many credits will the course comprise? 4 How many hours? 3 hours lecture & 3 hours lab
2. What prerequisite(s) would students need to complete before registering for the course? Co-requisite(s)?

Prereq for course is PHYS 1442 or department permission. No co-req

1. Explain briefly why this is an interdisciplinary course.

The cataclysms of 20th century physics reverberated not only within the field, but through other scientific and engineering disciplines, as well as through philosophy, and society. Experts in chemistry, computing, astronomy explain the technological and scientific applications of the discoveries. Analyzing the social changes wrought by nuclear power requires a historical perspective. A dialogue continues between philosophers and physicists regarding the shifts in the very definitions of observation, what is knowable, and reality, forced by basic principles of quantum mechanics such as principles of uncertainty, wave/particle duality, and measurement theory.

1. What is the proposed theme of the course? What complex central problem or question will it address? What disciplinary methods will be evoked and applied?

The goal of this course is to begin to understand fundamental 20th century physics and its effect on technology, science, and society. How has the study of physics facilitated developments in other fields? How has it informed our approach to observing and analyzing? How does it influence the political and economic balance of power?

Physics uses a rigorous, quantitative, and evidence-based approach. Emphasis is placed on its predictive power and precision.

Astronomy, chemistry are less predictive and more observational, but describe complicated existing systems, focusing on celestial objects and molecular interactions respectively.

Philosophy can help us verbalize, extract generalizable principles, find relationships to other areas of study, identify questions which must be addressed.

A historical study of past events assesses the impact on society.

1. Which general learning outcomes of an interdisciplinary course does this course address?   
   Please explain how the course will fulfill the bolded mandatory learning outcome below. In addition, select and explain at least three additional outcomes.

🗹 **Purposefully connect and integrate across-discipline knowledge and skills to solve problems**

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| Throughout the course, students are asked to research topics connected to the guest lectures and to explain a problem, experiment, or application in that discipline (chemistry, astronomy, computing, history, philosophy). Students must integrate their knowledge of the related physics concepts and the other disciplines, and bring both skillsets to bear on the problem.  For example, students might be asked to research the history of nuclear power after hearing about the history of nuclear weapons. An understanding of the physics of radiation of various kinds is essential to a meaningful discussion about nuclear power and its benefits and dangers. Similarly, students might be asked to discuss a question in quantum chemistry. |

🗹 **Synthesize and transfer knowledge across disciplinary boundaries**

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| Students must use physics concepts to understand explanations of phenomena in chemistry or astronomy and applications such as electronics and quantum computing. The reverse process occurs as well. In trying to understand how a device works or how a phenomenon makes sense, students often notice their own misconceptions or gaps in knowledge that can be addressed to deepen their understanding of the physics concept. |

🗹 Comprehend factors inherent in complex problems

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| Students observe the complexity of applying basic physics concepts to solve questions in other disciplines such as chemistry or to make a practical device such as GPS. Students also see how a variety of concepts and/or techniques must be synthesized to understand other concepts. A naïve attempt to rely on intuition is often seen to be insufficient. |

🗹 Apply integrative thinking to problem solving in ethically and socially responsible ways

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| Students are confronted with the ethical issues and social impact of nuclear weapons. Students will assess benefits and dangers of nuclear technology. |

🗹 Recognize varied perspectives

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| The wave/particle duality is precisely an example of how changing perspectives (changing the quality being tested) gives different results. Students also see perspectives of experts in different disciplines. |

🗹 Gain comfort with complexity and uncertainty

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| Students are confronted with numerous complicated, novel, and counterintuitive concepts. Uncertainty is an inextricable feature of quantum mechanics. Students are also introduced to many unresolved questions in physics and other areas. |

🗹 Think critically, communicate effectively, and work collaboratively

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| Students collaborate in lab to perform experiments. Students must think critically in order to correct mistakes which always arise in experiments. Students must learns to communicate effectively to give a presentation on their research project. |

🗹 Become flexible thinkers

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🞎 Other

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**General Education Learning Goals for City Tech Students**

* **Knowledge:** Develop knowledge from a range of disciplinary perspectives, and hone the ability to deepen and continue learning.
* **Skills:** Acquire and use the tools needed for communication, inquiry, creativity, analysis, and productive work.
* **Integration**: Work productively within and across disciplines.
* **Values, Ethics, and Relationships**: Understand and apply values, ethics, and diverse   
  perspectives in personal, professional, civic, and cultural/global domains.

1. How does this course address the general education learning goals for City Tech students?

Students develop knowledge about physics, chemistry, astronomy, history, philosophy and how to ask questions and do further research to continue learning. Students learn to use and integrate physics knowledge as related to other aforementioned disciplines. Students write researched essays demonstrating the ability to work productively and communicate learned ideas. In lab, students conduct their own inquiry and analyze results of data. Students do a research project requiring creativity and independent thinking. They must communicate their findings in a presentation given at the end of the class. A historical and philosophical perspective is used to give students an understanding of the ethical implications of the subject.

1. Which department would house this course[[3]](#footnote-3)? \_\_\_\_\_\_Physics\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
   Would all sections of the course be interdisciplinary? 🞎 No 🗹 Yes
   1. Would the course be cross-listed in two or more departments? 🗹 No 🞎 Yes   
      Explain.

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* 1. How will the course be team-taught[[4]](#footnote-4)? 🞎 Co-taught 🗹 Guest lecturers 🞎 Learning community  
       
     If co-taught, what is the proposed workload hour distribution? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
     🞎 Shared credits 🞎 Trading credits   
     If guest lecturers, for what approximate percentage of the course? 🗹 Minimum 20%[[5]](#footnote-5) 🞎 other: \_\_%  
       
     Please attach the evaluation framework used to assess the interdisciplinarity of the course.[[6]](#footnote-6)

Students will be asked questions on the exams requiring interdisciplinary analysis. Students will write essays or small projects which will require synthesis of physics and the discipline of guest lecturers, e.g. students might be asked to research and describe an aspect of the history of nuclear reactors after hearing about aspects of the history of nuclear weapons.

* 1. What strategies/resources would be implemented to facilitate students’ ability to make connections across the respective academic disciplines?

Faculty will facilitate discussions before, during, and after guest lectures on the relationship of the material to the physics and other guest lectures if appropriate. Students will be encouraged and required to write essays or do small projects to synthesize their understanding.

10. Would the course be designated as:

🗹 a College Option requirement[[7]](#footnote-7)? 🗹 an elective? 🗹 a Capstone course[[8]](#footnote-8)? 🞎 other? Explain.

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| Course has capstone designation and college option designation |

1. See “Application for Interdisciplinary Course Designation” question 9b for team-teaching options. [↑](#footnote-ref-1)
2. Exceptions are made for Departments that provide a home for multiple disciplines, such as Humanities and Social Science. [↑](#footnote-ref-2)
3. An interdisciplinary course for the College Option requirement may be housed in a department that is not liberal arts. [↑](#footnote-ref-3)
4. Attach evidence of consultation with all affected departments. [↑](#footnote-ref-4)
5. While an interdisciplinary course must be team-taught, there is no formal percentage requirement, but this minimum is a guideline. [↑](#footnote-ref-5)
6. In the case that a course is equally taught, include proposed plans for faculty classroom observation and student evaluation of teaching. [↑](#footnote-ref-6)
7. To qualify for the College Option, such a course must also meet the New York State definition of a liberal arts and sciences course.  
   <http://www.highered.nysed.gov/ocue/lrp/liberalarts.htm> [↑](#footnote-ref-7)
8. A course proposed as a Capstone course must be separately approved by the Capstone Experience Committee. [↑](#footnote-ref-8)