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

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**Application for Interdisciplinary Course Designation**

**Date:** April 8, 2015

**Submitted by:** Prof. Reginald Blake

**Department(s):** Physics

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

1. Identify the course type and title:  
     
   X An existing course\_\_\_**PHYS 1002: An Introduction to the Physics of Natural Disasters** \_\_\_\_\_\_\_\_\_\_  
   🞎 A new course \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
   🞎 A course under development \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Provide a course description

This geophysics course for non-science majors focuses on natural disasters and the dynamic Earth processes that control them. The course integrates the principles of geology, meteorology, climatology, oceanography, and astronomy to provide rudimentary understanding of geophysics. Physical concepts of thermodynamics, radiation and radiation budget, general circulation of the atmosphere, and wave dynamics are some of the basic physics that will be introduced and applied in the course. Students learn about the nature, causes, risks, impacts, and prediction of natural disasters including hurricanes, earthquakes, volcanoes, tsunamis, and climate change. Laboratory exercises are incorporated with class work to illustrate and supplement the lecture material.

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

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| Pre- and co-requisite: MAT 1190 |

1. Explain briefly why this is an interdisciplinary course.

Natural disasters are ubiquitous and, therefore, have relevance and impacts across a broad spectrum of societal domains from infrastructure and energy to basic survival. The scope and depth of the topics covered in the course are comprehensive, far-reaching, and interdisciplinary in nature. To elucidate the interdisciplinary subject matters of this geoscience course, connections will be drawn and integrative knowledge will be dispensed and applied from the disciplines of civil engineering, electrical engineering, and architecture.

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 proposed theme of the course coalesces around the unique integration of the earth, its subsystems, and their fragilities and vulnerabilities to both natural and anthropogenic perturbations that are governed by physical laws. The complex, central question this course addresses is - how effective are the physical laws in predicting the occurrence and forecasting and minimizing the impacts from these natural phenomena? This course will assimilate and apply the pedagogical approaches and techniques that are intrinsic to the disciplines of physics, geology, hydrology, meteorology, civil engineering, electrical engineering, and architecture.

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

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

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| The course will intentionally and easily connect, weave, and intertwine cross disciplinary knowledge and skills to address and to explain the vibrant nature of the Earth’s active and dynamic subsystems and thereby elucidate the mysteries behind nature’s fury, particularly in the context of providing insights and solutions to ameliorate impacts to the natural and built environments. |

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

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| Since the Earth and its sub-systems are symbiotic and interconnected by nature, and since a plethora of other disciplines is directly impacted by them, the geosciences readily lend themselves to the synthesis that blurs disciplinary boundaries and allows for border migration and knowledge transfer. The course will thus explicitly demonstrate how cross disciplinary knowledge transfer and applications from civil engineering, electrical engineering, and architecture are utilized to deepen understanding of the geosciences. |

🞎 Comprehend factors inherent in complex problems

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

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🞎 Recognize varied perspectives

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x Gain comfort with complexity and uncertainty

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| This course will help students to not only gain insights to the complexity of the geosciences, but it will also emphasize and explain the risks, the limitations, and the uncertainties involved in predicting the development, the track, and the impacts of natural phenomena. This approach to the scientific methodology of the geosciences will help students to better understand, appreciate the complexity of nature’s behavior and assist them in becoming better citizen scientists. |

x Think critically, communicate effectively, and work collaboratively

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| One of the highlights of the course will be group projects. This course component will help students to develop a host of skills including: communication/presentation (verbal and written – both poster and oral presentations and a paper will be required), team/group work, networking, basic research, critical thinking, inter-personal, leadership (each team will have a captain and a co-captain who will oversee the group’s project), break complex tasks into smaller components, time management, share and debate diverse perspectives, and hold each other accountable. |

🞎 Become flexible thinkers

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x Other

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| The course will develop citizen scientists. Students will not only better understand natural disasters, but they will also gain perspective on its relevance to their own lives and its interdisciplinary characteristics. They will be able to critically analyze, synthesize, and explain geophysical phenomena with a level of clarity and understanding that will produce broader impacts to their communities and to the society at large. Deeper understanding of environmental justice and environmental activism, the opportunity to become part of a cause that is bigger than the individual, the transferring of general knowledge to the next generation, and the enhancement of science-society-policy interactions will be further general learning outcomes of this ID course. |

**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?

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| The activities and the structure of this course will guide students to the attainment of each component of the General Education learning goals outlined above. These learning goals are all congruent to - and consistent with - the scope, expectations, and deliverables of the course. |

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

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* 1. How will the course be team-taught[[2]](#footnote-2)? 🞎 Co-taught X Guest lecturers 🞎 Learning community  
     If co-taught, what is the proposed workload hour distribution? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
     🞎 Shared credits 🞎 Trading credits
  2. If guest lecturers, for what approximate percentage of the course? X Minimum 20%[[3]](#footnote-3) 🞎 other: \_\_%  
       
     Please attach the evaluation framework used to assess the interdisciplinarity of the course.[[4]](#footnote-4)

The required assignments in PHYS 1002 will allow students to: 1) synthesize insights from at least two disciplines, 2) integrate ideas across disciplines, and 3) incorporate knowledge gained from the course for applications to their own majors. Specifically, perspectives on how earthquakes affect built environments, on how electrical engineering and its remote sensing applications are used to study air pollution impacts on climate change, and on how civil engineering techniques are used in floodplain and hydrograph analyses will be gained from the guest lecturers. Example assignments assessing the interdisciplinarity of the course may include the following:

1) An exam where students will have short answer questions related to the topic of the guest lecturers The questions may ask students to analyze a natural disaster phenomenon and provide solutions drawn from the other disciplines.

2) A group research project and presentation

Teams would be encouraged to choose a natural disaster phenomenon and connect it to at least one of the other disciplines covered in the guest lectures. Student teams will be graded based on a rubric that will include statements on how students were able to integrate multiple perspectives.

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

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| The strategies/resources include: 1) guest lectures by faculty from different disciplines; and 2) assignments, laboratories, and projects that are inherently interdisciplinary. |
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1. Would the course be designated as:

X a College Option requirement[[5]](#footnote-5)? 🞎 an elective? 🞎 a Capstone course[[6]](#footnote-6)? 🞎 other? Explain.

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**PHYS 1002: An Introduction to the Physics of Natural Disasters**

**Course Syllabus**

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| Week | **Lecture Topics** | **Laboratories and Exams** | **Chapters** |
| 1 | Natural Disasters and the Human Population | Introduction | 1 |
| 2 | Internal Energy and Plate Tectonics – Density Stratification, Isostasy, Radioactivity, Magnetism | Plate Tectonics | 2 |
| 3 | Earthquake Geology and Seismology – Faults, Elastic Rebound Theory  Guest Lecture by: Prof. Illya Azaroff  (Architecture Department) | Seismic Waves and locating Epicenters of Earthquakes | 3 |
| 4 | Plate Tectonics, Earthquakes, and Volcanoes – Subduction zones, Earthquake wave theory, Plate Collision | Volcanoes: Materials, Hazards, and Eruptive Mechanisms | 4, 5 |
| 5 | Volcanic Eruptions: Plate Tectonics and Magmas – Viscosity, Temperature, Density, Force | ***Exam #1*** | 6, 7 |
| 6 | Tsunami versus Wind-Caused Waves – Wave: frequency, period, length, amplitude, speed | Tsunami Generation, Propagation, Impact | 8 |
| 7 | External Energy Fuels Weather and Climate – Radiation: Planck’s Law, Stefan-Boltzmann Law, Wien Displacement Law. Thermodynamics: Latent Heat, Energy Transfer, Heat Engines, Adiabatic Processes, General Circulation of the Atmosphere and the Oceans |  | 9 |
| 8 | Hurricanes - Thermodynamics and Heat Engines | Hurricane Mechanics | 10 |
| 9 | Climate Change – Climate models  Guest Lecture by Prof. Viviana Vladutescu  (Electrical Engineering Technology Department) | Global Warming and Climate Change Impacts | 11 |
| 10 | Tornadoes, Lightening, Thunderstorms – vorticity, electricity, radar, super cell, thunder clouds | ***Exam #2*** | 12 |
| 11 | Floods – water balance equation, evapotranspiration, time series analyses, overland and subsurface flow, unit hydrograph  Guest Lecture by: Prof. Hamidreza Norouzi  (Civil Engineering Technology Department) | Hydrograph and Flood Plain Analysis | 13 |
| 12 | Fires | Flooding: River Velocity, Discharge, Erosion, and Sediment Deposition | 14 |
| 13 | Mass Movements – gravitational force, gravity, energy, force, work, power, and heat, slope stability, cohesion, debris flow | Downslope Movements of Landslides | 15 |
| 14 | Impacts with Space Objects – Earth’s orbit, extraterrestrial debris, asteroids, comets, impact craters | ***Oral Presentations*** | 16 |
| 15 | ***Final Exam*** | Lab Exam |  |

1. An interdisciplinary course for the College Option requirement may be housed in a department that is not liberal arts. [↑](#footnote-ref-1)
2. Attach evidence of consultation with all affected departments. [↑](#footnote-ref-2)
3. While an interdisciplinary course must be team-taught, there is no formal percentage requirement, but this minimum is a guideline. [↑](#footnote-ref-3)
4. In the case that a course is equally taught, include proposed plans for faculty classroom observation and student evaluation of teaching. [↑](#footnote-ref-4)
5. 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-5)
6. A course proposed as a Capstone course must be separately approved by the Capstone Experience Committee. [↑](#footnote-ref-6)