Common Core (Pathways)

Course Submission Form

Instructions: All courses submitted for the Common Core must be liberal arts courses. Courses submitted to the Course Review Committee may be submitted for only one area of the Common Core and must be 3credits. STEM waiver courses do not need to be approved by the Course Review Committee. This form should not be used for STEM waiver courses.

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Course Selected: **Subject** PHYS (PHYS - Physics)
Catalog Nbr 8

Course Revision & College

Form Submission Initial Submission

College Queens College

Course Data

Course ID 151949

Subject PHYS (PHYS - Physics)

Catalog Nbr 8

Catalog Status Pending

Contact Hours 3

No. of Credits 3

CourseTitle The Science of Fractals and Its Applications

Course Description Fractals are physical or mathematical objects with an ever-larger number of ever-smaller pieces. This course shows how scientists use fractals to analyze and solve problems. The course uses the tools of spreadsheets, graphs, algebra, numerical methods, folding pieces of paper, and performing in-class experiments to learn mathematical concepts and apply them to give insights into the nature and properties of physical, biological, and social systems.

Department Physics

Pre-Requisites/Co-Requisites

Course Syllabus [Attachment Filename(s)]

Physics_8_Syllabus_(1).docx

Location(Required or Flexible) and Learning Outcomes

	REQUIRED	FLEXIBLE
	English Composition	**World Cultures & Global Issues**
☑	**Math & Quantitative Reasoning**	**US Experience in its Diversity**
	Life and Physical Sciences	**Creative Expression**

Individual and Society

Scientific World

Learning Outcomes: Questions	Learning Outcomes: Responses
*** 1. Interpret and draw appropriate inferences from quantitative representations, such as formulas, graphs, or tables.**	Determine functional relationships from equations and graphs. Drawing inferences from quantitative representation of data as graphs. ? What Graphs Tell Us: Discovering Straight Lines ? What Graphs Tell Us: What the Straight Lines Mean
*** 2. Use algebraic, numerical, graphical, or statistical methods to draw accurate conclusions and solve mathematical problems.**	Determine iterative rules and scaling relationships using algebraic relationships, computed data in excel spreadsheets, and graphs. Using the Koch curve to understand limits and mathematically solve for its area and perimeter length using analytical and numerical methods. ? The Koch Curve: Introduction to the Snowflake ? The Koch Curve: Area and Limits ? The Koch Curve: Zeno's Animals and the Area of the Koch Curve ? The Koch Curve: Length, Infinity, and Dimension
*** 3. Represent quantitative problems expressed in natural language in a suitable mathematical format.**	Creating and iterating mathematical expressions from verbal descriptions of fractal iterations. Translate a physical process described in natural language into a symbolic mathematical system and use iterative rules to predict the results of that natural process. Here the process is the iterative folding of a strip of paper and its representation is that of a symbol sequence. ? Using Symbols to Represent Paper Folds: L's, R's ? Paper Folding Iterations: Real Folds in Real Paper and the Symbols L and
*** 4. Effectively communicate quantitative analysis or solutions to mathematical problems in written or oral form.**	Describe results in journal entries, homework, and in class oral presentations. Student projects identify fractals in nature, create them in the class, and present their results as oral presentations to the class and written reports. ? Newspaper Crumpling: Dimension, Density, and Scaling Relationships ? Finding Fractals: Outside the Classroom ? Finding Fractals: Inside the Classroom

*** 5. Evaluate solutions to problems for reasonableness using a variety of means, including informed estimation.**	Estimate fractal dimension compared to quantitative measures by box counting and scaling relationships. Students will identify or measure dimensions of mathematical and physical objects and compare those quantitative results expected for those objects embedded in 1, 2, and 3 dimensions. ? The Middle Third Cantor Set: Making a Fractal by Removing Pieces ? The Sierpinski Triangle: Many Different Ways ? Many Different Dimensions: Fractal, Topological, Embedding ? Figuring Out the Fractal Dimension: Box Counting ? Figuring Out the Fractal Dimension: The Scaling Relationship Objectives:
*** 6. Apply mathematical methods to problems in other fields of study.**	Use fractals to analyze biological patterns: heart, nerves, blood vessels. Students will use what they have learned from the mathematical properties of fractals to help understand the properties and function of physical and biological systems. ? More Scaling Relationships: How Nerves Work ? Even More Scaling Relationships: The Mass and Density of Fractals ? Fractal Statistics: How the Ear Works and More ? Fractal Statistics: How the Heart Works and More
A. If there is a change to the course title, what is the new course title?	
B. If there is a change to the course description, what is the new course description?	
C. If there is a change to the pre-requisites and/or co-requisites, what are the new pre-requisites and/or co-requisites?	

Chair (Approver) Comments

Comments The committee voted to approve this course.