

NEW COURSE PROPOSAL

PROGRAM AREA SCIENCES/ART

1. Catalog Description of the Course. *[Include the course prefix, number, full title, and units. Provide a course narrative including prerequisites and corequisites. If any of the following apply, include in the description: Repeatability (May be repeated to a maximum of ___ units); time distribution (Lecture ___ hours, laboratory ___ hours); non-traditional grading system (Graded CR/NC, ABC/NC). Follow accepted catalog format.]*

ART 208. THE PHYSICS OF ART AND VISUAL PERCEPTION (3)

Two hours lecture and two hours lab per week.

A course on the physics of light, color, art and visual perception. The course will cover the nature of light and optical phenomena, the perception and psychology of color, the reproduction of color in different media, and the analysis of art from a science perspective. The emphasis is on factors which permit the artist and observer to understand and more fully control the design and interpretation of images of all kinds. Demonstrations, experiments, and video/computer simulations are used to analyze signals received by the eyes or instruments. GenEd: B1,C1 (Same as PHYS 208)

PHYS 208. The Physics of Art and Visual Perception (3)

Two hours lecture and two hours lab per week.

A course on the physics of light, color, art and visual perception. The course will cover the nature of light and optical phenomena, the perception and psychology of color, the reproduction of color in different media, and the analysis of art from a science perspective. The emphasis is on factors which permit the artist and observer to understand and more fully control the design and interpretation of images of all kinds. Demonstrations, experiments, and video/computer simulations are used to analyze signals received by the eyes or instruments. GenEd: B1,C1 (Same as ART 208)

2. Mode of Instruction.

	Units	Hours per Unit	Benchmark Enrollment
Lecture	<u>2</u>	<u>1</u>	<u>20</u>
Seminar	<u> </u>	<u> </u>	<u> </u>
Laboratory	<u> </u>	<u> </u>	<u> </u>
Activity	<u>1</u>	<u>2</u>	<u>20</u>

3. Justification and Learning Objectives for the Course. (Indicate whether required or elective, and whether it meets University Writing, and/or Language requirements) *[Use as much space as necessary]*

Justification

This course fulfills three units of the six unit lower division studio art requirement for the Art Major; it is also available for GE credit and as an elective.

Though art and science are traditionally considered antithetical disciplines, with art dependent on intuition for its development and science on logic and sequential thinking, both nevertheless rely on an initial burst of inspiration regarding the nature of reality, and in Western culture the two have followed separate but remarkably similar paths. This course provides a stimulating arena for the non-scientist to learn some science, to gain an appreciation of nature and perception, and to form a new understanding of art, photography and artists. By using material from the sciences and the arts, it examines the ways in which ideas of knowledge and of human nature have been fashioned. The specific topics include physical theories about light, biological and psychological theories of visual perception, and artistic theories and practices concerned with representation. Such a course has the added benefit of binding science and art.

Learning Objectives

Through studio projects involving technical demonstrations, artistic exercises, class discussions, field trips to museums and galleries, project presentations and class critiques, students will:

- Develop projects that combine experiments within an artistic and scientific context.
- Articulate, verbally and in written form, their conscious intentions and coherent aesthetics in relationship to projects they produce.
- Demonstrate the fundamental properties of light and image formation in the eye and in photography
- Demonstrate proficiency in the development of scientific art projects.
- Produce group art projects involving collaborative team assignments.
- Demonstrate methods and processes utilized in refinement of artistic ideas and technical issues.
- Participate in the critical evaluation process of peer projects.
- Develop visual imagery in terms of color and visual perception

4. Is this a General Education Course YES NO
 If Yes, indicate GE category:

A (English Language, Communication, Critical Thinking)	
B (Mathematics & Sciences)	X
C (Fine Arts, Literature, Languages & Cultures)	X
D (Social Perspectives)	
E (Human Psychological and Physiological Perspectives)	

5. Course Content in Outline Form. *[Be as brief as possible, but use as much space as necessary]*

ART/PHYS 208. The Physics of Art and Visual Perception (3)

I. The physical nature of light

- A. The transverse wave theory: electric and magnetic fields: speed of light: origin of color
- B. Photon theory: historical development: Which theory works best?
- C. Light and energy

II. The origin of color

- A. Illumination terminology, physical units
- B. Blackbody radiation
- C. Reflection, transmission and absorption
- D. Primary colors: color addition and subtraction

III. Colorimetry

- A. Newton's system
- B. The CIE system
- C. Munsell color notation system: Ostwald color system

IV. Color vision

- A. Trichromacy: constancy
- B. Contrast and after-images
- C. Color Blindness
- D. Current theories of color vision (Zone and Retinex theories: Kuffler units): Which to use, and when?

- V. Appearance of objects
 - A. Opaque surfaces
 - B. Metals
 - C. Transparent colorants
 - D. Pigment particles

- VI. Geometric Optics
 - A. Reflection: plane and curved mirrors
 - B. Refraction
 - C. Lenses: lens equations
 - D. Chromatic aberration

- VII. Applied geometrical optics
 - A. The reduced eye
 - B. Adaptation
 - C. Defects of vision
 - D. The camera (telephoto lenses: light sensitivity: f-numbers: exposure/film speed: depth of field)
 - E. Other optical devices (microscope: telescope: projector)

- VIII. Wave optics
 - A. Two slit experiment
 - B. Diffraction grating and single slit diffraction
 - C. The laser: holograms
 - D. Polarization

- IX. Light and color in nature
 - A. Rainbows and halos
 - B. Interference phenomena (oil spots: bubbles: iridescence)
 - C. Scattering effects: Rayleigh scattering
 - D. Mirages
 - E. Aurora

- X. The psychology of color
 - A. Physiological effects of color : contrast and harmonies
 - B. Color and emotion
 - C. Depth perception
 - D. Texture

- XI. Works of art
 - A. Subjective and objective responses: visual structure
 - B. Aesthetics: Innovation: What is great art?
 - C. Cultural influences

6. References. [Provide 3 - 5 references on which this course is based and/or support it.]

- Falk, Brill and Stork. *Seeing the Light*. Wiley, 1986.
- Livingstone, Margaret. *Vision and Art: The Biology of Seeing*, Harry N Abrams, 2002.
- Shlain, Leonard. *Art & Physics: Parallel Visions in Space, Time, and Light*. Quill, 1993.
- Cartwright, Lisa & Maria Sturken. *Practices of Looking*, Oxford: Oxford University Press, 2001.
- Albers, Joseph. *Interaction of Color*, Princeton: Yale Univ Press, 1987
- Overheim, Daniel. *Light and Color*, New York, John Wiley & Sons, 1992

Birren, Faber. *Color Psychology and Color Therapy*, Secaucus: Citadel Press, 1969
Livingstone, Margaret. *Vision and Art: The Biology of Seeing*, Harry N Abrams, 2002

7. List Faculty Qualified to Teach This Course.

Jack Reilly, MFA, Professor of Fine Arts
Geoff Dougherty, PhD, Professor of Physics

8. Frequency.

a. Projected semesters to be offered: Fall _____ Spring x Summer _____

9. New Resources Required.

- a. Computer (data processing), audio visual, broadcasting needs, other equipment
- b. Library needs
- c. Facility/space needs

10. Consultation.

Attach consultation sheet from all program areas, Library, and others (if necessary)

11. If this new course will alter any degree, credential, certificate, or minor in your program, attach a program modification.

Geoff Dougherty, PHD, Professor of Physics

Jack Reilly, MFA, Professor of Fine Arts 01/09/03

Proposer of Course

Date

GE CRITERIA APPROVAL FORM

Course Number and Title:

ART/PHYS 208. The Physics of Art and Visual Perception (3)

Faculty Member(s) Proposing Course: Geoff Dougherty and Jack Reilly

Indicate which of the following categories would be satisfied by this course by marking an “X” on the appropriate lines. Courses may be placed in up to two GE categories as appropriate. Upper Division Interdisciplinary GE courses may be placed in two categories plus the UDIGE category.

	A1: Oral Communication
	A2: English Writing
	A3: Critical Thinking
X	B1: Physical Sciences
	B2: Life Sciences
	B3: Mathematics
	B4: Computers and Technology
X	C1: Fine Arts
	C2: Literature
	C3: Languages & Cultures
	D: Social Perspectives
	E: Human Psychological & Physiological Perspectives
	Upper Division Interdisciplinary GE

Lab Included? Yes No

Please provide a brief explanation of how the proposed course meets each of the criteria for the selected General Education categories.

All Category B courses shall:

- Promote the understanding and appreciation of the methodologies of math or science as investigative tools and the limitations of mathematical or scientific endeavors.

→ The course will present to non-science students a first hand look at the physical foundations of light and visual perception by demonstration and computer study. These will be presented in a way to fuse art and science. Students will be encouraged to recognize the limitations and inconsistencies in the popular presentation of such concepts.

- Present mathematical or scientific knowledge in a historical perspective and the influences of math or science on the development of world civilizations, both past and present.

→ The concepts will be studied from a historical perspective, showing how theories evolved over time.

- Apply inductive and deductive reasoning processes and explore fallacies and misconceptions in the mathematical or scientific areas.

→Critical reasoning skills in the application of physical principles will be encouraged.

Category B-1 Physical Sciences—Chemistry, Physics, Geology, and Earth Sciences courses shall:

- Present the principles and concepts of the physical sciences and the physical universe.

→ Scientific principles and concepts, and their applications, will be discussed.

All Category C courses shall:

- Develop students' ability to respond subjectively as well as objectively to experience

→ Although most students understand the beauty of art subjectively, the course will enable them to understand those feelings in an objective manner.

- Cultivate and refine students' affective, cognitive, and physical faculties through studying great works of the human imagination.

→ Through studying the use of color and texture in art, students will have an opportunity for both affective and cognitive development.

- Increase awareness and appreciation in the traditional humanistic disciplines such as art, dance, drama, literature, and music.

→ This course will increase students' awareness and appreciation of fine art by analyzing examples of it.

- Examine the interrelationship between the creative arts, the humanities, and self.

→ Students will integrate knowledge and experience to arrive at creative solutions.

- Include an exposure to world cultures.

→ Students will be exposed to the cultures that produced great art.

Category C-1 Art courses shall:

- Impart knowledge of the visual and performing arts.

→ Numerous examples of visual art will be studied.

- Promote students' ability to effectively analyze and respond to works of human imagination

→ Examples of visual art will be studied with a view to trying to understand the use of color and texture by the artist and their impact on the observer.

In addition to meeting Category A-E criteria as appropriate all Upper Division Interdisciplinary GE courses shall:

- Emphasize interdisciplinarity by integrating content, ideas, and approaches from two or more disciplines.

→ This course is an example of connecting the disciplines of physics and art in a most explicit manner.

- Include substantive written work consisting of in-class writing as well as outside class writing of revised prose.

→ Each student is required to provide written reports on their experiments and projects. The writing consists of descriptive explanations of the methods and results. Group discussions and critiques will also take place.