Rochester Institute of Technology
Rochester, New York

COLLEGE of SCIENCE
Department of Imaging Science

REVISED COURSE: 1051-400

1.0 **Title**: Vision and Psychophysics **Date**: 03/10/2003
Credit Hours: 4
Prerequisite(s): 1051-204 (Introduction to Imaging Systems) or permission of instructor
Corequisite(s):
Course proposed by: Jeff Pelz

2.0 Course information:

	Contact hours	Maximum students/section
Classroom	4	35
Lab	-	
Studio	-	
Other (specify _____)		

Quarter(s) offered (check)
_____ Fall _____ Winter __X___ Spring _____ Summer

Students required to take this course: (by program and year, as appropriate)
Typically 2nd year Imaging Science students
The course may also be taken in the third year for students who enter Imaging Science as juniors.

Students who might elect to take the course:
Diagnostic Medical Sonography, Math, Physics; others with permission of instructor

3.0 Goals of the course (including rationale for the course, when appropriate):
The goal of *Vision and Psychophysics* is to provide a detailed overview of the components making up the human visual system, and the tools used to make quantitative measurements of perceptual phenomenon (psychophysics). Components include physical elements (*e.g.*, visual optics, photoreceptors) and neural processes such as retinal and cortical processing.

4.0 Course description

1051-400 Vision & Psychophysics

The final 'component' in many imaging systems is visual perception. The human visual system can also be considered as an imaging system itself; arguably the most complex system. From visual optics through high-level cortical processing such as the perception of depth and motion. An understanding of the characteristics and limitations of the visual system aids in designing and evaluating imaging systems. Unlike other elements of imaging systems, it is difficult or impossible to get objective measures of visual perception; psychophysics provides tools for measuring perceptual mechanisms. This course presents an overview of the organization and function of the human visual system and some of the psychophysical techniques used to study visual perception. (1051-204 or permission of instructor) **Class 4, Credit 4** (S)

Offered Spring Quarter

5.0 Possible resources (texts, references, computer packages, etc.)

5.1 Vision Science; from Photons to Phenomenology, Palmer, S.E. (1999)
5.2 Psychophysics - the Fundamentals, Gescheider
5.3 Seeing the Light, Falk, Brill, & Stork
5.4 Foundations of Vision, Wandell Sinaur
5.5 The First Steps in Seeing, Rodieck, Sinaur
5.6 Sensation and Perception, Goldstein
5.7 The Senses, Barlow & Mollon

6.0 Topics (outline):

6.1 Vision as Imaging Chain; Visual Optics
- 6.1.1 Cornea
- 6.1.2 Eyelens
- 6.1.3 Accommodation
- 6.1.4 Refractive errors
- 6.1.5 Spectacle correction (glasses, contact lenses, laser surgery)
- 6.1.6 The Inverse problem

6.2 Photodetector array
- 6.2.1 Rods and cones
- 6.2.2 Foveal/peripheral distribution
- 6.2.3 Spectral selectivity of cone classes

6.3 Retinal processing
- 6.3.1 Retinal cells; rods, cones, horizontal, bipolar, amacrine, and ganglion
- 6.3.2 Lateral inhibition

6.3.3 Retinal receptive fields

6.4 Cortical Processing
- 6.4.1 Optic nerve /chiasma
- 6.4.2 Lateral geniculate nucleus
- 6.4.3 Cortical pathways

6.5 Spatial Vision
- 6.5.1 Contrast sensitivity function
- 6.5.2 Acuity/hyperacuity
- 6.5.3 Visual fields

6.6 Depth and size perception
- 6.6.1 Monoclar cues
  - 6.6.1.1 Accommodation
  - 6.6.1.2 Pictorial
  - 6.6.1.3 Motion parallax
- 6.6.2 Binocular cues
  - 6.6.2.1 Vergence
  - 6.6.2.2 Stereopsis; retinal disparity

6.7 Color perception
- 6.7.1 Principle of univariance
- 6.7.2 Trichromatic *vs.* opponent models
- 6.7.3 Color constancy

6.8 Temporal and motion perception
- 6.8.1 Flicker and apparent motion
- 6.8.2 Motion selectivity mechanisms
- 6.8.3 Retinal stabilization and destabilization; eye movements

6.9 Visual Psychophysics
- 6.9.1 Classical methods
- 6.9.2 Signal detection theory
- 6.9.3 Image quality scaling methods

7.0 Intended learning outcomes and associated assessment methods of those outcomes

7.1 Demonstrating knowledge of individual components in the human visual system
- 7.1.1 Examinations, homework

7.2 Demonstrating knowledge of the human visual system as an imaging chain
- 7.2.1 Examinations, homework

7.3 Demonstrating knowledge of retinal processing
- 7.3.1 Examinations, homework, programming

8.0 Program or general education goals supported by this course

This course supports many fundamental imaging science program outcomes, such as “gaining knowledge of imaging systems, physics, mathematics, and digital processing so as to formulate, analyze, and solve practical problems in imaging science.”

9.0 Other relevant information

9.1 Media requirements: VGA and video projection facilities

10.0 Supplemental information