Rochester Institute of Technology
Rochester, New York

COLLEGE of SCIENCE
Center for Imaging Science

Information Theory for Imaging Science 1051-714

1.0 Title: Information Theory for Imaging Science
Date: October 25, 2006
Credit Hours: 4
Prerequisite(s):1051-713 or permission of instructor.

2.0 Course information:

	Contact hours	**Maximum students/section**
Classroom	4	30
Lab		
Studio		
Other (specify _____)		

Quarter(s) offered (check)
__X__**Fall** _____**Winter** _____**Spring** _____**Summer**

Students required to take this course:
None

Students who might elect to take this course:
Graduate students in Imaging Science, Graduate students in the College of Science or College of Engineering.

3.0 Goals of the course (including rationale for the course, when appropriate)
3.1. Understanding of information measures
3.2. Understanding of source coding techniques based on symbol sequences
3.3. Understanding of storage and communication channel models
3.4. Understanding of transformation, quantization and coding for compression
3.5. Understanding of error control techniques for storage and communications

4.0 Course description (as it will appear in the RIT Catalog, including pre- and co-requisites, quarters offered)

1051-714 Information Theory for Imaging Systems
This course develops a basic understanding of the efficient representation of information for storage and transmission. Classical concepts of information theory are developed and applied to image compression, storage and transmission.

The intent is to develop a foundation for the efficient handling of image-based information in imaging systems. Also offered online..**Class 4, Credit 4 (S)**

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

5.1 Instructor's Course Notes
5.2 Journal and conference papers

6.0 Topics

6.1 Efficient representation of discrete symbol sequences. Instantaneous codes for IID sources. Kraft's inequality, McMillan's inequality and Huffman codes.

6.2 The classical measure of information and its relationship to entropy. The relationship of entropy to efficient source coding.

6.3 Mutual information and channel capacity

6.4 Limits on information transmission rate. Shannon's channel coding theorem discussed via the law of large numbers.

6.5 Basic error control techniques using linear block codes.

6.6 Waveform and image coding by use of linear prediction to reduce sample redundancy.

6.7 Image transformations for the reduction of redundancy and match to perceptual factors. Emphasis on DCT and wavelet coding.

6.8 Examples of transform-based lossy compression (JPEG and JPEG 2000)

6.9 Decision theory and optimal decision rules

7.0 Intended learning outcomes and associated assessment methods of those outcomes

Learning Outcome	In class attendance and evaluation	Homework Assignments
7.1 Ability to construct efficient lossless coding algorithms	X	X
7.2 Ability to analyze rate-distortion tradeoff for lossy compressing systems	X	X
7.3 Ability to estimate the capacity of an information transmission channel	X	X
7.4 Ability to compute information relationships in source-observer systems	X	X

8.0 Program or general education goals supported by this course

8.1 Provides fundamental knowledge for graduate study in image and signal processing.

8.2 Provides system design knowledge to enable modeling of tradeoff issues imaging and signal processing systems.

8.3 Prepares graduate students in science and engineering for careers in imaging science.

9.0 Other relevant information (such as special classroom, studio or lab needs, special scheduling, media requirements, etc.)

9.1 Classroom with computer projection system, internet access and conference telephone access for online participation.

10.0 Supplemental information - NONE