

Electrical Eng

©

PROPOSAL NUMBER: 99-1467

CURRICULUM PROPOSAL FORM

\*DEADLINES:

REGULAR COURSE PROPOSALS: OCTOBER 23, 1998 FOR FALL, 1999 AND FEBRUARY 19, 1999 FOR SPRING, 2000  
SHORT-TERM COURSE PROPOSALS: DECEMBER 11, 1998 FOR FALL, 1999 AND MARCH 26, 1998 FOR SPRING 2000

PROPOSAL TITLE: Introduction to Digital Image Processing (0909.452)  
SPONSOR/S: S MANDAYANI AND JOHN SCHMALZID. ECE CORE COURSE  
DEPARTMENT: ENGINEERING 0909.452

CHECK ALL THAT APPLY:  
 UNDERGRADUATE \_\_\_\_\_ GRADUATE  
COLLEGE: ENGINEERING  
If LAS: \_\_\_\_\_ History/Humanities  
\_\_\_\_\_ Math/Sciences  
\_\_\_\_\_ Social/Behavioral Sciences  
\*\*\*\*\*  
TYPE OF PROPOSAL (Check ALL that Apply)  
\_\_\_\_\_ General Education  
\_\_\_\_\_ New Course in \_\_\_\_\_ Bank  
\_\_\_\_\_ Existing course, Add To \_\_\_\_\_ Bank  
\_\_\_\_\_ Multicultural/Global Designation  
\_\_\_\_\_ Writing Intensive Designation  
\_\_\_\_\_ New Minor/Concentration/Specialization  
\_\_\_\_\_ New Major/Degree Program  
\_\_\_\_\_ Short Term Course Proposal  
 New Course (NOT Gen. Ed.)  
\_\_\_\_\_ Name Change (Dept., School, Major)  
\_\_\_\_\_ Changes in Degree Requirements  
\_\_\_\_\_ Changes Involve Gen. Ed. requirements  
\_\_\_\_\_ Minor Changes to Existing Courses  
\_\_\_\_\_ Course is NOT General Education  
\_\_\_\_\_ Course IS General Education

DEPARTMENT (SIGNATURE INDICATES APPROVAL)  
Ravi Prakash Ramachandran 03/24/99  
DEPT. CURRICULUM CHAIR / DATE  
John Schmalzid 06/14/99  
DEPT. CHAIRPERSON / DATE

COLLEGE CURRICULUM COMMITTEE  
DATE OF OPEN HEARING (if necessary)  
 APPROVED  
\_\_\_\_\_ NOT APPROVED  
Comments:  
Robert R. Herzka 4/20/99  
SIGNATURE DATE

ACADEMIC DEAN (& GRADUATE DEAN, for New Graduate Programs Only)  
 APPROVED  
\_\_\_\_\_ NOT APPROVED  
Comments:  
[Signature] 3/9/99  
SIGNATURE (Academic Dean) DATE  
SIGNATURE (Graduate Dean) DATE

UNIVERSITY CURRICULUM COMMITTEE

DATE OF OPEN HEARING (if necessary) 4/20/99 *college level only*

~~---~~ APPROVED

----- NOT APPROVED

Comments:

Francis Reeves 5/15/99

SIGNATURE DATE

SENATE

Date announced at Senate 4/20/99

Voted upon at Senate: \_\_\_\_\_ Approved \_\_\_\_\_ Not Approved \_\_\_\_\_ Date: \_\_\_\_\_

EXECUTIVE VICE PRESIDENT/PROVOST

\_\_\_\_ APPROVED

\_\_\_\_ NOT APPROVED If no, reasons are as follows:

STUDENT CREDIT HOURS \_\_\_\_\_ FACULTY LOAD HOURS \_\_\_\_\_ EQUALIZED CREDIT HOURS \_\_\_\_\_

OFFICIAL COPY & APPROVAL SHEET FILED (DATE): \_\_\_\_\_

DATE/SIGNATURE EXECUTIVE VICE PRESIDENT/PROVOST [Signature] 5/26/99

REGISTRAR

DATE APPROVED COURSE DESCRIPTION RECEIVED \_\_\_\_\_

HEGIS TAXONOMY & COURSE NUMBER ASSIGNED 0909.452

DATE/SIGNATURE OF REGISTRAR Robert A. Kubat 7/6/99

NOTIFICATION FORWARD:

SENATE CURRICULUM COMMITTEE CHAIRPERSON

DEPARTMENT CHAIRPERSONS

ACADEMIC DEAN(S)

REGISTRAR

\_\_\_\_ SPONSOR(S)

[Signature] 7/6/99

## Course Proposal

### 1. Details:

a) Course Title:	Introduction to Digital Image Processing (0909.452)
b) Sponsor:	Dr. Shreekanth Mandayam and Dr. John L. Schmalzel, Electrical Engineering
c) Credit Hours:	3 credit hours
d) Course Level:	Senior Elective
e) Curricular Effect:	Available to electrical engineering seniors as an elective
f) Prerequisites:	Digital Signal Processing (0909.351) or permission of instructor
g) Suggested Time/ Scale of Implementation	Spring 2000 One section
h) Resources	Faculty will be hired and laboratory equipment obtained consistent with Engineering School multi-year budget. Library acquisitions will be required.

### 2. Rationale:

The proposed course will be available as a senior level elective to Electrical & Computer Engineering students.

Digital image processing is a rapidly evolving field in the context of the current phenomenal demand for information access and delivery in a multimedia format, on an internet based platform. Modern digital image processing, seen from an Electrical Engineering perspective, draws upon prior (and some recent) developments in digital signal processing. The field encompasses the following four categories: Image Enhancement, Image Restoration, Image Compression and Image Recognition. Image restoration techniques are largely based on discrete filter theory and image compression algorithms are largely transform based. Students will gain familiarity with both established and emergent algorithms for accomplishing image processing tasks in the above mentioned categories. State-of-the-art software tools will be employed for performing monochromatic image processing on real-world images.

### 3. Essence of the Course:

#### a) Objectives:

The proposed course has a number of objectives:

- (i) Provide an introduction to the digital signal processing principles employed for processing images.
- (ii) Provide a working knowledge of the mathematical tools for describing monochromatic images.
- (iii) Provide a working knowledge of the state-of-the-art image processing algorithms for performing image enhancement, restoration, compression and recognition (with emphasis on restoration and compression algorithms).
- (iv) Continually demonstrate the applications of image processing, for example, in multimedia information delivery, telemedicine, remote sensing, analysis and synthesis of medical images and robotic vision.

**b) Topical Outline:**

The general topical outline is described below; however, prior to each semester's offering, the instructor will assess any technology advances in the course subject matter or in teaching resources prior to the course and make changes deemed appropriate to maintain requisite content and currency.

Digital image fundamentals  
Elements of visual perception  
Sampling and quantization  
Pixel relationships and imaging geometry

Image transforms  
Discrete Fourier, Cosine, Walsh, Hadamard and Karhunen-Loeve transforms

Image enhancement  
Point processing  
Spatial and frequency domain filtering  
Contemporary applications

Image restoration  
Degradation models  
Algebraic restoration  
Filtering  
Geometric transformations  
Contemporary applications

Image Compression  
Models

Error-free compression  
Lossy and lossless compression  
Standards – GIF, JPEG, MPEG

Image Recognition  
Segmentation  
Representation  
Feature extraction  
Interpretation  
Contemporary applications

**c) Evaluation and Grading Procedures:**

Student grades will be based on projects, examinations, homework, and written and oral technical communication.

**d) Course Evaluation:**

The proposed course will be evaluated based on student evaluations and critical review by engineering faculty.

**4. Results of Consultations:**

**a) Consulted Departments:** None

**b) Consultants and Consultant Statements:** (N/A)

**c) Written Consultations:** (N/A)

**5. Additional Supporting Information:**

Example textbooks that could serve as primary or supplemental references for this course:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Addison-Wesley, Reading, MA.
2. A. K. Jain, Fundamentals of Digital Image Processing, Prentice-Hall, Englewood Cliffs, NJ.

Example software that could be used in conjunction with the course:

1. *Matlab Image Processing Toolbox*, The MathWorks Inc., Natick, MA.

## **6. Catalog Description:**

### **Introduction to Digital Image Processing (0909.452)**

Introduction to digital image processing covers the analysis and contemporaneous applications of the enhancement, restoration, compression and recognition of monochromatic images. Both classical and state-of-the-art algorithms will be employed in conjunction with appropriate software for analyzing real-world images.

Senior elective. Prerequisite of Digital Signal Processing (0909.351) or permission of instructor required.

## MEMORANDUM

To: Dr's Shreekanth Mandayam and John Schmalzel, Electrical and Computer Engineering Dept.  
From: Department of Geography/Anthropology  
Subject: Response to the course proposal for Digital Image Processing (0909.552)  
Date: May 4, 1999

The Geography/Anthropology Department has reviewed the proposal and is pleased that the Engineering School will be offering advanced work in digital image processing.

The Geography/Anthropology Dept. has been teaching an introductory level course in remote sensing, incorporating both analog (visual) and digital image processing for nearly two decades. The emphasis has been on practical applications of the tools and techniques used in the analytical processing of remotely sensed images. Use of remotely sensed data has been an integral part of the curricula taught in geography, geology, earth science, and other fields since the establishment of the American Society of Photogrammetry and Remote Sensing in 1934.

The capacity of digital image processing to enhance fundamental image analysis was, of course, an outgrowth of the introduction of computers and their subsequent development. The point which needs to be emphasized is that many fields of inquiry, including those from the physical sciences, medicine, technology, and others have legitimate curricular involvement in these techniques. There is no exclusivness with respect to knowledge, and it is essential that professionals in many diverse fields, as well as those in the teaching community, be made aware of the mutal interests, concerns, and applications through continuing exchanges of ideas and cooperation.

In that context, the Geography/Anthropology Department approves and welcomes this proposal.



For the Department of Geography/Anthropology, Prof. W.R Carrier

c.c. The University Curriculum Committee



*Computer Science Department*  
*Don C. Stone, Ph.D., Chair*

To: John Schmalzel, Electrical and Computer Engineering  
From: Don Stone, Computer Science  
Date: 3 May 1999 DC5  
Re: Course proposal

Thank you for consulting with the Computer Science Department on your graduate course proposal entitled Digital Image Processing. It looks reasonable to us, and we support it. We assume that if we propose a graduate Computer Vision course, you will support that.

We wish you the best of success in implementing this course!