

ROWAN UNIVERSITY CURRICULUM PROPOSAL

(2)

PROPOSAL TITLE: DIGITAL IMAGE PROCESSING 0909.552

CHECK APPROPRIATE: UNDERGRADUATE GRADUATE SEMESTER HOURS 3

SPONSOR(S): DR. SHREEKANTH MAADAYAM & DR. JIM L. SCHMALZ

DEPARTMENT/TELEPHONE # ELECTRICAL ENGINEERING / 4612

CHECK ONE: COURSE MINOR PROGRAM CONCENTRATION SPECIALIZATION

ACHIEVEMENT CERTIFICATE CERTIFICATION PROGRAM MAJOR PROGRAM

<p>Step #1 (Department)</p> <p><u>22 Oct 97</u> Approved (Date)</p> <p><input type="checkbox"/> Not Approved (Date)</p> <p><u>John Self</u> Dept. Curriculum Chr.</p> <p><u>22 Oct 97</u> Reviewed (Date)</p> <p><u>John Self</u> Dept. Chr.</p>	<p>Step #2 (Receipt)</p> <p>SCC# <u>97-98-176</u></p> <p><u>10-24-97</u> Date Received Senate</p> <p>_____ Senate Curriculum Chr.</p>	<p>Step #3 (School)</p> <p>Reviewed Date: <u>22 Oct 97</u></p> <p><input checked="" type="checkbox"/> Recommend to Approved</p> <p><input type="checkbox"/> Recommend NOT to Approve</p> <p>Forward for Open Hearing:</p> <p><input checked="" type="checkbox"/> WITHOUT Reservations</p> <p><input type="checkbox"/> WITH Reservations:</p> <p>Comments:</p> <p><u>Robert G. Heppets</u> School Committee Chr.</p>
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Step #4 (Academic Dean): Recommended NOT Recommended Conditionally Recommended (See Comments)

Comments:

Dean Signature/Date: [Signature] 10/28/97

Step #5 (Senate Curriculum Committee): Open Hearing Date: _____ Approved by Curriculum Committee Date 12-13-97

Returned to Sponsor(s) for the following reason: [Handwritten note]

Step #6 (Senate) Date announced/voted on at Senate 12/17/97 If voted on: Approved NOT Approved

Date forwarded to Executive Vice President/Provost _____

Senate Curriculum Committee chair Signature/Date: [Signature] 12/26/97

#7 (Executive Vice President/Provost): Date Received _____

Approved

NOT Approved If no, reasons are as follows:

ent Credit Hours 3

ulty Load Hours 3

alized Credit Hours _____

cial Copy & Approval Sheet Filed (Date) _____

utive Vice President/Provost Signature [Signature]

7/21/99

Registrar

Approved Course Description Received _____

s Taxonomy and Course Number Assigned 0909.552

Signature of Registrar Robert A. Lubat 7/20/99

ification Forward:

Senate Curriculum Committee Chairperson

Department Chairpersons

Academic Dean(s)

Registrar

____ Sponsor(s)

TM
8/16/99

Course Proposal

1. Details:

a) Course Title:	Digital Image Processing (0909.552)
b) Sponsor:	Dr. Shreekanth Mandayam and Dr. John L. Schmalzel, Electrical Engineering
c) Credit Hours:	3 credit hours
d) Course Level:	Graduate / Senior Elective
e) Curricular Effect:	Graduate electrical engineering course / available to electrical engineering seniors as an elective
f) Prerequisites:	Digital Signal Processing 0909.351
g) Suggested Time/ Scale of Implementation	Spring 1998 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 is a graduate level Engineering course, that is also available as a senior level elective to Electrical 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. Concurrent with this endeavour, there exist ongoing efforts to —

- (a) design artificial vision systems that could ultimately perform the visual functions of living beings
- (b) develop techniques for analyzing images (pictures) acquired and transmitted from space/earth based telescopes, and
- (c) develop procedures for analyzing medical images acquired via invasive or noninvasive procedures.

Modern digital image processing draws upon prior (and some recent) developments in digital signal processing, computing hardware and heuristic knowledge of biological vision systems. The field encompasses the following four categories: Image Enhancement, Image Restoration, Image Compression and Image Recognition. 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.
- (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:

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.

Prerequisite of Digital Signal Processing required.

Memo To: John Schmalzel, Electrical Engineering

From: Seth Bergmann, Department Chairperson, Computer Science Department

Date: March 18, 1998

Subject: Course Proposal: Digital Image Processing

Thank you for consulting with us on your course proposal for a new graduate level course titled "Digital Image Processing".

We note that the rationale for this course includes efforts to "design artificial vision systems that could ultimately perform the visual functions of living beings", which is clearly one of the goals of computer scientists engaged in artificial intelligence research. In addition, most of the topics listed in the topical outline, including "Digital image fundamentals; Image enhancement; Image restoration; Image compression; and Image recognition" are normally included in image processing when taught from a "computer science" perspective.

We also would like to point out that one of our tenured faculty in computer science, Dr. Jianning Xu, has done extensive research in the area of image processing. He is well qualified to teach this subject at the graduate level.

Since this is a subject which can be taught effectively by both electrical engineers and computer scientists, we feel that this course should be "cross-listed" in the catalog. I.e., it would be listed under both departments, each with a "pointer" to the other in the catalog description. The two department chairs would then cooperatively schedule and staff the course. We support the course proposal, with the following modifications:

1. This course should be listed in the catalog under both Electrical Engineering (Hegis number 0909.552) and Computer Science (Hegis number 0707.552), with the same title.

2. The catalog description for 0909.552 should contain the sentence: "This course is equivalent to 0707.552 under Computer Science". The catalog description for 0707.552 should contain the sentence: "This course is equivalent to 0909.552 under Electrical Engineering".
3. The prerequisites should be: "Digital Signal Processing, Software Engineering, or permission of the instructor"
4. The curricular effect would be: "Graduate level electrical engineering, computer science or electrical engineering senior level elective. This course will also appeal to computer science graduates."

Copy: University Curriculum Committee

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RECEIVED

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