Rochester Institute of Technology
College of Science

New Course Proposal

TITLE: Testing of Focal Plane Arrays
1051-742

DATE: February 4, 2001

PROPOSED BY: Zoran Ninkov

DEPARTMENT: Imaging Science

PREREQUISITES: Graduate student status
In Imaging Science or
Permission of Instructor.

COREQUISITES: None

DEPARTMENT IN WHICH COURSE WILL BE TAUGHT: Imaging Science

MAXIMUM NUMBER OF STUDENTS PER SECTION:

Lecture: 10
Recitation: 0
Laboratory: 10

QUARTER OR QUARTERS WHEN COURSE WILL BE OFFERED (list hours per week in appropriate column):

<table>
<thead>
<tr>
<th>FALL</th>
<th>WINTER</th>
<th>SPRING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture:</td>
<td>Lecture:</td>
<td>Lecture: 2</td>
</tr>
<tr>
<td>Recitation:</td>
<td>Recitation:</td>
<td>Recitation:</td>
</tr>
<tr>
<td>Laboratory:</td>
<td>Laboratory:</td>
<td>Laboratory: 6</td>
</tr>
</tbody>
</table>

STUDENTS REQUIRED TO TAKE THE COURSE: None.

STUDENTS WHO MAY ELECT COURSE: Graduate Students in Imaging Science
students or any student with permission of the instructor.

JUSTIFICATION FOR THE NEW COURSE: This course will provide instruction in the
techniques needed for testing a variety of focal plane arrays including
CCDs, CMOS and
IR arrays. Many of our students obtain employment whose duties include acceptance
testing of camera systems. Those systems might be consumer digital cameras,
spectroscopic cameras, or cooled high performance cameras for astronomy and medical
imaging. This course will provide students with the knowledge needed to undertake the
task of testing focal plane arrays.

SPECIAL NEEDS: Lecture classroom with computer display projector and Web access.
Rochester Institute of Technology
College of Science
Testing of Focal Plane Arrays
Course Number 1051-742

1.0 COURSE: Testing of Focal Plane Arrays
1.1 A one quarter course of 4 credit hours
1.2 Two 1 hour lectures per week and 6 hours of laboratory time per week
1.3 Prerequisites: Graduate Student in Imaging Science, or permission of instructor
1.4 Corequisites: none

2.0 COURSE DESCRIPTION:

An introduction to the techniques used for the testing of solid state imaging detectors such as CCDs, CMOS and Infrared Arrays is provided. Focal Plane Array users in industry, government and university need to ensure that key operating parameters for such devices either fall within an operating range or that the limitation to the performance is understood. This is a hands-on course where the students will measure the performance parameters of a particular camera in detail. While this course can be taken individually, students would obtain maximum educational value by taking it as the third part of a sequence of imaging science courses preceded by 1051-739 “Principles of Solid State Imaging Arrays” and then 1051-728 “Design and Fabrication of a Solid State Camera”.

3.0 COURSE OBJECTIVES

3.1 Introduce students to a range of common tests made on focal plane arrays.
3.2 Introduce students to methods for manipulating and analyzing digital data for performance and consistency.

4.0 COURSE OUTLINE: Topics

4.1 Basics of electro-magnetic propagation and collection
4.2 Basics of imager operation
4.3 Photon Transfer Method
4.4 Noise and its limitations in focal plane arrays.
4.5 Optics and coupling instruments.

5.0 COURSE OUTLINE: Laboratory

5.1 Photon Transfer Method for estimation of system gain, linearity and read noise.
5.2 Dark Current measurement and its variation as a function of temperature. Its effect on limiting performance.
5.3 Calibration of the absolute quantum efficiency of a focal plane array traceable to a NIST standard. Estimation of an ISO speed for the camera.
5.4 Charge Transfer Efficiency measurement using an Fe\(^{55}\) source.
5.5 Measurement of the MTF of a focal plane array in multiple orientations using sine targets and an edge.
5.6 Coupling the focal plane camera to an optical instrument (e.g. a microscope or a telescope).

6.0 SUGGESTED EVALUATION:
6.1 Final exam
6.2 Laboratory write-ups
6.3 Oral Exam

7.0 SUGGESTED TEXT: none, uses course and laboratory handouts.