

### **Instructor:**

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**WWW:** Course material will be posted on a course website, available through [www.sce.carleton.ca/faculty/marble/teaching.html](http://www.sce.carleton.ca/faculty/marble/teaching.html)

### **Calendar Description:**

Introduction to image processing for medical applications. Two dimensional signals, filters and Fourier transforms. Image acquisition, sampling, quantization and representation. Image perception. Digital and film cameras. Brief introduction to medical imaging technology. Image processing operations: histogram operations, convolution operations, morphological operations. Image compression and formats.

### **Course Textbook:**

J. L. Prince and J. M. Links, Medical Imaging Signals and Systems, Prentice Hall. ISBN 9780130653536

It is strongly recommended that all students have access to the textbook.

### **Other References:**

Gonzalez and Woods, Digital Image Processing, 3<sup>rd</sup> Edition, Prentice Hall. ISBN 9780131687288  
Any other digital image processing text would also be suitable.

### **Supplementary Lecture Notes and Laboratory Manual:**

Materials supplementing the material discussed in class (code, figures) will be posted on the course website. Laboratory instructions are also available on the website.

### **Prerequisites:**

SYSC 3600 or SYSC 3500, MATH 3705 and 4<sup>th</sup> year status in engineering. Students who have not satisfied the prerequisites for this course must either a) withdraw from the course or b) obtain a prerequisite waiver from [www.sce.carleton.ca/ughelp](http://www.sce.carleton.ca/ughelp). Students who are registered but do not satisfy the prerequisites and who have not been granted a prerequisite waiver may be deregistered from the course after the last day to register for courses in the term.

### **Examinations:**

There will be one in class midterm, worth 20%, held on Feb. 17. Any date changes will be mentioned in class and posted on the website. Midterm attendance is **required**. Students who miss the midterm exam due to illness are required to provide a doctor's note to their instructor within 48 hours of returning to campus, and in this case the midterm exam weight will be shifted to the final exam. Other excuses for missing the midterm exam will not be accepted and a grade of zero will be assigned.

The final examination will be held during the University's examination period, April 11<sup>th</sup> through 24<sup>th</sup>. **Students must pass the final examination** (D- or better on the final exam) in order to pass the course.

The final examination is for evaluation purposes only and will not be returned to students.

Both exams (midterm and final) will be closed-book but students **will be allowed to prepare and bring with them one 8.5"x11" crib sheet, both sides, to each exam.**

**Labs/Tutorials:**

There will be **six** lab sessions, held alternate weeks. Students will complete lab exercises in the areas of:

1. Introduction to Matlab for image processing
2. Morphological operations on images
3. Convolution operations on images
4. Tomographic image reconstruction for X-ray CT
5. Correlation / pattern recognition
6. Complete image processing example – students will develop an algorithm incorporating two or more of the topics above to automatically process a set of sample images.

Labs may be completed in groups of two and are due one week after the last section of that lab has been completed. More information regarding the timing of the labs will be provided.

**Assignments:**

There will be **four** assignments. Assignments will involve image processing exercises which reinforce the concepts discussed in class.

**Students with Disabilities:**

Students with disabilities who require academic accommodations in this course are encouraged to contact the Paul Menton Centre (PMC) to complete the necessary *letters of accommodation*. After registering with the PMC, make an appointment with the instructor to discuss your specific needs at least two weeks prior to the first in-term test. Deadlines for submission of completed forms to the PMC for accommodations during final exams are listed in the Undergraduate Calendar.

**Plagiarism:**

Plagiarism (copying and handing in for credit someone else's work) is a serious instructional offense that will not be tolerated. Please refer to the section on instructional offenses in the Undergraduate Calendar for additional information.

**Week by Week Outline (subject to revision):**

Week 1: Introduction / Definitions  
Week 2,3: Mathematical tools: Convolution / 2D Fourier Transform  
Week 4: Image sampling / quantization / representation  
Week 5: Image acquisition: cameras, film and digital  
Week 6,7: Image acquisition: X-Ray, CT, SPECT, PET  
Week 7,8: Image acquisition: MRI, ultrasound  
Week 9: Image displays: linearity, resolution, interlacing  
Week 10: Histogram operations: contrast stretching, equalization  
Week 11: Convolution operations: smoothing, edge enhancement  
Week 12: Morphological operations: dilation/erosion, skeletonization

**NOTE:** The above plan is tentative and subject to change. Students will be notified of changes in class and the course website.

**Grading:**

Assignments: 15%; Labs: 30%; Theory Midterm: 20%  
Final Exam: 35%

**Health and Safety:**

Every student should have a copy of our Health and Safety Manual. An electronic version of the manual can be found at <http://www.sce.carleton.ca/courses/health-and-safety.pdf>