Instructor Information and Office hours

Stephanie Bennett
Office: Minto Building Room 6010
Email: sbennett@sce.carleton.ca
Office hours: To be posted on the course webpage (cuLearn).

TA Information and Office hours

Nadia Farrag
Email: nadiafarrag@email.carleton.ca

Reminder for all emails to the Instructor and the TA:
- Should include 'SYSC 4205' in the subject of the email.
- All email correspondence should be from your Carleton email account. Email from accounts other than your Carleton email account may not receive any response.

Calendar Description


Prerequisites

MATH 1005 and fourth year status in Engineering. Students who have not satisfied the prerequisites for this course must either withdraw from the course or obtain a prerequisite waiver by visiting the Engineering Undergraduate Academic Support Office.

Assumed Knowledge

Upon entry into this course, students are expected to have knowledge of: first-order differential equations, second-order linear equations with constant coefficients, undetermined coefficients, variation of parameters. Sequences and series, convergence tests, estimation of sums. Power series, Taylor series, remainders. Fourier series.
Course Objectives


Learning Outcomes

By the end of the course, students should be able to:
1. Understand digitization processes (sampling and quantization) of a 2-D image.
2. Understand a histogram of a digital image.
3. Understand the mechanism of image contrast in medical images.
4. Explain image artifacts (image errors) in medical images.
5. Implement digital image processing to enhance the image quality in spatial and frequency domains using a computer program.
6. Implement digital image processing to perform image segmentation, restoration, and feature extraction and recognition using a computer program.

Graduate Attributes (GA's)

The Canadian Engineering Accreditation Board requires graduates of engineering programs to possess 12 attributes at the time of graduation. Activities related to the learning outcomes listed above are measured throughout the course and are part of the department’s continual improvement process. Graduate attribute measurements will not be taken into consideration in determining a student’s grade in the course. For more information, please visit: https://engineerscanada.ca/.

<table>
<thead>
<tr>
<th>Graduate Attribute</th>
<th>Learning Outcome(s)</th>
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<tbody>
<tr>
<td>1.10.S Knowledge Base: Discipline-Specific Concept SCE-7: Biomedical Instrumentation</td>
<td>1-6</td>
</tr>
</tbody>
</table>

Textbooks (or other resources)


Other Resources:

• Any other textbooks for digital image processing would also be useful.

Evaluation and Grading Scheme

To pass the course, a student must: (1) pass the final examination test (D- or better), and (2) obtain an overall passing average. For students who pass the final exam, the final grade will be calculated as follows:

• Assignments: 15%
• Labs: 15%
• Midterm: 20%
• Final Exam: 50%

Breakdown of Course Requirements

• Laboratories:
  There will be five graded labs. Lab attendance is required. More information regarding the timing of the labs will be provided in the course website.

• Assignments:
  There will be five assignments. Assignments will involve image processing exercises which reinforce the concepts discussed in class. More information regarding the timing of the assignments will be provided in the course website.

• Examinations:
  There will be one midterm examination. The details and date will be mentioned in class and posted on the website. Midterm attendance is required. It may be held outside of regular class time if necessary. The final examination is for evaluation purposes only and will not be returned to students. You will be able to make arrangements with the instructor or with the department office to see your marked final examination after the final grades have been made available.

Tentative Week-by-Week breakdown

<table>
<thead>
<tr>
<th>Week</th>
<th>Subject</th>
<th>Course Note</th>
<th>Textbook</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Course overview</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Introduction to imaging processing</td>
<td>#1</td>
<td>Ch 1</td>
</tr>
<tr>
<td></td>
<td>Fundamentals of digital image processing</td>
<td>#2</td>
<td>Ch 5; 2.6</td>
</tr>
<tr>
<td>2</td>
<td>Imaging system</td>
<td>#3</td>
<td>Ch 2; 7.6</td>
</tr>
<tr>
<td>3, 4</td>
<td>Medical imaging: X-ray, CT, Nuclear medicine</td>
<td>#4</td>
<td>Ch 3; 7.8</td>
</tr>
<tr>
<td>5</td>
<td>Image enhancement in the spatial domain</td>
<td>#5</td>
<td>Ch 6</td>
</tr>
<tr>
<td>6</td>
<td>Image enhancement in the frequency domain</td>
<td>#6</td>
<td>Ch 7</td>
</tr>
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### General Regulations

**Attendance:** Students are expected to attend all lectures and lab periods. The University requires students to have a conflict-free timetable. For more information, see the current *Undergraduate Calendar, Academic Regulations of the University, Section 2.1.3, Course Selection and Registration and Section 2.1.7, Deregistration.*

**Health and Safety:** Every student should have a copy of our Health and Safety Manual. A PDF copy of this manual is available online: [http://sce.carleton.ca/courses/health-and-safety.pdf](http://sce.carleton.ca/courses/health-and-safety.pdf)

**Deferred Term Work:** Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases this must occur no later than three (3.0) working days after the term work was due. The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. For more information, see the current *Undergraduate Calendar, Academic Regulations of the University, Section 4.4, Deferred Term Work.*

**Appeal of Grades:** The processes for dealing with questions or concerns regarding grades assigned during the term and final grades is described in the *Undergraduate Calendar, Academic Regulations of the University, Section 3.3.4, Informal Appeal of Grade and Section 3.3.5 Formal Appeal of Grade.*

**Academic Integrity:** Students should be aware of their obligations with regards to academic integrity. Please review the information about academic integrity at: [https://carleton.ca/registrar/academic-integrity/](https://carleton.ca/registrar/academic-integrity/). This site also contains a link to the complete Academic Integrity Policy that was approved by the University's Senate.

**Plagiarism:** Plagiarism (copying and handing in for credit someone else's work) is a serious instructional offense that will not be tolerated.

**Academic Accommodation:** You may need special arrangements to meet your academic obligations during the term. You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at [http://www.carleton.ca/equity/](http://www.carleton.ca/equity/). For an accommodation request, the processes are as follows:
- **Pregnancy or Religious obligation**: Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see [https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)

- **Academic Accommodations for Students with Disabilities**: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your *Letter of Accommodation* at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (*if applicable*). **Requests made within two weeks will be reviewed on a case-by-case basis.** After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website ([www.carleton.ca/pmc](http://www.carleton.ca/pmc)) for the deadline to request accommodations for the formally-scheduled exam (*if applicable*).

- **Survivors of Sexual Violence**: As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton’s Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: [https://carleton.ca/sexual-violence-support/](https://carleton.ca/sexual-violence-support/).

- **Accommodation for Student Activities**: Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see [https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf](https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf)

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