COMP ENG 4TN4
Image Processing

COURSE OUTLINE

CALENDAR/COURSE DESCRIPTION

Digital image formation and representation; filtering, enhancement and restoration; edge detection; discrete image transforms; encoding and compression; segmentation; recognition and interpretation; 3D imagery; applications.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in level III or greater in any Computer or Electrical Engineering Program; ELECENG 3TP4, ELECENG 3TQ4 or STATS 3Y03
Antirequisite(s): COMPENG 4TN3

SCHEDULE

Lectures: Tuesday, Wednesday & Friday 9:30 – 10:20
Tutorial: Tuesday 15:30 – 16:20

INSTRUCTOR

Dr. Xiaolin Wu
ITB-A315
xwu@mail.ece.mcmaster.ca
905-525-9140 ext. 24190

Office Hours:
by appointment

TEACHING ASSISTANTS

Contact information and office hours for the following TAs are provided on the course website.

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

http://www.ece.mcmaster.ca/~xwu
http://avenue.mcmaster.ca/

COURSE OBJECTIVES

Prerequisite(s): Registration in level III or greater in any Computer or Electrical Engineering Program; ELECENG 3TP4, ELECENG 3TQ4 or STATS 3Y03
Antirequisite(s): COMPENG 4TN3
By the end of this course, students should be able to:

- Master basic concepts and methodologies for the formation, representation, enhancement, restoration, analysis and compression of digital images.
- Design and implement practical algorithms for image processing.
- Establish a foundation for research in the field of image processing.

**ASSUMED KNOWLEDGE**

Fundamentals of signal processing
Numerical analysis

**COURSE MATERIALS**

**Required Texts:**

**Calculator:**
Only the McMaster Standard Calculator (Casio FX-991 MS or MS Plus) will be permitted in tests and examinations. This is available at the Campus Store.

**COURSE OVERVIEW**

<table>
<thead>
<tr>
<th>Date/Week</th>
<th>Topic</th>
<th>Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Introduction</td>
<td>Chapter 1</td>
</tr>
<tr>
<td>Week 2~3</td>
<td>Digital image fundamentals</td>
<td>Chapter 2</td>
</tr>
<tr>
<td>Week 4~5</td>
<td>Image enhancement</td>
<td>Chapter 3,4</td>
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<tr>
<td>Week 6~8</td>
<td>Image restoration</td>
<td>Chapter 5</td>
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<tr>
<td>Week 9</td>
<td>Image segmentation</td>
<td>Chapter 10</td>
</tr>
<tr>
<td>Week 10~11</td>
<td>Morphological image processing</td>
<td>Chapter 9</td>
</tr>
<tr>
<td>Week 12</td>
<td>Color image processing</td>
<td>Chapter 6</td>
</tr>
<tr>
<td>Week 13</td>
<td>Image compression</td>
<td>Chapter 8</td>
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</tbody>
</table>

**LABORATORY OVERVIEW**

<table>
<thead>
<tr>
<th>Date/Week</th>
<th>Topic</th>
<th>Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 2~6</td>
<td>Course project I</td>
<td>N/A</td>
</tr>
<tr>
<td>Week 7~12</td>
<td>Course project II</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**LABORATORY OPERATION**

- At the beginning of every term, every Undergraduate student using an ECE Lab is required to complete the ECE Lab Safety Quiz (one completed quiz covers every course that term). The quiz and other information is provided on the webpage: [https://www.eng.mcmaster.ca/ece/resources#health-safety](https://www.eng.mcmaster.ca/ece/resources#health-safety)
• Access to all labs is restricted in the interest of security and safety. Information on accessing and using the lab can be found on the webpage: https://www.eng.mcmaster.ca/ece/labs-and-health-safety#Labs-Access-and-Use

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Projects</td>
<td>40 %</td>
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<tr>
<td>Quizzes</td>
<td>20 %</td>
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<tr>
<td>Final Exam</td>
<td>40 %</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
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Late submissions of assignments or project report are subject to 20% penalty per day (less than one day is counted as one day).

**ACCREDITATION LEARNING OUTCOMES**

Note: The Learning Outcomes defined in this section are measured throughout the course and form part of the Department’s continuous improvement process. They are a key component of the accreditation process for the program and will not be taken into consideration in determining a student’s actual grade in the course. For more information on accreditation, please ask your instructor or visit: http://www.engineerscanada.ca.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Indicators</th>
<th>Measurement Methods(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time management and tasks prioritization</td>
<td>11.2</td>
<td>Course projects and exams</td>
</tr>
<tr>
<td>Mastering of image processing libraries in both public domain and</td>
<td>5.2</td>
<td>Course projects</td>
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<td>commercial software.</td>
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<tr>
<td>The collection and use of big data to both develop and validate</td>
<td>3.2</td>
<td>Course projects</td>
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<tr>
<td>engineering solutions.</td>
<td></td>
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<tr>
<td>The ability to identify reasonable assumptions/conditions for the</td>
<td>6.2</td>
<td>Course projects and exams</td>
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<tr>
<td>efficacy of practical solutions.</td>
<td></td>
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<tr>
<td>The ability to identify and balance mutually conflicting design</td>
<td>3.2</td>
<td>Course projects</td>
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<tr>
<td>criteria.</td>
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**ACADEMIC INTEGRITY**

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of
credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at http://www.mcmaster.ca/academicintegrity

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

ACADEMIC ACCOMMODATIONS

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca. For further information, consult McMaster University’s Academic Accommodation of Students with Disabilities policy.

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students requiring a RISO accommodation should submit their request to the Engineering Student Services office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar’s Office prior to their examinations.

Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

NOTIFICATION OF STUDENT ABSENCE AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work": http://www.mcmaster.ca/msaf/

NOTICE REGARDING POSSIBLE COURSE MODIFICATION

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.
**TURNITIN.COM STATEMENT**

In this course we will be using a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to [http://www.mcmaster.ca/academicintegrity/](http://www.mcmaster.ca/academicintegrity/).

**ON-LINE STATEMENT FOR COURSES REQUIRING ONLINE ACCESS OR WORK**

In this course, we will be using Avenue To Learn. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

**REFERENCE TO RESEARCH ETHICS**

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to [http://www.mcmaster.ca/policy/faculty/Conduct/ResearchEthicsPolicy.pdf](http://www.mcmaster.ca/policy/faculty/Conduct/ResearchEthicsPolicy.pdf).

www.eng.mcmaster.ca/ece

Electrical and Computer Engineering Lab Safety

Information for Laboratory Safety and Important Contacts
This document is for users of ECE instructional laboratories in the Information Technology Building (ITB).

This document provides important information for the healthy and safe operation of ECE instructional laboratories. This document is required reading for all laboratory supervisors, instructors, researchers, staff, and students working in or managing instructional laboratories in ECE. It is expected that revisions and updates to this document will be done continually. A McMaster University lab manual is also available to read in every laboratory.

**General Health and Safety Principles**

Good laboratory practice requires that every laboratory worker and supervisor observe the following:

1. Food and beverages are not permitted in the instructional laboratories.
2. A Laboratory Information Sheet on each lab door identifying potential hazards and emergency contact names should be known.
3. Laboratory equipment should only be used for its designed purpose.
4. Proper and safe use of lab equipment should be known before using it.
5. The course TA leading the lab should be informed of any unsafe condition.
6. The location and correct use of all available safety equipment should be known.
7. Potential hazards and appropriate safety precautions should be determined, and sufficiency of existing safety equipment should be confirmed before beginning new operations.
8. Proper waste disposal procedures should be followed.

**Location of Safety Equipment**

- **Fire Extinguisher**
  On walls in halls outside of labs

- **First Aid Kit**
  ITB A111, or dial “88” after 4:30 p.m.

- **Telephone**
  On the wall of every lab near the door

- **Fire Alarm Pulls**
  Near all building exit doors on all floors
Who to Contact


Non-Emergency Accident or Incident: Immediately inform the TA on duty or Course Instructor.

University Security (Enquiries / Non-Emergency): Dial 24281 on a McMaster phone or dial 905-525-9140 ext. 24281 from a cell phone.

See TA or Instructor: For problems with heat, ventilation, fire extinguishers, or immediate repairs

Environmental & Occupational Health Support Services (EOHSS): For health and safety questions dial 24352 on a McMaster phone or dial 905-525-9140 ext. 24352 from a cell phone.

ECE Specific Instructional Laboratory Concerns: For non-emergency questions specific to the ECE laboratories, please contact 24103.

In Case of a Fire (Dial 88)
When calling to report a fire, give name, exact location, and building.

1. Immediately vacate the building via the nearest Exit Route. Do not use elevators!
2. Everyone is responsible for knowing the location of the nearest fire extinguisher, the fire alarm, and the nearest fire escape.
3. The safety of all people in the vicinity of a fire is of foremost importance. But do not endanger yourself!
4. In the event of a fire in your work area shout "Fire!" and pull the nearest fire alarm.
5. Do not attempt to extinguish a fire unless you are confident it can be done in a prompt and safe manner utilizing a hand-held fire extinguisher. Use the appropriate fire extinguisher for the specific type of fire. Most labs are equipped with Class A, B, and C extinguishers. Do not attempt to extinguish Class D fires which involve combustible metals such as magnesium, titanium, sodium, potassium, zirconium, lithium, and any other finely divided metals which are oxidizable. Use a fire sand bucket for Class D fires.
6. Do not attempt to fight a major fire on your own.
7. If possible, make sure the room is evacuated; close but do not lock the door and safely exit the building.

Clothing on Fire
Do not use a fire extinguisher on people

1. Douse with water from safety shower immediately or
2. Roll on floor and scream for help or
3. Wrap with fire blanket to smother flame (a coat or other nonflammable fiber may be used if blanket is unavailable). Do not wrap a standing person; rather, lay the victim
down to extinguish the fire. The blanket should be removed once the fire is out to disperse the heat.

**Equipment Failure or Hazard**
Failure of equipment may be indicative of a safety hazard - You must report all incidents.
Should you observe excessive heat, excessive noise, damage, and/or abnormal behaviour of the lab equipment:
1. Immediately discontinue use of the equipment.
2. In Power Lab, press wall-mounted emergency shut-off button.
3. Inform your TA of the problem.
4. Wait for further instructions from your TA.
5. TA must file an incident report.

**Protocol for Safe Laboratory Practice**
Leave equipment in a safe state for the next person - if you’re not sure, ask!
In general, leave equipment in a safe state when you finish with it. When in doubt, consult the course TA.

**Defined Roles**

<table>
<thead>
<tr>
<th>Role</th>
<th>Contact Information</th>
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<tbody>
<tr>
<td>TA</td>
<td>The first point of contact for lab supervision</td>
</tr>
<tr>
<td>ECE Lab Supervisor</td>
<td>Steve Spencer - ITB 147 <a href="mailto:steve@mail.ece.mcmaster.ca">steve@mail.ece.mcmaster.ca</a></td>
</tr>
<tr>
<td>ECE Chair</td>
<td>Tim Davidson - ITB A111 <a href="mailto:davidson@mcmaster.ca">davidson@mcmaster.ca</a></td>
</tr>
<tr>
<td>ECE Administrator</td>
<td>Kerri Hastings - ITB A111 <a href="mailto:hastings@mcmaster.ca">hastings@mcmaster.ca</a></td>
</tr>
<tr>
<td>ECE Course Instructor</td>
<td>Please contact your specific course instructor directly</td>
</tr>
</tbody>
</table>