1 INSTRUCTIONAL SUPPORT

1.1 Instructor
Instructor: Petros Spachos, Ph.D.
Office: RICH 2505, ext. 54012
Email: petros@uoguelph.ca
Office hours: Tuesday and Thursday 5:30 pm–6:30 pm or by appointment @ RICH 2505

1.2 Lab Technician
Technician: Hong Ma
Office: RICH 1506, ext. 53873
Email: hongma@uoguelph.ca

1.3 Teaching Assistants
GTA Email

Marc Jayson Baucas baucas@uoguelph.ca
2 Learning Resources

2.1 Course Website
Course material, news, announcements, and grades will be regularly posted to the ENGG*4200 Courselink site. You are responsible for checking the site regularly.

2.2 Required Resources
- Lecture notes and slides

2.3 Recommended Resources

2.4 Additional Resources
Lecture Information: All the lecture notes are posted on the web page (week #1-#12).

Lab Information: The handouts for all the lab sessions are within the lab section. All types of resources regarding tutorials, links to web pages can be found in this section.

Assignments: Download the assignments according to the schedule given in this handout. All the solutions will be posted as indicated.

Exams: Some midterms and finals of previous years are posted as samples of exams. The solutions are also posted for your convenience.

Miscellaneous Information: Other information related to ENGG*4200 are also posted on the web page.

2.5 Communication & Email Policy
Please use lectures and lab help sessions as your main opportunity to ask questions about the course. Topics of personal and confidential nature (e.g. marks) should be emailed to the instructor: petros@uoguelph.ca. Major announcements will be posted to the course website. It is your responsibility to check the course website regularly. As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.
3 ASSESSMENT

3.1 Dates and Distribution

Labs: 15%
See section 5.3 below for due dates.

Project: 20%
See section 5.4 below for due dates.

Midterm exam: 25%
Tuesday, Oct. 29th, 7:00 pm – 8:20 pm, in class

Final Exam: 40%
Friday, Dec. 13th, 11:30 am - 1:30 pm, Room TBA on Webadvisor

3.2 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. Please see below for specific details and consult the undergraduate calendar for information on regulations and procedures for Academic Consideration:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Passing grade: In order to pass the course, you must pass both the laboratory and exam course portions. Students must obtain a grade of 50% or higher on the exam portion of the course in order for the laboratory write-up portion of the course to count towards the final grade.

Missed midterm tests: If you miss a test due to grounds for granting academic consideration or religious accommodation, the weight of the missed test will be added to the final exam. There will be no makeup midterm tests.

Lab Work: You must attend and complete all laboratories. If you miss a laboratory due to grounds for granting academic consideration or religious accommodation, arrangements must be made with the teaching assistant to complete a makeup lab.

Clarification About Grades: If you have questions about the grade your assignment received, please ask your TA. However, all requests for re-marking must be made to the instructor. Any item that is re-marked will be re-marked entirely. Therefore it is strongly suggested that you thoroughly review your entire document before making a re-marking request. Re-marking requests will not be honoured more than one week after the document has been returned.
4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.1 Calendar Description

This course provides students with an opportunity to learn the fundamentals behind the design of wireless sensor networks. Topics include node architecture, operating systems, prototypes and applications for wireless sensor networks. The course emphasises on basic architectural framework including physical layer, medium access control layer and network layer. It also covers network management topics such as power management, time synchronization and localization. The course has a number of experiments with sensor network software and hardware. The primary focus of the experiments is to give students hands-on programming experience with various microcontrollers and sensing platforms.

Prerequisite(s): ENGG*3640

4.2 Course Aims

This course provides students with an opportunity to learn the fundamentals behind the design of wireless sensor networks. A primary focus of this course is to give students hands-on programming experience with various sensors and sensing platforms.

4.3 Learning Objectives

At the successful completion of this course, the student will have demonstrated the ability to:

1. Learn the fundamental concepts of sensor network design.
2. Learn to apply sensor network protocols, mechanisms, and algorithms to implement sensing systems.
3. Design, program, simulate and experiment with sensor network software and hardware.
4. Solve various sensor network design problems individually and in teams.
5. Communicate effectively about specifications, design, simulation, testing, and applications of wireless sensor networks.
6. Investigate design and deployment issues in wireless sensors network systems.

4.4 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

<table>
<thead>
<tr>
<th>Graduate Attribute</th>
<th>Learning Objectives</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Knowledge Base for Engineering</td>
<td>1, 2</td>
<td>Tests and assignments</td>
</tr>
<tr>
<td>2. Problem Analysis</td>
<td>3, 4, 6</td>
<td>Lab project and experiments</td>
</tr>
<tr>
<td>3. Investigation</td>
<td>3, 5</td>
<td>Lab project and experiments</td>
</tr>
<tr>
<td>4. Design</td>
<td>3, 4, 5, 6</td>
<td>Lab project, assignments and experiments</td>
</tr>
<tr>
<td>5. Use of Engineering Tools</td>
<td>3, 4, 5, 6</td>
<td>Lab project and experiments</td>
</tr>
<tr>
<td>6. Individual and Teamwork</td>
<td>3, 4</td>
<td>Lab project and experiments</td>
</tr>
<tr>
<td>7. Communication</td>
<td>4, 5</td>
<td>Lab project and experiments</td>
</tr>
</tbody>
</table>
4.5 Instructor’s Role and Responsibility to Students

The instructor’s role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink/D2L but these are not intended to be stand-alone course notes. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and project.

4.6 Students’ Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and tutorials. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

4.7 Relationships with other Courses & Labs

Previous Courses:

ENG*3640: This course focuses on the subject of interfacing microcomputers to external equipment. Topics include peripheral devices, hardware interfaces, device driver software and real-time programming.

Follow-on Courses:

- Not Applicable
5 Teaching and Learning Activities

5.1 Timetable

Lectures:
- Tuesdays 7:00 pm – 9:50 pm MCKN 224

Laboratory:
- Thursdays 10:30 am – 12:20 pm RICH 1532

5.2 Lecture Schedule

<table>
<thead>
<tr>
<th>Lectures</th>
<th>Lecture Topics (Tentative*)</th>
<th>References</th>
<th>Learning Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction and WSN Applications</td>
<td>Chapter 1, 2</td>
<td>1, 2</td>
</tr>
<tr>
<td>2</td>
<td>Node Architecture</td>
<td>Chapter 3</td>
<td>1, 2</td>
</tr>
<tr>
<td>3</td>
<td>Operating Systems</td>
<td>Chapter 4</td>
<td>3, 4, 5</td>
</tr>
<tr>
<td>4</td>
<td>Physical Layer</td>
<td>Chapter 5</td>
<td>3, 4, 5</td>
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<tr>
<td>5</td>
<td>Medium Access Control (I)</td>
<td>Chapter 6</td>
<td>3, 4, 5</td>
</tr>
<tr>
<td>6</td>
<td>Medium Access Control (II)</td>
<td>Chapter 6</td>
<td>3, 4, 5</td>
</tr>
<tr>
<td>7</td>
<td>Network Layer (I)</td>
<td>Chapter 7</td>
<td>4, 5</td>
</tr>
<tr>
<td>8</td>
<td>Network Layer (II)</td>
<td>Chapter 7</td>
<td>4, 5</td>
</tr>
<tr>
<td>9</td>
<td>Time Synchronisation</td>
<td>Chapter 9</td>
<td>3, 4, 6</td>
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<tr>
<td>10</td>
<td>Localization</td>
<td>Chapter 10</td>
<td>4, 5, 6</td>
</tr>
<tr>
<td>11</td>
<td>Security</td>
<td>Chapter 11</td>
<td>5, 6</td>
</tr>
<tr>
<td>12</td>
<td>Course Review and Final Exam Preparation</td>
<td></td>
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</table>

*Topics schedule will be adjusted throughout the course as needed.

5.3 Lab Schedule and Information

The real learning in this course goes on in the laboratory where you design, build and test and fix real systems. There are five mandatory labs of two hours each. You will work in groups.

In each lab, you will typically have to build, in software or hardware a sensor network system. Once this is done, show it to your TA for grading, out of 3:

<table>
<thead>
<tr>
<th>Judgement of TA</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did not attend or try</td>
<td>0</td>
</tr>
<tr>
<td>Tried, but failed to get much working</td>
<td>1</td>
</tr>
<tr>
<td>Most, but not all working</td>
<td>2</td>
</tr>
<tr>
<td>Everything worked</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Although the lab portion of the course is worth only 15%, both the midterm and the final exam will contain questions directly related to skills learned in the lab.
<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 12</td>
<td>Laboratory 1</td>
<td>Lab manual 3 Marks</td>
</tr>
<tr>
<td>September 19</td>
<td>Laboratory 2</td>
<td>Lab manual 3 Marks</td>
</tr>
<tr>
<td>September 26</td>
<td>Laboratory 3</td>
<td>Lab manual 3 Marks</td>
</tr>
<tr>
<td>October 3</td>
<td>Laboratory 4</td>
<td>Lab manual 3 Marks</td>
</tr>
<tr>
<td>October 10</td>
<td>Laboratory 5</td>
<td>Lab manual 3 Marks</td>
</tr>
<tr>
<td>October 17</td>
<td>No lab – Fall Study Break</td>
<td></td>
</tr>
<tr>
<td>October 24</td>
<td>Tutorial</td>
<td>Lab manual 1 Marks</td>
</tr>
<tr>
<td>October 31</td>
<td>Project Proposal</td>
<td>Lab manual 1 Marks</td>
</tr>
<tr>
<td>November 7</td>
<td>Project Period 1</td>
<td></td>
</tr>
<tr>
<td>November 14</td>
<td>Project Period 2 – Interim Report</td>
<td>1 Mark</td>
</tr>
<tr>
<td>November 21</td>
<td>Project Period 3</td>
<td></td>
</tr>
<tr>
<td>November 28</td>
<td>Project Presentation</td>
<td>12 Marks</td>
</tr>
<tr>
<td>November 29</td>
<td>Project final report</td>
<td>6 Marks</td>
</tr>
</tbody>
</table>

### 5.4 Project Schedule and Information

**The Task**

The purpose of the project is to:

1. Gain experience dealing with the design of a network system, and to deal with the issues in going from a soft simple specification (“make a wireless sensor node”) to an actual complete design.

2. Express your creativity by applying what you have learned in this course to a project of your own choosing.

You will design and implement a project of your own choosing that uses network software or hardware components in some creative way. You may use any of the parts available in the lab. An important part of this lab is the creativity required to think up an interesting project, and then negotiate with the TA or instructor as to the final form of the project.
Originality/Uniqueness Approval
The first step in your project is to come up with an original idea. You must submit your idea, in a 1-3 line description, via email to the instructor for “originality” or “uniqueness” approval. The instructor will quickly respond to tell you if the idea has already been proposed more than once. If it has, you'll have to come up with something different. Please note that this approval is only the first step and only deals with the basic idea, and not the scope/effort required for the project; that comes next.

Before the First Project lab
You will submit a short project proposal of what your project is about. This should be a short description that gives:

- The basic idea of the project, and the basic function of your system.
- Describe the inputs and outputs and give a simple block diagram describing how the various parts of your system interact.
- Your plan of action for each of the three lab periods - "milestones"
- Present this to your TA to get their opinion on whether the project is viable. This is just a check to make sure that you do not try something overly ambitious.

Demonstration and Report
You will demonstrate your project to the instructor in the final lab period and will be required to provide a short report describing your project.

5.5 Other Important Dates

- Thursday, September 5th, 2019: First day of classes
- Monday, October 14th, 2019: Thanksgiving holiday
- Tuesday, October 15th, 2019: Fall study day, no classes
- Wednesday, November 27th, 2019: Last day of classes
- Thursday, November 28th, 2019: Make up for Study Day (Tuesday Schedule)
- Friday, November 29th, 2019: Make up for Thanksgiving Day (Monday Schedule)

6 Lab Safety
Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course, you are responsible for taking all reasonable safety
precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible. If the laboratory rules are not followed, consequences will include removing student’s access to the lab. If this results in lab work not being completed, the student will receive a grade of 0.

7 Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University’s policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

7.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:
http://www.academicintegrity.uoguelph.ca/

Please also review the section on Academic Misconduct in your Engineering Program Guide.

The School of Engineering has adopted a Code of Ethics that can be found at:
http://www.uoguelph.ca/engineering/undergrad-counselling-ethics

8 Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Centre for Students with Disabilities as soon as possible.
9 RECORDING OF MATERIALS

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

10 RESOURCES

The Academic Calendars are the source of information about the University of Guelph’s procedures, policies and regulations which apply to undergraduate, graduate and diploma programs: http://www.uoguelph.ca/registrar/calendars/index.cfm?index