ENGG*2400 Engineering Systems Analysis

01

Winter 2021
Section(s): C01

School of Engineering
Credit Weight: 0.50
Version 1.00 - January 08, 2021

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1 Course Details

1.1 Calendar Description

This course provides the foundational skills required to model and analyze elementary dynamic engineering systems. The course will focus on basic mechanical, electrical, thermal and hydraulic systems under the assumptions of linearity and time invariance. Students will learn to identify relevant elements and generate system models. System behaviours will be analyzed by solving for such responses as the impulse response, step response, and sinusoidal steady-state response using differential equations, Laplace transform methods, and computer-based methods. The relationship of such system parameters as time constant, degree of damping and resonance frequencies with the transient and steady-state responses will be examined. The complex valued system transfer function will be defined and analyzed.

Pre-Requisites:	ENGG*1210, ENGG*1500, MATH*1200, MATH*1210, PHYS*1010
Co-Requisites:	MATH*2270

1.2 Timetable

Lecture: Monday, Wednesday - 4:00 - 5:20 PM - Zoom

Tutorial:

S01 - Wednesday - 9:30 - 10:20 AM

S02 - Wednesday - 2:30 - 3:20 PM

1.3 Final Exam

April 22, 2:30 - 4:30PM.

Exam time is subject to change. Please see WebAdvisor for the latest information.

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Cam Farrow Ph.D.
Email: cfarrow@uoguelph.ca
Telephone: +1-519-824-4120 x53838
Office: RICH 1515

2.2 Teaching Assistants

Teaching Assistant: Camille Leclerc
Email: cleclerc@uoguelph.ca

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3 Learning Resources

3.1 Required Resources

Textbook (Textbook)
Close, Frederick & Newell, *Modeling and Analysis of Dynamic Systems*, Third Edition, Wiley, 2002

Course Website (Website)
https://courselink.uoguelph.ca
Course material, news, announcements, and grades will be regularly posted to the ENGG*2400 Courselink site. You are responsible for checking the site daily

3.2 Additional Resources

Alternate textbook (Textbook)
Woods & Lawrence, *Modeling and Simulation of Dynamic Systems*, Prentice Hall, 1997
(I will place copies in the library course reserve)

3.3 Communication & Email Policy

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.

It is your responsibility to abide by the following guidelines for all email correspondence:

- Send all emails from your uoguelph.ca e-mail account.
- Include the course code “ENGG*2400” in the subject line of all emails.
- Use a professional tone and appropriate etiquette in all your correspondence. This includes addressing the email using the correct salutation (correct name and correct title).
- Before emailing a GTA or the instructor with a question, check the course outline and Courselink announcements/newsfeed to see if your question has already been answered there.

Failure to follow these guidelines may result in your email being disregarded.

Important: Unprofessional emails will not be responded to. This includes those using l33t, text messaging shorthand, a complete lack of punctuation or capitals, etc.

For all correspondence satisfying the above guidelines, the instructor and TAs will abide by the following guidelines:

- Respond to questions within 24 hours on weekdays. Do not expect replies on evenings, holidays, or weekends.
- Use a professional tone and appropriate etiquette in all correspondence

Occasionally, an email may get missed, especially during busy times in the term. If you have not received a timely reply and you are confident that you have abided by all of the guidelines above, we apologize. Please resend your email and we will try to respond to it immediately.

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4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Identify and defend assumptions and simplifications in constructing an engineering model
2. Identify suitable elements to represent physical devices
3. Identify appropriate through and across variables for a system model
4. Construct graphs or free body diagrams as graphical representations of a system model
5. Create a mathematical model through node analysis
6. Formulate time domain and Laplace domain mathematical models of a system and use computer based methods to simulate them

7. Solve system responses for first order and second order models
8. Solve for step, impulse, and frequency response
9. Assess the entire solution in the context of the problem domain

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	2, 3, 4, 5, 6, 8
1.3	Recall, describe and apply fundamental engineering principles and concepts	2, 3, 4, 5, 6, 8
2	Problem Analysis	1, 2, 4, 5, 6, 7, 8, 9
2.2	Identify, organize and justify appropriate information, including assumptions	1, 2
2.3	Construct a conceptual framework and select an appropriate solution approach	1, 2, 4, 5
2.4	Execute an engineering solution	5, 6, 7, 8, 9
2.5	Critique and appraise solution approach and results	9
5	Use of Engineering Tools	6
5.2	Demonstrate proficiency in the application of selected engineering tools	6

5 Teaching and Learning Activities

Lecture schedule is tentative and subject to change

5.1 Lecture

Topics: **Lectures 1-8: First order systems**

Modeling: including hydraulic, thermal, and electrical systems
Analysis: including step, impulse, free, forced, and complete responses
Flow diagrams

Topics: **Lectures 9-11: H(D)**

Nodal analysis
Block diagram manipulation
Frequency response

Wed, Feb 24

Topics: **Lecture 12: Midterm 1**

Topics: **Lectures 13-17: Second order systems**
Modeling: Mechanical systems, inertiance, state space
Analysis: Under-damped systems, resonance

Wed, Mar 17

Topics: **Lecture 18: Midterm 2**

Topics: **Lectures 19-23: Laplace transform**
Transfer function
Partial fraction expansion
Black box modelling
Stability
Final value theorem and static gain

Topics: **Lecture 24: Review**

5.2 Other Important Dates

Please see the schedule of dates for other important dates in the academic year: https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c03/index.shtml

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6 Assessments

6.1 Marking Schemes & Distributions

The scheme that yields the **highest** grade will be used.

Name	Scheme A (%)	Scheme B (%)	Scheme C (%)	Scheme D (%)
Midterm 1	25	25	0	0

Name	Scheme A (%)	Scheme B (%)	Scheme C (%)	Scheme D (%)
Midterm 2	25	0	25	0
Final Exam	50	75	75	100
Total	100	100	100	100

6.2 Assessment Details

Midterm 1 (25%)
Date: Wed, Feb 24
Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8, 9
If you miss the midterm, the weight will be transferred to the final exam.

Midterm 2 (25%)
Date: Wed, Mar 17
Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8, 9
If you miss the midterm, the weight will be transferred to the final exam.

Final Exam (50%)
Date: Thu, Apr 22, 2:30 PM - , 4:30 PM, Online
Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8, 9
Accommodation for missed final exams is not under the purview of the course instructors. If you miss the final exam and need advice on how to proceed, please contact the Engineering Program Counselors office.

6.3 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to ground for granting academic or religious consideration please email **Dr. Farrow**. See 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 Consideration of Religious Obligations:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml 2

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

Passing Grade: As per University policy, the minimum passing grade is 50%

7 School of Engineering Statements

7.1 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 but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. 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 labs.

7.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. 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.

7.3 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.

8 University Statements

8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

8.6 Academic Integrity

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 encourages academic integrity. 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 or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

8.7 Recording of Materials

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

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph’s procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

8.10 Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.
