ENGG*2400 Engineering Systems Analysis
Winter 2018

School of Engineering

1 INSTRUCTIONAL SUPPORT

1.0 Instructor

Instructor: Cameron Farrow, PhD
Office: THRN 2361, ext. 53385
Email: cfarrow@uoguelph.ca
Office hours: Open door policy and by appointment

1.1 Teaching Assistants

GTA	Email	Office Hours
Sarah Rixon	srixon@uoguelph.ca	TBA

2 LEARNING RESOURCES

2.0 Course Contact Hours (Lectures, Labs, & Tutorials)

The lectures and tutorials are the primary means used to support your learning in this course. Lectures will be the primary means for course news and announcements in addition to provision of course materials. Lecture attendance is expected. Tutorials will be the primary means for the instructional team to coach you. Tutorial attendance is expected.

2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the ENGG*2400 Courselink site. You are responsible for checking the site regularly.

2.2 Required Resources

Close, Frederick & Newell, Modeling and Analysis of Dynamic Systems, Third Edition, Wiley, 2002

2.3 Additional Resources

Woods & Lawrence, Modeling and Simulation of Dynamic Systems, Prentice Hall, 1997 (copies will be available in the library course reserve)

2.4 Communication & Email Policy

Communication associated with course material is delivered by a combination of the lectures, tutorials and the Courselink site. It is your responsibility to receive communication from ALL of these sources – there will be some mutual reinforcement between these sources but they are not completely redundant. As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

3 ASSESSMENT

3.0 Dates

Tutorial Assignments:

Every tutorial period unless stated otherwise in Courselink and/or Piazza

Midterm Exam:

Tuesday, Feb 27th, during lecture period.

Final Exam:

Tuesday, April 17th, 2018 (Room TBA). Exam time and location is subject to change. Please see WebAdvisor for the latest information.

3.1 Final Grade Calculation

The breakdown for grading the course is given below. It is based on the premise that you must pass the exams in order to pass the course while ensuring that there are no step discontinuities in the grades (e.g., getting a 50% on the final exam versus a 49% will not change your grade from 70% to 49%). Additionally, if you do better on the final exam than the midterm, the final will have a higher weighting.

Given: Final Grade := G, Final exam := F , Midterm := M , and Tutorials =: T (all in percent), then set

$$E := \frac{1}{0.9}\max\{0.55F + 0.35M, 0.65F + 0.25M\}$$

and

$$x := \frac{E - 40\%}{20\%}.$$

Your final grade is then given by:

$$G := \begin{cases} 0.9E + 0.1T, & E \geq 60\% \\ \min\{(1-x)E + x(0.9E + 0.1T), \\ \qquad 0.9E + 0.1T\}, & 40\% \leq E \leq 60\% \\ \min\{E,\ 0.9E + 0.1T\} & E \leq 40\%. \end{cases}$$

The ideal weighting (i.e., if you get over 60% on everything and do better on the midterm than the final) is:

- Midterm=35%
- Final=55%
- Tutorials=10%.

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. 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 Accommodation of Religious Obligations: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Passing grade: To pass the course students must obtain a grade of 50% or higher.

Missed test: If you miss the midterm due to grounds for granting academic consideration or religious accommodation, the weight of the missed midterm will be added to the final exam.

4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.0 Calendar Description

Analytical description and modelling of engineering systems such as mechanical, electrical, thermal, hydraulic, biological and environmental systems. Applications of multivariable calculus, linear algebra and differential equations to simulate and analyse such systems.

Prerequisite(s): ENGG*1210, ENGG*1500, MATH*1200, MATH*1210, PHYS*1130

Corequisite(s): MATH*2270

4.1 Course Aims

This course aims to provide the student with the analytical skills required to model and analyze engineering systems across a range of disciplines. Students will learn to identify the relevant elements that comprise a system, apply elemental laws and general theorems to derive mathematical models, and then solve the mathematical models using techniques taught in other courses as well as using computer software for system simulation. The modelling and solution techniques form the foundations of analysis techniques in later, more discipline-specific advanced courses.

4.2 Learning Objectives

At the successful completion of this course, the student will have demonstrated the ability 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 or loop analysis
6. Formulate time domain, computer methods, and Laplace domain mathematical models of a system
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

4.3 Graduate Attributes

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

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	1, 2, 3	Exams
2. Problem Analysis	1-9	Exams
3. Investigation	-	-
4. Design	-	-
5. Use of Engineering Tools	6, 7	Exams
6. Communication	-	-
7. Individual and Teamwork	-	-
8. Professionalism	-	
9. Impact of Engineering on Society and the Environment	-	-
10. Ethics and Equity	-	
11. Business & Project Management	-	
12. Life-Long Learning	-	-

4.4 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. 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.

4.5 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.

4.6 Relationships with other Courses & Labs

Previous Courses:

ENGG*1210: Mechanical system fundamentals such as force, torques, friction, moments, free body diagrams

ENGG*1500: Solving systems of linear equations, matrix algebra, complex numbers

MATH*1200 & MATH*1210: Limits, differentiation, integration, series expansion

PHYS*1130: Harmonic motion, electric potential, DC circuits

Concurrent Courses:

MATH*2270: Differential equations, solving linear ODEs, Laplace transform

Follow-on Courses:

ENGG*2450: Foundations of RLC circuit analysis, ideal operational amplifiers

ENGG*2660: Foundations of heat and mass balance, energy flows

ENGG*3260: Foundations of energy balances, thermal flow, thermal properties

ENGG*3280: Foundations of dynamical mechanical systems

ENGG*3390: Foundations of systems analysis, frequency response

ENGG*3410: Foundations of systems analysis, frequency response

5 TEACHING AND LEARNING ACTIVITIES

5.0 Timetable

Lectures:			
Tuesday, Thursday		5:30-6:50	RICH 2529
Tutorials:			
Wednesday	Sec 01	12:30 -1:20	MACN 118
Wednesday	Sec 02	8:30 – 9:20	MACN 118
Thursday	Sec 03	2:30 – 3:20	MINS 037

- You may only attend an alternate tutorial time with prior permission of the instructor.

5.1 Lecture Schedule

The lectures are roughly laid out in the following order:

- **Systems fundamentals**
- **First order systems**
  - Fluid Systems
  - Euler's solution
  - Thermal systems
  - Solving the forced equation (step and impulse responses)
  - Frequency response
  - Electrical systems (RC)
  - Op-amps and nodal analysis
  - The Big Picture part 1
- **Second order systems**
  - Mass-spring-damper systems
  - Time responses
  - Inductance (fluids and electrical)
  - Frequency response
  - State-space representations
  - The Big Picture part 2
- **Higher order systems and the Laplace Transform**
  - Solving using Laplace (Heavyside, PFE)
  - Poles and stability

- Interconnected systems
- Block diagrams

• The **real** Big Picture

5.2 Other Important Dates

Monday, January 8th: First day of class
Monday, February 19th– Friday, February 23rd: Reading Week
Friday, March 9th: 40th class: Last day to drop single semester courses
Friday, April 6th: Final Class

6 LAB SAFETY

N/A

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.

7.0 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 Student Accessibility Services as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208, email csd@uoguelph.ca or see the website: http://www.uoguelph.ca/csd/

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, GTA, technician, 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