ENGG*2400 Engineering Systems Analysis
Fall 2016

UNIVERSITY of GUELPH
School of Engineering

(Revision 1.1: Sept 8, 2016)

INSTRUCTIONAL SUPPORT

Instructor

Instructors:	Bob Dony, Ph.D., P.Eng.	Julie Vale, Ph.D., P.Eng.
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Office hours:	Mon 10:30-11:30 THRN 1126	Tue 9:30-10:30 THRN 2340
	Wed 14:30-15:30 THRN 1425	Thu 10:30-11:30 THRN 1425
	Or by appointment	Or by appointment

Teaching Assistants

GTA	Email	Office Hours
Andrea Dinardo	dinardoa@uoguelph.ca	By Appointment
Craig Duval	cduvall@uoguelph.ca	By Appointment
Mohamed Kahlil	khalil@uoguelph.ca	By Appointment
Kelsie McNeill	kmcnei02@uoguelph.ca	By Appointment
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Sarah Rixon	srixon@uoguelph.ca	By Appointment
Simranjit Sahni	ssahni@uoguelph.ca	By Appointment
Yasser Selima	yselima@uoguelph.ca	By Appointment

LEARNING RESOURCES

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.

Required Resources

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

Communication & Email Policy

Please use lectures and tutorials as your main opportunity to ask questions about the course. Major announcements will be posted to the Courselink site. **It is your responsibility to check the course website regularly.** 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 student.

Please abide by the following guidelines for all email correspondence:

- Include the course code "ENGG*2400" in the subject line of all emails.
- Use a professional tone and appropriate etiquette in all your correspondence.
- Do not ask questions that have already been answered in the course outline, on Courselink, or announced in class.

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

ASSESSMENT

Dates

Tutorial Assignments: (best 8 out of 11)
Every tutorial period

Midterm Exam:
Sat Oct 22 13:00-14:30, RICH 2520, 2529 and MACN 105

Final Exam:
Mon Dec 12, 19:00-21:00, Room TBA

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.

Define: 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

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

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%.

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

Because the tutorial assignment grade is calculated using the best 8 out of 11 quizzes, academic consideration will only be considered if you have grounds for missing *4 or more tutorial assignments*.

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

Missed midterm exam: If you miss the midterm exam due to grounds for granting academic consideration or religious accommodation, you will have the opportunity to write a make-up midterm exam on Tue Oct 25 17:30-19:00. If you are unable to attend the make-up exam as well due to grounds for granting academic consideration or religious accommodation, the weight of the midterm will be moved to the final exam as there will be no further make-up midterm exam.

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

AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

Calendar Description (Current)

Analytical description and modeling 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

Calendar Description (Proposed)

This course aims to provide the student with the foundational analytical 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, as these systems form the building-blocks for a range of engineering disciplines. Students will learn to identify relevant elements that comprise a system, apply element laws relating through and across variables, and, using applicable conservation laws, generate system models. Such models will include graphical representations such as flow graphs, block diagrams and free body diagrams, as well as mathematical representations such as input-output differential equations and state variable equations. Students will analyze system behaviours by solving for such responses as the impulse response, step response, and sinusoidal steady-state response using solution methods of 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 effect of the poles and zeros values of the system transfer function on the system response, including stability analysis, will also be examined.
Prerequisite(s): ENGG*1210, ENGG*1500, MATH*1200, MATH*1210, PHYS*1130
Corequisite(s): MATH*2270

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.

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

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. Environment, Society, Business, & Project Management	-	-
12. Life-Long Learning	-	-

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 other assessments.

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.

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

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TEACHING AND LEARNING ACTIVITIES

Timetable

Lectures:

Sec 1	Tues	16:00-17:20	RICH 2520
	Thur	16:00-17:20	RICH 2520
Sec 2	Tues	11:30-12:50	MACN 105
	Thur	11:00-12:50	MACN 105

Tutorials:

Fri	Sec 0x01	13:30 - 14:20	MCKN 237
Wed	Sec 0x02	12:30 - 13:20	MCKN 235
Tue	Sec 0x03	17:30 - 18:20	MCKN 238
Mon	Sec 0x04	12:30 - 13:20	MCKN 235
Wed	Sec 0x05	10:30 - 11:20	MCKN 238
Tue	Sec 0x06	08:30 - 09:20	MCKN 234
Mon	Sec 0x07	10:30 - 11:20	MCKN 237
Wed	Sec 0x08	17:30 - 18:20	MCKN 238
Mon	Sec 0x09	09:30 - 10:20	MCKN 233
Mon	Sec 0x10	10:30 - 11:20	MCKN 235

Lecture Schedule

Week	Lecture Topics	References	Learning Objectives
1	Mechanical Systems	Chapter 2	1-4
2	System Representations	Chapter 3	6
3	Rotational Mechanical Systems	Chapter 5	1-4
4-5	Electrical Systems	Chapter 6	1-4
6	Thermal Systems	Chapter 11	1-4
	Fluid Systems	Chapter 12	1-4
-	Midterm		
7	Graphical Representation	Chapter 4	4,5
8-10	Solutions	Chapter 7, Appendix D, E	6-9
11	Transfer Function	Chapter 8	6
12	Frequency Response	Chapter 8.4, Appendix C	8

Other Important Dates

Monday October 10: Thanksgiving Holiday

Tuesday October 11: Fall Study Break Day

Friday, November 4: Drop Date - 40th class

Thursday, December 1: *Tuesday Schedule*

Friday, December 2: *Monday Schedule*, and last day of classes

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LAB SAFETY

N/A.

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.

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

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 (SAS) as soon as possible

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

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.

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