Syllabus
MEGR 3122 Dynamic Systems II (Section 002)
Department of Mechanical Engineering and Engineering Science
UNC Charlotte
Spring 2024

Instructor:	A. Wolek, Ph.D. <awolek@charlotte.edu>
Instructor office hours:	Wensdays: 1:30pm – 2:30 pm
	(BATT CAVE Rm. 103 or by appointment via Zoom)
TA/e-mail:	Samuel Weaver <sweave28@charlotte.edu>
TA office hours:	Mondays: 1:00 pm – 2:00 pm
	Tuesdays: 4:00 pm – 5:00 pm
	(Duke Rm. 242 or by appointment via Zoom)

Important Links:

Piazza page:	https://piazza.com/uncc/spring2024/202410megr312200222757/home
Course content:	https://github.com/robotics-uncc/MEGR_3121_DynamicSystemsI
Homework submission/grades:	https://canvas.charlotte.edu
Virtual suggestion box:	https://forms.gle/yCWe4aAGtKzxLeHz9

Classes Meet In Person:

Class hours:	Tues./Thurs.: 2:30pm – 3:45pm (EPIC 1249)

Prerequisites   MEGR 3121 Dynamic Systems I with C or better. The course will also require concepts you previously learned in a differential equations and computational methods course.

Course Description   Modeling of mechanical dynamic systems. Vibration of lumped mass systems. Analysis and design of mechanical systems using time domain and frequency domain methods.

Course Objectives   After completing this course students will be able to:

1. Solve first and second order linear differential equations using Laplace transforms
2. Obtain differential equation motion models of mechanical systems based on free-body diagrams
3. Obtain the response of first and second order systems due to initial conditions and various forcing functions, such as a step, ramp, and sinusoid
4. Develop lumped parameter models of dynamic systems
5. Use MATLAB for dynamic simulation

Course Topics

1. Introduction to System Dynamics
2. Terminology/Review Of Ordinary Differential Equations (ODEs)
3. 1st Order ODEs
4. 2nd Order ODEs

5. Complex Arithmetic
6. Laplace Transforms
7. Additional Laplace Transform Properties
8. Inverse Laplace Transform
9. Solving ODEs with the Laplace Transform
10. MATLAB tools for ODEs
11. Damped Harmonic Oscillator
12. Transfer Functions
13. Rotational Systems
14. Multi Degree-of-freedom Systems
15. Lumped Parameter Systems
16. Thermal Systems
17. Electrical Systems
18. Frequency Response of Systems
19. Resonance
20. Vibration Isolators
21. Dynamic Vibration Absorbers
22. Vibration Modes
23. Bode Diagrams
24. Sketching Bode Diagrams
25. Zero Pole Gain Form
26. Block Diagrams

Lecture Notes (Required). I will provide PDF copies of lecture notes uploaded weekly.

Textbooks (Recommended). You can complete the course using just the lecture notes provided, but you are encouraged to obtain access to one or both of the following textbooks for your own reference:

- *Official Course Textbook (Free online).* The official textbook for the course is: M. A. Davies, T. L. Schmitz. System Dynamics for Mechanical Engineers, Springer, 2015.
  PDF Link: https://link.springer.com/book/10.1007%2F978-1-4614-9293-1
  Must be accessed by a UNC Charlotte computer/network login

- *Secondary Course Textbook.* K. Ogata. System Dynamics (4th Edition), Pearson Prentice Hall, 2004.

MATLAB. This course will make heavy use of MATLAB. Please refer to the MATLAB Help document posted to ensure your have MATLAB correctly installed and if you are rusty on working with MATLAB.

Required Reading. I have prepared typeset lecture notes that you are expected to read weekly.

Class Lectures. During our lectures I will go over the week's reading material with additional context and examples. These meetings are intended to be interactive and provide you an opportunity to ask questions and promote discussion. Class meetings are *not* intended to completely replace your *required* reading of the course lecture notes that delve into greater detail into the course topics.

Homework. Weekly homework assignments should be expected and must be submitted via Canvas (i.e., not via email or hardcopy). You are encouraged to discuss homework with each other, form study groups, etc. as long as the discussion is conceptual in nature for the purposes of learning.

Online Submission File Formats.   Homework (or exams, if virtual) must be submitted electronically via Canvas in PDF format. PDF format, as opposed to image formats (.JPG, .PNG, etc.) is preferred because it facilitates grader annotation to provide feedback and often is more legible/higher quality. Suggested ways to generate a PDF for submission:

- Use a tablet/stylus to create your homework assignment, then export to PDF
- Scan written copies of your homework into PDF format

It is a good habit to check your PDF file before and after you upload to Canvas to ensure it is accurate and complete. Digital file time stamps or other methods of verifying when a homework was completed cannot be used to submit a homework after the due date. Give yourself ample time to overcome any technical issues with submission, scanning, etc. If you are having technical issues specifically with Canvas submission then email me your homework in its current state before the deadline.

Late Homework.   The homework submission window will be indicated on Canvas for particular assignments. Late homework cannot be uploaded once the submission window ends. In general, late homework will not be accepted unless a legitimate reason is provided or you discuss with me any extenuating circumstances well in advance of the due date.

Midterm and Final Exam Policy.   Midterm exams will take place during class hours and exact dates will be communicated to students at least two weeks prior (e.g., during class meetings or through Canvas/email). There may be other activities in the class room before/after our class hours and therefore the exams will start/end promptly with our scheduled class time. The final exam date will be communicated to students via email. The UNCC policy for final exams is to only reschedule if there are three or more exams the same day (see https://legal.charlotte.edu/policies/up-202, bullet 4). In this class, we follow a similar system for midterm exams: midterm exams will be reschedule only if students have three or more exams the same day and they communicate this conflict with me at least one week in advance (with names of other courses/instructors). If the conflict affects only a small number of students then they may be accomodated seperately by taking the exam at a different time. Otherwise, the exam date generally cannot be changed for individual students.

Homework/exam grade dispute.   It is the student's responsibility to review their graded homework and exam as soon as possible after receiving a grade. Any concerns regarding the grade should be raised with the instructor or TA, as appropriate, within five (5) days of the grade being posted. After five (5) days the exam or homework grade is considered final and no further changes can be made.

Grading Policy   Homework and exams will be based on *both* the required reading materials and what was said in class. The typical UNCC grading scale will be used.

- A 100 % to 90.0% (Excellent)
- B < 90.0 % to 80.0% (Good)
- C < 80.0 % to 70.0% (Fair)
- D < 70.0 % to 60.0% (Passing)
- F < 60.0 % to 0.0% (Fail)

The grade will be computed using the following weighting:

Course Element	Percentage
Homework*	25 %
Exams (Three midterms + final)**	70 %
Unannounced Quizzes***	5 %

* The single lowest homework grade will be dropped. All homework assignments have equal weight.
** The lowest exam grade of the four exams will be dropped. Thus, the final exam is optional and the best three exams will be equally weighted to give a total of 70% towards the final grade.
*** The single lowest quiz grade will be dropped. All quizzes have equal weight.

Homework Grades. For each homework the TA/instructor may grade only a randomly chosen subset of the questions assigned, or all questions, as per their discretion. In either case students should complete all homework problems assigned and are expected to carefully review the posted solutions.

Curving Course Grades. Course grades may be curved up but never curved down. Curves are generally applied throughout the semester rather than at the end of the course—the goal is to provide students with the most accurate grade possible so that large curves are not anticipated/expected at the end of the course. For final course letter grades: below each grade cutoff there is a fuzzy area. If you are in this fuzzy area, you may receive the higher grade. Three factors will be used in determining this: i) your attitude and class participation, ii) your exam grades rising or dropping, and iii) your quality of performance on homework. Note that two students with nearly identical weighted percents may receive different grades. Grades in the fuzzy area will be determined based on the above subjective criteria at the instructor's discretion.

Extra Credit. Extra credit may or may not be offered each semester (instructor's discretion). Note that the grading policy already provides students with some leeway by dropping the lowest exam, homework, and and quiz. The main mechanism for students at the end of the course to improve their grade is to study carefully for the comprehensive final exam.

Office Hours. I will provide office hours as indicated on the front page of the syllabus. Please come prepared with specific questions and only after reading the lecture notes. Office hours are meant to clarify specific concepts, not to reproduce course material that was already presented/provided to students.

Piazza. We will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions to me or the TA, I encourage you to post your questions on Piazza. See link above or access via Canvas.

Email Communication. I prefer that you do not email me directly with course questions, unless they are of a personal nature (e.g., medical circumstances preventing you from participating in class/exam). Instead you are encouraged to post on Piazza (note: you can also post anonymously).

Important dates. It is your responsibility to also keep track of other important dates set by the university that may affect your involvement in this course. https://registrar.uncc.edu/printable-calendar

Changes in Syllabus. The standards and requirements set forth in this syllabus may be modified at any time by the course instructor. Notice of such changes will be by announcement in class, on the course webpage, or by email.

Academic Integrity Suspected cases of academic misconduct on homework/exams (cheating, fabrication, falsification, plagiarism, obtaining solutions online or from other students, etc.) will be promptly handled according to the Procedures for Adjudication of Academic Misconduct Cases. Faculty may ask students to produce identification at examinations and may require students to demonstrate that graded assignments completed outside of class are their own work.

Standard university policies that apply to this course can be found at the link below. A selection of these policies are provided below for emphasis. https://legal.uncc.edu/policies/university-policies.

Classroom Environment All students and the instructor are expected to engage with each other respectfully. Unwelcome conduct directed toward another person based upon that person's actual or perceived race, actual or perceived gender, color, religion, age, national origin, ethnicity, disability, or veteran status, or for any other reason, may constitute a violation of University Policy 406, The Code of Student Responsibility. Any student suspected of engaging in such conduct will be referred to the Office of Student Conduct.

Recording Policy Electronic video, image capture, and/or audio recording is not permitted during class, whether conducted in person or online, unless the student obtains permission from the instructor. If permission is granted, any distribution of the recording is prohibited. Students with specific electronic recording accommodations authorized by the Office of Disability Services do not require instructor permission; however, the instructor must be notified of any such accommodation prior to recording. Any distribution of such recordings is prohibited.

Course Workload This 3-credit course requires 3 hours of classroom or direct faculty instruction and 6 hours of out-of-class student work each week for approximately 15 weeks. Out-of-class work may include but is not limited to: required reading, homework assignments, and studying for exams.

Seeking Help It is common for college students to experience challenges that may interfere with academic success such as academic stress, sleep problems, juggling responsibilities, life events, relationship concerns, or feelings of anxiety, hopelessness, or depression. If you or a friend is struggling, we strongly encourage you to seek support. Helpful, effective resources are available on campus at no additional cost.

If you are struggling academically with this class, please visit me during office hours or contact me by email at awolek@uncc.edu

- Meet with your academic advisor if you are struggling academically in multiple classes, unsure whether you are making the most of your time at UNC Charlotte, or unsure what academic resources are available at UNC Charlotte.

- Visit the Counseling and Psychological Services website at caps.uncc.edu for information about the broad range of confidential on-campus mental health services, online health assessments, hours, and additional information.

- Call CAPS at (704) 687-0311 if interested in scheduling an appointment with a counselor. After-hours crisis support is also available through this phone number.

Disability Accommodations Students in this course seeking accommodations to disabilities must first consult with the Office of Disability Services and follow the instructions of that office for obtaining accommodations.