Georgia Institute of Technology

George W. Woodruff School of Mechanical Engineering

ME4451, ROBOTICS Fall 2026

Professor:

Dr. Anirban Mazumdar

GTA 1:

GTA 2:

Overview:

This course is an upper division (4000 level) mechanical engineering course that introduces students to the mechanical engineering aspects of robotics.

The course covers:

Robot mechanisms

Forward and Reverse Displacement Analysis for Planar Serial Robots

Forward and Reverse Displacement Analysis for Planar Parallel Robots

Differential Motion

Robot statics

Spatial Kinematics (Homogeneous Transformation Matrices)

Lagrangian Dynamics

Linearization and basic feedback control

Mobile Robot kinematics and control

Mobile robot localization

Robot sensing and actuation

Introductory uncertainty analysis and propagation

Prerequisites: ME2202 & ME3017. Basic knowledge of Statics, Dynamics, Linear Algebra, and Matlab Programming is required.

Recommended Text:

Robotics: Modeling, Planning and Control by Bruno Siciliano, Lorenzo Sciavicco, and Luigi Villani, Springer-Verlag London Limited, 2010. Download from https://link.springer.com/content/pdf/10.1007%2F978-1-84628-642-1.pdf

(Links to an external site.)

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Additional References:

[1] Introduction to Autonomous Mobile Robots by Roland Siegwart, Illah Nourbakhsh, Davide Scaramuzza, 2nd Edition, MIT Press 2011.

[2] Introduction to Robotics: Mechanics and Control by John J. Craig, 4th Edition, Pearson Publishing, 2018.

[3] Planning Algorithms by Steven M. LaValle, Available for downloading at http://planning.cs.uiuc.edu/

(Links to an external site.)

Lecture:

Lectures provide the basis for the course. The lectures are done on the whiteboard and cover all key components.

In-person attendance is not required but is strongly encouraged. Occasional extra credit will be given for in-class attendance.

All essential materials for homeworks and exams will be covered during lecture. A set of historical lectures (2020) have been recorded and are available for asynchronous viewing.

Lecture times are MW 3:30-4:20pm.

Laboratory:

Laboratories enable the students to strengthen their knowledge of core class concepts on physical robotic systems.

Labs are in person, and take place in MRDC 3334.

Lab sections consist of 1.5 hours of pre-lab preparation and 1.5 hours of in-lab exercises.

Lab attendance is mandatory.

We expect all students to arrive to lab on time unless it has been previously communicated with the TA's. You will have a grace period of 5 minutes, after which you will lose 5% of that lab grade for each subsequent 5 minutes you are late to lab.

You will lose 20% per section of the lab not completed in lab, with the potential to get back 10% per section during office hours. For example, if you fail to complete two sections of lab 1, that drops your lab 1 grade down to a 60%, but you have the chance to raise that back up to an 80% by finishing those missed sections in office hours.

Lab Tentative Schedule:

Lab: Week of:

Lab 1

Lab 2

Lab 3

Lab 4

Lab 5

Lab 6/Lab 7

Lab 8

Lab 9

Homeworks

Homework sets are used to deepen and evaluate student understanding of core course concepts.

The homework sets will be assigned biweekly.

Group collaboration is encouraged. Students must write who they worked with on top of their problem sets.

Late problem sets will automatically be deducted points (10% per day).

Solutions are posted after the deadline and no late problem sets are accepted after solutions have been posted.

Copying is against institute regulations.

To receive credit for your work, you must show your steps. Poorly written and illegible problem sets will automatically be deducted points.

Exam

The exam is used to evaluate student understanding of core course concepts.

1 midterm exam is given towards the end of the course.

No final exam is given for this course.

Grading Policy:

Grade Distribution

Homework:30%

Labs: 40%

Exam: 30%

If assignments are missing your name, you will receive a zero.

Letter grades will be assigned using the following percentage scores;

A: 90%-100%

B: 80%-90%

C: 70%-80%

D: 60%-70%

F: 0%-60%

Assignment Overview

Homeworks

Homework 1

Homework 2

Homework 3

Homework 4

Homework 5

Homework 6

Labs

Lab 1

Lab 2

Lab 3

Lab 4

Lab 5

Lab 6

Lab7

Lab 8

Exams

On-line Resources:

Canvas - https://canvas.gatech.edu/, used mostly for grades and some resources and submissions.

Lab Schedule

Current Code

A01 is T 12:30-3:30

A02 is T 3:30-6:30

A03 is R 3:30-6:30

A04: is R 6:30-9:30

Subsections

A01- F meets for the FIRST 1.5 hours

A01- S meets for the SECOND 1.5 hours

Etc.

Sign ups for re-coded subsections will be posted during the first week of class.

Academic Honesty

The Student Conduct Code is described in the current Georgia Tech General Catalog. All items in the Honor Code under the topic of Academic Misconduct apply to this class. In particular, the following items are considered to be cheating:

Submission of a computer program that is copied from another student

Copying from another student's paper during an exam

Alteration of graded tests submitted for regarding

Academic misconduct will be reported to the Vice President for Student Affairs as described in the General Catalog.

Student Illness

During the semester, you may need to self-isolate to avoid the risk of infection to others.

During the isolation period you may feel completely well, ill but able to work as usual, or too ill to work until you recover.

In-person courses and in-person class sessions during hybrid courses. When in isolation or quarantine you will be unable to attend in-person course sessions but your instructor may require you either to participate in the course remotely, complete some complementary work that parallels what you are missing in class, or make up some class work when you return.

If you are ill and unable to do course work this will be treated similarly to any student illness. The Dean of Students will have been contacted when you report your positive test or are told that it is necessary to quarantine and will notify your instructor that you may be unable to attend class events or finish your work as the result of a health issue. Your instructor will not be told the reason. We have asked all faculty to be lenient and understanding when setting work deadlines or expecting students to finish work, and so you should be able to catch up with any work that you miss while in quarantine or isolation. Your instructor may make available any video recordings of classes or slides that have been used while you are absent, and may prepare some complementary asynchronous assignments that compensate for your inability to participate in class sessions. Ask your instructor for the details.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The

Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Campus Resources for Students

A list of resources for undergraduate students' academic success and information about advising can be found at Success at Tech.

Academic Support: Academic Success and Advising (a unit in the Office of Undergraduate Education & Student Success) provides free support for your courses. Students can attend scheduled supplemental review (PLUS) sessions, stop by Drop-In Tutoring, or schedule a one-on-one appointment through Knack. To explore what options work best for you, please visit us online at gatech.edu/tutoring, email us at tutoring@gatech.edu, or come see us at Clough Undergraduate Learning Commons, Suite 283.