# CSD1241 Linear Algebra and Geometry

## Fall 2022

*Prerequisites: MAT 200 or MAT 230*

## General Information

- Mode of teaching: mixed between on-line and on-campus
- Class schedule
  - Lecture (on-line): Tuesdays 3-6pm
  - Tutorial: check your individual schedules
- Module Coordinator: Do Duc Tai
  Contact: ductai.do@digipen.edu
- Module Co-Coordinator: Rosa Anajao
  Contact: rosa.anajao@digipen.edu
- Office hours: Wednesdays 1-3pm
  Individual consultation: immediately after tutorial sessions or by appointment

## Course Description

The two main themes throughout the module are vector geometry and linear transformations. Topics from vector geometry include vector arithmetic, dot product, cross product, and representations of lines and planes in three-space. Linear transformations covered include rotations, reflections, shears and projections. Students study the matrix representations of linear transformations along with their derivations. The curriculum also presents affine geometry and affine transformations along with connections to computer graphics. This module also includes a review of relevant algebra and trigonometry concepts.

## Course Objectives and Learning Outcomes

Upon successfully completing this course, students should be able to

1. Understand coordinate systems and perform coordinate conversion between any two coordinate systems, that is, between local and global coordinates.
2. Understand fundamental data types of points and vectors, and know the algebraic and geometric differences between them.
3. Compute basic vector operations like dot product and cross product, and apply these concepts in representing geometric objects such as lines and planes.
4. Know the concepts of affine combinations and barycentric coordinates, and use these concepts in representing and manipulating geometric objects such as lines and planes.
5. Explain matrices as linear maps, and compute the matrix representation of any linear map.
6. Compute matrix representations of standard geometric transformations including scaling, projection, reflection, rotation, and shear.
7. Build *affine maps* from linear maps.

## Learning Resources

Recommended books

1. Practical Linear Algebra: A Geometry Toolbox, 3rd edition, Gerald Farin and Dianne Hansford, CRC Press, ISBN-13: 978-1-4665-7956-9
2. Elementary Linear Algebra with Supplemental Applications, 10th edition by H. Anton and C. Rorres, International Student Version. ISBN-13: 978-0470561577

## Module Content and Tentative Schedule

The following schedule is tentative and subject to change.

Week 1: Points, Vectors and Lines in $\mathbb{R}^2$

Week 2: Lines and Planes in $\mathbb{R}^3$

Week 3: Cross Products and Intersections

Week 4: Angles, Distances and Matrices

Week 5: Matrices and Determinants

Week 6: Linear Transformations

*Week 7: Recess Week*

Week 8: 2D Linear Maps

Week 9: 2D Linear Maps (continued)

Week 10: 3D Linear Maps

Week 11: Affine Maps

Week 12: Barycentric Coordinates

Week 13: Revision

Week 14-15: Final Examination (exact date to be announced by DigiPen Administration)

## External Preparation

It is expected that the students in this class spend 8 hours on average per week for outside classroom activities through the trimester, including, but not limited to, homework, reading assignments, project implementation, group discussions, preparation of examinations, etc.

## Assessment

The following is a tentative summary of the assessment and it is subject to change.

| Assessment Task | Weight | Tentative dates |
|---|---|---|
| Homeworks | 10% | Weeks 1-12 |
| Quizzes (5) | 30% | Weeks 3,5,9,11,13 |
| Midterm test (1) | 30% | Week 6 |
| Final test (1) | 30% | Week 14/15 |

A "D" grade or above is considered as 'Pass' and an "F" grade is considered as "Fail". Students with grades "D" or "D+" will be given the option to repeat the module but the maximum GPA for the repeated attempt will be capped at 2.0. Successful completion of the academic module is also based on fulfilment of any other requirement(s) set by the Module Coordinator and Programme Leader.

Marks are final after ratification by the Board of Examiners.

Do note that the criteria for acceptable standing in any given trimester is maintaining a minimum Cumulative Grade Point Average (CGPA) of 2.0. Refer to the SIT Academic Guide for further details.

## Course Policies

### Attendance policy

- Student more than 15 minutes late to class will be marked as absent for that entire class.
- Student may not leave the class early without the instructor's permission.
- Student absent from all classes without explanation for a period of 14 calendar days would receive the Letter of Warning from the Registrar's Office. The student must reply with the reasons of absence and resume attending classes within the next 14 calendar days to avoid being withdrawn from the Institute.
- To apply for your absences to be excused, please submit your documents (Medical Certificate, Reservist notice etc) via IN4SIT and registrar.sg@digipen.edu within 7 calendar days of your return.
- Unexcused absences would result in the following penalty to your final grade.

| 1 letter grade down for the number of unexcused absences | 2 letter grade down for the number of unexcused absences |
|---|---|
| 4 | 8 |

Example: A student attained a final grade of "A-" for the module. If he/she had 4 unexcused absences, his/her final letter grade would be downgraded to "B+" due to the penalty. If he/she had 8 unexcused absences, his/her final letter grade would be downgraded to "B" due to the penalty.

### Late Policy

Any assignment submissions after the deadline will be considered late and will receive a zero grade. No make-up quizzes, midterm and final exams will be offered without a prior arrangement or a surprise disaster.

### Academic Integrity Policy

Academic dishonesty in any form will not be tolerated in this course. Cheating, copying, plagiarizing, or any other form of academic dishonesty (including doing someone else's individual assignments) will result in, at the very minimum, a zero on the assignment in question, and could result in a failing grade in the course or even expulsion from DigiPen.

### Disability Support Service

Students who have special needs or medical conditions and require formal accommodations in order to fully participate or effectively demonstrate learning in this class should contact the Student Life & Advising Office (studentlife.sg@digipen.edu) at the beginning of each semester. A Student Life & Advising Officer will meet with the student privately to discuss how the accommodations will be implemented.

### Last Day to Withdraw

In order to withdraw from a course it is not sufficient simply to stop attending class or to inform the instructor. In accordance with the policy, contact your advisor or the Registrar to begin the withdrawal process. The last day for withdrawal from this course is cited in the official catalog.