# COMPUTER GRAPHICS & GAME TECHNOLOGY, MSE

Interactive entertainment and computer-animated visual effects are now part of our mainstream culture. Creating such computer-generated imagery, however, is no trivial task. It requires a delicate blending of art with science by teams of highly skilled professionals, including artists, animators, writers, designers, engineers and software developers working long hours with cutting-edge technology and tools. Currently there are very few interdisciplinary academic programs at four-year research universities adequately preparing students for such positions. The Master of Science in Engineering in Computer Graphics and Game Technology (CGGT) was created specifically to address this need.

**For more information:** http://www.cis.upenn.edu/prospective-students/graduate/cggt.php

## Curriculum

A total of 10 course units are required for the MSE in Computer Graphics and Game Technology (CGGT).[1, 2]

| Code | Title | Course Units |
|---|---|---|
| **Core Areas** | | |
| *Creative Arts and Design* | | |
| FNAR 635 | | 1 |
| *Computer Science, Systems and Technology* | | |
| CIS 560 | Interactive Computer Graphics | 1 |
| CIS 562 | Computer Animation | 1 |
| CIS 660 | Advanced Topics in Computer Graphics and Animation | 1 |
| Select 1 required Math-based course. Recommendations include: | | 1 |
| CIS 519 | Applied Machine Learning | |
| CIS 520 | Machine Learning | |
| CIS 561 | Advanced Computer Graphics | |
| CIS 563 | Physically Based Animation | |
| CIS 581 | Computer Vision & Computational Photography | |
| CIS 580 | Machine Perception | |
| ENM 503 | Introduction to Probability and Statistics | |
| *Business and Entrepreneurship* | | |
| Select 1 Business and Entrepreneurship course. Recommendations include: | | 1 |
| EAS 545 | Engineering Entrepreneurship I | |
| IPD 515 | Product Design | |
| **Graphics Elective** [3] | | |
| Select 1 Graphics elective. Recommendations include: | | 1 |
| CIS 565 | GPU Programming and Architecture | |
| CIS 561 | Advanced Computer Graphics | |
| CIS 563 | Physically Based Animation | |
| FNAR 567 | Computer Animation | |
| FNAR 661 | Video I | |
| FNAR 665 | Cinema Production | |
| **Technical Elective** [4] | | |
| Select 1 Technical elective. Recommendations include: | | 1 |
| CIS 561 | Advanced Computer Graphics | |
| CIS 563 | Physically Based Animation | |
| CIS 581 | Computer Vision & Computational Photography | |
| CIS 580 | Machine Perception | |
| CIS 519 | Applied Machine Learning | |
| CIS 520 | Machine Learning | |
| ESE 505 | Feedback Control Design and Analysis | |
| ESE 619 | Model Predictive Control | |
| CIS 555 | Internet and Web Systems | |
| CIS 599 | Independent Study for Masters Students | |
| CIS 564 | Game Design and Development (only offered during the summer term) | |
| **Free Elective** [5,6] | | |
| Select 1 free elective. Recommendations include: | | 1 |
| EAS 546 | Engineering Entrepreneurship II | |
| FNAR 536 | | |
| FNAR 634 | | |
| OIDD 662 | Enabling Technologies | |
| **Design Project** | | |
| CIS 568 | Game Design Practicum | 1 |
| or CIS 597 | Master's Thesis Research | |
| Total Course Units | | 10 |

1. 10 course units are required; 9 course units in addition to a one semester design project over a one year period.
2. Students enrolled in the program from outside the University who have taken substantially similar coursework at their undergraduate institutions also can petition the program for approval of appropriate course substitutions. Granting of such approvals will be at the Program Director's discretion, and will be made on a case by case basis.
3. Must be graduate-level technical or creative course in the area of graphics or animation. Approval of the CGGT program director is required.
4. Any graduate level course in the School of Applied Science and Engineering (SEAS). Approval of the CGGT program director is required.
5. Any graduate level course at the University that relates in some way to graphics, animation and/or games. Approval of the CGGT program director is required.
6. Recommended choices include any of the Graphics Elective, Technical Elective or Business and Entrepreneurship courses.

## Additional Information

- CGGT Related Course Schedules and Descriptions (http://www.cis.upenn.edu/current-students/graduate/cggt/courses.php)
- Candidates with non CS backgrounds (http://www.cis.upenn.edu/current-students/graduate/cggt/non-cs.php)
- Submatriculants interested in CGGT (http://www.cis.upenn.edu/current-students/graduate/cggt/submatriculation.php)

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2020 and later. Students should

consult with their academic program regarding final certifications and requirements for graduation.

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