

**TEMPLATE 8-D**

Faculty of Science

CSCI 3090: Computer Graphics and Visualization

Course outline for Winter 2017

**1. Course Details & Important Dates\***

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| Term | Section | Course Type | Day | Time |
| W | A | Lecture | Tuesday | 11:10 am - 12:30 pm |
| W | A | Lecture | Thursday | 11:10 am - 12:30 pm |

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| Location | CRN # | Classes Start | Classes End | Final Exam Period |
| UA 1220 | 70126 | January 9, 2018 | April 5, 2018 | TBA |

\* for other important dates go to: [www.uoit.ca](http://www.uoit.ca) >Current Students >Important Dates

**2. Instructor Contact Information**

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| Instructor Name | Office | | Phone | Email |
| George Kougioumtzoglou | | UAB439, UAB440 |  | [george.kougioumtzoglou@uoit.ca](mailto:george.kougioumtzoglou@uoit.ca) |
| Office Hours: Tuesdays, 1:00 pm – 3:30 pm or by appointment | | | | |

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| Laboratory/Teaching Assistant Name | Office | Phone | Email |
| David Arppe, Michael Orr | TBA | TBA | [david.arppe@uoit.net](mailto:david.arppe@uoit.net), [michael.orr3@uoit.net](mailto:michael.orr3@uoit.net) |
| Office Hours: TBA | | | |

**3. Course Description**

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| This course is an introduction to Computer Graphics. The first objective of this course is to familiarize the students with the basic theory, practice and techniques of Computer Graphics as a background for the implementation of this knowledge on computer graphics programming. The main topics include graphics I/O devices characteristics, basic graphics architecture, pipeline, projections, rendering, shaders, 2D/3D Transformations, color, texturing and lighting. The course will also provide the students with the knowledge to use the OpenGL API in order to develop Computer Graphics applications. Prerequisites: CSCI 2010U, MATH 2050U. Credit restriction: ENGR 4860U. |

**4. Learning Outcomes**

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| On the successful completion of the course, students will be able to:   1. Recognize and implement the fundamental computer graphics theory, terms and concepts. 2. Explain the basics of graphics hardware and pipelines. 3. Understand and use the OpenGL Graphics Pipeline. 4. Develop Computer Graphics applications using OpenGL. 5. Identify and use software packages that assist with the production of graphics applications. 6. Apply Transformations, Texturing, Geometric modelling techniques and Lighting into graphical scenes. 7. Describe the theory underlying ray tracing techniques and implement a simple ray tracer to render a scene. 8. Understand and implement the visual representation of color. 9. Apply graphical techniques to the display of different types of data. 10. Explain the most important advances in graphics hardware, including GPU programming, and relate them to the most challenging problems in the discipline. |

**5. Course Design**

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| This course is delivered as a combination of lectures and laboratories. The concepts are covered in the lectures and illustrated in the laboratory exercises. |

**6. Outline of Topics in the Course**

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| 1. Computer Graphics Theory and Graphics Pipeline:    1. From model to pixels, overview of the basic process. 2. Introduction to Graphics Programming with OpenGL:    1. OpenGL Pipeline.    2. Libraries (GLEW, GLFW, GLM).    3. Vertex and Fragment Shaders.    4. Transformations.    5. Texturing.    6. Lighting.    7. Geometrical data. 3. Modeling:    1. Polygons, face and vertex tables, normal vectors.    2. Transformations, matrices, composition of transformations.    3. Homogeneous coordinates.    4. Implicit representations.    5. Parametric representations, piecewise representation, continuity.    6. Cubic curves, canonical form, blending functions.    7. Hermite, natural spline, Cardinal spline, Bezier curve.    8. Hierarchical modeling.    9. Subdivision algorithms. 4. Rendering:    1. Viewing transformations, projections.    2. Hidden surface, z-buffer, BSP trees.    3. Basic lighting, Phong Reflection Model.    4. Texture mapping, Mipmaps, texture mapping in OpenGL. 5. Ray Tracing:    1. Local and global illumination.    2. Basic ray tracing technique, reflection, refraction, shadows.    3. Intersection calculations, sphere, plane, polygons.    4. Performance, bounding volumes, grids.    5. Distributed ray tracing, sampling patterns, path tracing. 6. Graphics Hardware:    1. Video, sync, frame buffers, bandwidth issues.    2. 3D acceleration, path to fixed function pipeline.    3. GPU architecture. 7. Colour:    1. Human perception of colour.    2. Colour theory.    3. Colour spaces. 8. Advanced OpenGL programming:    1. Tessellation and Geometry Shaders.    2. Procedural textures.    3. GPGPU.    4. OpenGL versions. 9. Graphics Application Development:    1. Data file formats.    2. Interaction.    3. Case studies. |

**7. Required Texts/Readings**

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| Computer Graphics: Principles and Practice, 3rd Edition, John Hughes, Andries van Dam, Morgan McGuire, David Sklar, James Foley, Steven Feiner and Kurt Akeley, Addison-Wesley, 2013.  OpenGL Programming Guide, 9th Edition  OpenGL SuperBible, 7th Edition  *Additional readings may be assigned or recommended during the course.* |

**8. Evaluation Method**

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| Labs (10)  Assignments (3)  Mid-Term Examination  Final Examination | 20% (2% each)  25%  25%  30% |
| *Final course grades may be adjusted to conform to program or Faculty grade distribution profiles. Further information on grading can be found in Section 5 of the UOIT Academic Calendar.* | |

**9. Assignments and Tests**

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| Tentative assignment topics and due dates are:   1. Assignment 1 (5%), Due Date: February 15, 2018 2. Midterm Examination: February 27, 2018 3. Assignment 2 (10%), Due Date: March 8, 2018 4. Assignment 3 (10%), Due Date: April 6, 2018 5. Final Examination: TBA |

**10. Accessibility**

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| Students with disabilities may request to be considered for formal academic accommodation in accordance with the Ontario Human Rights Code. Students seeking accommodation must make their requests through the Centre for Students with Disabilities in a timely manner, and provide relevant and recent documentation to verify the effect of their disability and to allow the University to determine appropriate accommodations.  Accommodation decisions will be made in accordance with the Ontario Human Rights Code. Accommodations will be consistent with and supportive of the essential requirements of courses and programs, and provided in a way that respects the dignity of students with disabilities and encourages integration and equality of opportunity. Reasonable academic accommodation may require instructors to exercise creativity and flexibility in responding to the needs of students with disabilities while maintaining academic integrity. |

**11. Professional Conduct (if applicable)**

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**12. Academic Integrity**

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| Students and faculty at UOIT share an important responsibility to maintain the integrity of the teaching and learning relationship. This relationship is characterized by honesty, fairness and mutual respect for the aim and principles of the pursuit of education. Academic misconduct impedes the activities of the university community and is punishable by appropriate disciplinary action.  Students are expected to be familiar with UOIT’s regulations on Academic Conduct (Section 5.15 of the Academic Calendar) which sets out the kinds of actions that constitute academic misconduct, including plagiarism, copying or allowing one’s own work to copied, use of unauthorized aids in examinations and tests, submitting work prepared in collaboration with another student when such collaboration has not been authorized, and other academic offences. The regulations also describe the procedures for dealing with allegations, and the sanctions for any finding of academic misconduct, which can range from a written reprimand to permanent expulsion from the university. A lack of familiarity with UOIT’s regulations on academic conduct does not constitute a defense against its application.  Further information about academic misconduct can be found in the Academic Integrity link on your laptop. |

**13. Turnitin (if applicable)**

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| UOIT and faculty members reserve the right to use electronic means to detect and help prevent plagiarism. Students agree that by taking this course all assignments are subject to submission for textual similarity review by Turnitin.com. Assignments submitted to Turnitin.com will be included as source documents in Turnitin.com's restricted access database solely for the purpose of detecting plagiarism in such documents for five academic years. The instructor may require students to submit their assignments electronically to Turnitin.com or the instructor may submit questionable text on behalf of a student. The terms that apply to UOIT's use of the Turnitin.com service are described on the Turnitin.com website.  Students who do not wish to have their work submitted to Turnitin.com must inform their instructor at the time the work is assigned and provide with their assignment a signed Turnitin.com Assignment Cover sheet: <http://www.uoit.ca/assets/Academic~Integrity~Site/Forms/Assignment%20Cover%20sheet.pdf>  Further information about Turnitin can be found on the Academic Integrity link on your laptop. |

**14. Final Examinations (if applicable)**

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| Final examinations are held during the final examination period at the end of the semester and may take place in a different room and on a different day from the regularly scheduled class. Check the published Examination Schedule for a complete list of days and times.  Students are advised to obtain their Student ID Card well in advance of the examination period as they will not be able to write their examinations without it. Student ID cards can be obtained at the Campus ID Services, in G1004 in the Campus Recreation and Wellness Centre.  Students who are unable to write a final examination when scheduled due to religious publications may make arrangements to write a deferred examination. These students are required to submit a Request for Accommodation for Religious Obligations to the Faculty concerned as soon as possible and no later than three week prior to the first day of the final examination period.  Further information on final examinations can be found in Section 5.24 of the Academic Calendar. |

**15. Course Evaluations**

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| Student evaluation of teaching is a highly valued and helpful mechanism for monitoring the quality of UOIT’s programs and instructional effectiveness. To that end, course evaluations are administered by an external company in an online, anonymous process during the last few weeks of classes. Students are encouraged to participate actively in this process and will be notified of the dates. Notifications about course evaluations will be sent via e-mail, and posted on Blackboard, Weekly News and signage around the campus. |