**University of Asia Pacific (UAP)**

**Department of Computer Science and Engineering (CSE)**

**Course Outline**

**Program:** Computer Science and Engineering (CSE)

**Course Title:** Computer Graphics

**Course Code:** CSE 425

**Semester:** Spring-2020

**Level:**  8th Semester

**Credit Hour:** 3.0

**Name & Designation of Teacher:** Dr. Bilkis Jamal Ferdosi, Professor

**Office/Room:** 7th Floor, teacher’s compound

**Class Hours:** SECTION A: Tuesday: 11 AM – 12:20PM

Thursday: 11 AM – 12:20PM

SECTION B: Wednesday: 3:30PM – 4:50PM

Saturday: 3:30PM – 4:50PM

**Consultation Hours:** TBA

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**Mobile:** +8801760242388

**Rationale:** (a set of reasons or a logical basis for a course of action or a particular belief. )

This course is designed to provide fundamental concepts of vector and raster graphics and practices involved in Digital Device like Computer.

**Pre-requisite** (if any)**: Nill**

**Course Synopsis:** This course provides a comprehensive introduction to computer graphics. Focuses on fundamental concepts and techniques, and their cross-cutting relationship to multiple problem domains in graphics (rendering, animation, geometry, imaging). Topics include: Introduction to the basic concepts, 2-D and 3-D modeling and transformations, viewing transformations, projections, rendering techniques. Students will use a standard computer graphics API to reinforce concepts and study fundamental computer graphics algorithms.

**Course Objectives :** The objectives of this course are:

* To identify and explain the core concepts of computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.
* To apply graphics programming techniques to design, and create computer graphics scenes.
* To create effective OpenGL programs to solve graphics programming issues, including 3D transformation

**Course Outcomes (CO) and their mapping with Program outcomes (PO) and Teaching-Learning Assessment methods:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO**  **No.** | **CO Statements:**  Upon successful completion of the course, students will able to: | **Corresponding**  **POs**  **(Appendix-1)** | **Bloom’s taxonomy domain/level**  **(Appendix-2)** | **Delivery methods and activities** | **Assessment**  **Tools** |
| CO1 | **Understand** Computer Graphics (CG) Basics, CG Pipeline and fundamentals of CG algorithms | 1 | Cognitive/ Understand | Lecture, multimedia, |  |
| CO2 | **Describe** the concepts and techniques used in 3D computer graphics, including viewing transformations, hierarchical modeling, color, lighting and texture mapping. | 1 | Cognitive/  Understand | Lecture, multimedia |  |
| CO3 | **Apply** CG algorithms and techniques in Computer Animation | 1 | Cognitive/ Apply | Lecture, Discussion |  |
| CO4 | **Implement** interactive computer graphics using graphics API such as OpenGL | 3 | Cognitive/ Create | Problem Solving, Group discussion |  |

**Weighting COs with Assessment methods:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Assessment Type** | **% weight** | **CO1** | **CO2** | **CO3** | **CO4** |
| Final Exam | **50%** | 15 | 20 | 10 | 5 |
| Mid Term | **20%** | 5 | 10 | 5 |  |
| Class performance,  Assignments,  CTs | **30%** | 5 | 10 | 5 | 10 |
| **Total** | **100%** | 25 | 40 | 20 | 15 |

**Minimum attendance:** 70% class attendance is mandatory for a student in order to appear at the final examination.

**Grading System:** As per the approved grading scale of University of Asia Pacific (Appendix-3).

**Lecture Schedule (Tentative)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Weeks | Lecture # | Topics | **Course Outcome** | **Delivery methods and activities** | **Reading Materials** |
| 1 | 1 | Introduction, Motivation, Applications, History | CO1 | Lecture, multimedia | Slides,  Chapter 1 (Required References: 1 and 2) |
| 2 | Introduction to OpenGL  Description and Assignment of OpenGL Programming problem | CO4 | Lecture, multimedia, Discussion | Notes,  Required Reference: 3 |
| 2 | 3, 4 | Math preliminaries, Bezier Curves and Splines | CO1 | Lecture, Problem Solving | Slides,  Chapter 3 and 15 (Required Reference: 1)  Chapter 10 (Required Reference: 2) |
| 3 | 5, 6 | [Coordinates and Transformations](https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-837-computer-graphics-fall-2012/lecture-notes/MIT6_837F12_Lec03.pdf) | CO2 | Lecture, multimedia, Discussion Problem Solving | Slides  Chapter 6 (Required Reference: 1) and Chapter 3 (Required Reference: 2) |
| 4 | 7 | CT1 |  |  |  |
| 8 | View Transformation | CO2 | Lecture, multimedia, Discussion Problem Solving | Slides  Chapter 7 (Required Reference: 1) and Chapter 4 (Required Reference: 2) |
| 5 | 9,10 | 3D Object Representation and [Hierarchical Modeling](https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-837-computer-graphics-fall-2012/lecture-notes/MIT6_837F12_Lec04.pdf) | CO2 | Lecture, multimedia, Discussion Problem Solving | Slides  Chapter 8 (Required Reference: 2) |
| 6 | 11 | Color | CO2 | Lecture, multimedia, Discussion Problem Solving | Slides  Chapter 20 (Required Reference: 1) and Chapter 2 & 6(Required Reference: 2) |
| 12 | CT2 |  |  |  |
| 7 | 13, 14 | Clipping | CO2 | Lecture, multimedia, Discussion Problem Solving | Slides  Chapter 12 (Required Reference: 1) and Chapter 6 (Required Reference: 2) |
| Mid Term | | | | | |
| 8 | 15, 16 | Hidden Surface Removal and Collision Detection | CO2 | Lecture, multimedia, Discussion Problem Solving | Slides  Chapter 8 (Required Reference: 1) and Chapter 4 & 6(Required Reference: 2) |
| 9 | 17, 18 | Illumination and Shading | CO2 | Lecture, multimedia, Discussion Problem Solving | Slides  Chapter 9 (Required Reference: 1) and Chapter 5 (Required Reference: 2) |
| 10 | 19 | CT3 |  |  |  |
| 20 | [Texture Mapping and Shaders](https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-837-computer-graphics-fall-2012/lecture-notes/MIT6_837F12_Lec16.pdf) | CO2 | Lecture, multimedia, Discussion | Slides  Chapter 11 (Required Reference: 1) and Chapter 7 (Required Reference: 2) |
| 11 | 21, 22 | Graphics Pipeline and Rasterization (Scan Conversion) | CO1, CO2 | Lecture, multimedia, Discussion, Problem Solving | Slides  Chapter 3 (Required Reference: 1) and Chapter 6 (Required Reference: 2) |
| 12 | 23 | [Basics of Computer Animation](https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-837-computer-graphics-fall-2012/lecture-notes/MIT6_837F12_Lec06.pdf) | CO3 | Lecture, multimedia, Discussion | Slides  Chapter 16 (Required Reference: 1)  Chapter 8 (Required Reference: 2) |
| 24 | [Particle Systems and ODEs](https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-837-computer-graphics-fall-2012/lecture-notes/MIT6_837F12_Lec07.pdf) | CO3 | Lecture, multimedia, Discussion | Slides  Chapter 16 (Required Reference: 1)  Chapter 9 (Required Reference: 2) |
| 13 | 25 | CT4 |  |  |  |
| 25, 26 | Advanced Rendering: Ray Casting and Ray Tracing | CO2 | Lecture, multimedia, Discussion, | Slides  Chapter 11 (Required Reference: 2) |
| 14 | 27 | Presentation on Assignment by the Groups | CO4 | multimedia, Discussion, |  |
| 28 | Review |  |  |  |
| Final Exam | | | | | |

**Required References: 1.** Fundamentals of Computer Graphics by **Peter Shirley et al.**,

**2.** Interactive Computer Graphics: A Top-Down Approach Using OpenGL by **E. Angel and Dave Shreiner**

**3. OpenGL Red Book :** [**http://www.glprogramming.com/red/**](http://www.glprogramming.com/red/)

**Recommended References: 1.** Computer Graphics principles and practices by **Foley et al.**

**2.** Schaum's Outline of Computer Graphics by **Zhigang Xiang and Roy A. Plastock**

**Student’s responsibilities:** Students must come to the class prepared for the course material covered in the previous class (es). They must submit their assignments on time. No late or partial assignments will be acceptable. There will be no make-up quizzes.

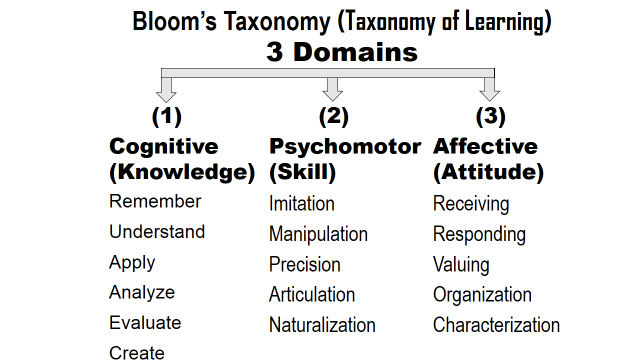
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| **Prepared by** | **Checked by** | **Approved by** |
| Course Teacher | Chairman, PSAC committee | Head of the Department |

**Appendix-1:**

**Washington Accord Program Outcomes (PO) for engineering programs:**

|  |  |  |
| --- | --- | --- |
| **No.** | **PO** | **Differentiating Characteristic** |
| 1 | Engineering Knowledge | Breadth and depth of education and type of knowledge, both theoretical and practical |
| 2 | Problem Analysis | Complexity of analysis |
| 3 | Design/ development of solutions | Breadth and uniqueness of engineering problems i.e. the extent to which problems are original and to which solutions have previously been identified or codified |
| 4 | Investigation | Breadth and depth of investigation and experimentation |
| 5 | Modern Tool Usage | Level of understanding of the appropriateness of the tool |
| 6 | The Engineer and Society | Level of knowledge and responsibility |
| 7 | Environment and Sustainability | Type of solutions. |
| 8 | Ethics | Understanding and level of practice |
| 9 | Individual and Team work | Role in and diversity of team |
| 10 | Communication | Level of communication according to type of activities performed |
| 11 | Project Management and Finance | Level of management required  for differing types of activity |
| 12 | Lifelong learning | Preparation for and depth of Continuing learning. |

**Appendix-2**



**Appendix-3: Grading Policy**

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| --- | --- | --- |
| **Numeric Grade** | **Letter Grade** | **Grade Point** |
|  |  |  |
| 80% and above | A+ | 4.00 |
| 75% to less than 80% | A | 3.75 |
| 70% to less than 75% | A- | 3.50 |
| 65% to less than 70% | B+ | 3.25 |
| 60% to less than 65% | B | 3.00 |
| 55% to less than 60% | B- | 2.75 |
| 50% to less than 55% | C+ | 2.50 |
| 45% to less than 50% | C | 2.25 |
| 40% to less than 45% | D | 2.00 |
| Less than 40% | F | 0.00 |