**University of Asia Pacific (UAP)**

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

**Course Outline**

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

**Course Title:** Computer Graphics Lab

**Course Code:** CSE 426

**Semester:** Spring 2021

**Level:** 8th Semester (4th Year, 2nd Semester)

**Credit Hour:** 1.5

**Name & Designation of Teacher:** S M Rafiuddin Rifat, Lecturer

**Office/Room:** 7th Floor, Teachers’ Area

**Class Hours: Section A1:**

**Thursday: 02:00PM – 04:45PM**

**Section A2:**

**Wednesday: 09:30AM - 12:20PM**

**Section B1:**

**Wednesday: 02:00PM – 04:45PM**

**Section B2:**

**Thursday: 9:30AM - 12:20PM**

**Consultation Hours: Section A1:**

**Thursday: 05:00PM – 06:15PM**

**Section A2:**

**Wednesday: 12:30PM - 01:45PM**

**Section B1:**

**Wednesday: 05:00PM – 06:15PM**

**Section B2:**

**Thursday: 12:30AM - 01:45PM**

**E-mail:** rifat.cse@uap-bd.edu

**Mobile:** +8801737775379

**Rationale:** The goal of this course is to provide an introduction of the application to the theory and practice of computer graphics. The course will assume a good background in programming in C or C++ and a background in mathematics including familiarity with the theory and use of coordinate geometry and of linear algebra.

**Pre-requisite** (if any)**:** Students are expected to complete the following courses**—**

MTH 205 (Math IV), CSE 103 (Discrete Mathematics)

**Course Synopsis:** Standard Graphics Primitives, Graphical User Interface; Graphics Hardware: Display devices, Raster refresh graphics display Use of frame buffer and look up table. Coordinate convention: Device coordinate and wild coordinate system. Raster Scan Graphics: Mid-point Line and Circle Creation Algorithms, Animalizing. Polygons: Difference type of polygons, Point location, polygon filling, triangulation Windowing and Clipping, Window Viewpoint, Zooming, panning, line text and polygon, clipping. Transformation: Homogeneous coordination, Transformation matrices, Transformation in 2D, Translation, rotation, sealing, Transformation in 3D translation, rotation, scaling. Projection: Parallel and perspective, isometric projection. Three-dimensional Viewing and representation: Curves, surfaces and volumes with cubic and bi cubic spines, B-Reb, CSG, Spatial Occupancy Representations. Hidden Lines and Surface removal: Painter's algorithm, Z-Buffering. Rendering: Light Models, Shading Interpolation Technique constant, Ground and Phong, Ray Tracing. Image File Format: PPM file, BMP file. Introduction to Graphics Programming: The nature of computer animation, simulation, kinematics, barometries, dynamics, and meta-morphosis.

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

1. **Provide** knowledge and understanding on principles of Computer Graphics.
2. **Introduce** the concept of different types of transformation and projection.
3. **Emphasize** the design and implement of different types computer graphics and animation techniques to simulate the real world.

**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 should be able to— | **Corresponding**  **POs**  **(Appendix-1)** | **Bloom’s taxonomy domain/level**  **(Appendix-2)** | **Delivery methods and activities** | **Assessment**  **Tools** |
| CO 1 | **Understand** the objectives, terminology associated with Computer Graphics. | 1 | Cognitive / Understand | Lecture, Group discussion | Quiz |
| CO 2 | **Apply** the techniques and algorithms of Computer Graphics and Data Visualization. | 2, 5 | Cognitive / Apply | Problem Solving | Quiz, Lab Test |
| CO 3 | **Design** the methodologies of Computer Graphics on data visualization of various geometric objects of both 2D and 3D objects. | 3, 9, 10 | Cognitive / Analyze | Project | Assignment |

**Weighting COs with Assessment methods:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Assessment Type** | **% weight** | **CO1** | **CO2** | **CO3** |
| Assessment | **50%** |  |  |  |
| Project | **50%** |  |  |  |
|  |  |  |  |  |
| **Total** | **100%** |  |  |  |

**Grading Policy:** As per the approved grading policy of UAP (Appendix-3)

**Course Content Outline and mapping with COs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Lecture** | **Topic** | **Course Outcome** | **Delivery methods and activities** | **Reading assignment** |
| Lecture 1 | OpenGL basic syntax and environment setup.  Points, line, triangle, quads, polygon drawing using OpenGL. | CO1 | Lecture, Group discussion | An introduction to Graphics Programming in OpenGL, Chapter 2, 3 |
| Lecture 2 | Translation, scaling and rotation of 2D objects in OpenGL.  Complex shape changing of 2D objects using OpenGL. | CO1, CO2 | Lecture, Problem Solving | An introduction to Graphics Programming in OpenGL, Chapter 4, 5 |
| Lecture 3 | Create groups of 2 members and assign Projects.  Introduction to Unity Game Engine. Hand on experience in Unity. | CO1, CO2 | Lecture, Problem Solving | Web Content |
| Lecture 4 | Unity Programming Introduction in C#.  Problem Assignment: Syntax and Basic C# programming in Unity. | CO1, CO3 | Lecture, Problem Solving | Web Content |
| Lecture 5 | Movement and Camera flow in Unity.  Problem Assignment: Viewing Objects from different aspects and position and camera view. | CO3 | Lecture, Problem Solving | Web Content |
| Lecture 6 | Collision Simulation in Unity.  Problem Assignment: Collision simulation between two objects. | CO2, CO3 | Lecture, Problem Solving | Web Content |
| Mid Term Examination | | | | |
| Lecture 7 | Animations in Unity.  Problem assignment: Apply the projection technique in animations. | CO3, CO4 | Lecture, Problem Solving | Web Content |
| Lecture 8 | Simulations in Unity.  Problem Assignment: Using Physics feature and apply it in simulation. | CO3, CO4 | Lecture, Problem Solving | Web Content |
| Lecture 9 | Movement of objects.  Problem Assignment: Apply Movement is a game idea. | CO3, CO4 | Lecture, Problem Solving | Web Content |
| Lecture 10 | Game UI.  Updates on Game development project. | CO3, CO4 | Lecture, Problem Solving | Web Content |
| Lecture 11 | Console Design.  Problem assignment: Game controls. | CO3, CO4 | Lecture, Problem Solving | Web Content |
| Lecture 12 | Data Visualization in Python using Matplotlib.  Project Submission. | CO4, CO 5 | Lecture, Problem Solving | Web Content |
| Final Examination | | | | |

**Required References:** An introduction to Graphics Programming in OpenGL, Toby Howard

**Special Instructions:**

* Minimum Required Attendance is 70%
* No make-up for quizzes and mid-term exam
* Plagiarism policy: zero tolerance in case of plagiarism

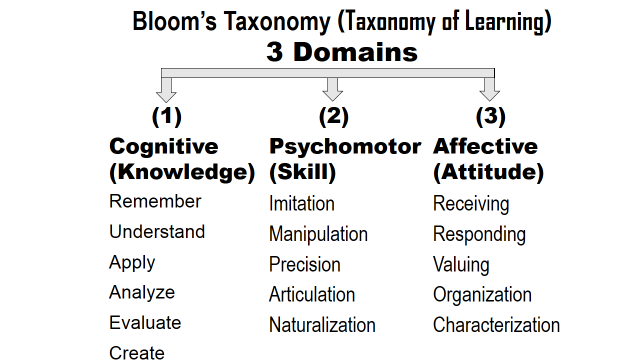
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| **Prepared by** | **Checked by** | **Approved by** |
| S M Rafiuddin Rifat  (Course Teacher) | Chairman, PSAC committee | Head of the Department |

**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**

**UAP Grading Policy:**

|  |  |  |
| --- | --- | --- |
| **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 |
|  |  |  |