20	Comparative study	1	Slide 7	Difference between Copyrights, Patent & Trade Secret
21	Patent Application	1	Slide 7	Procedure for filing an application in Bangladesh
22	The U.S. Patent System	1	Slide 8	The Constitution, Congress, Patent Office (PTO), courts, Analyzing and understanding judicial opinions
23	Types of Patent	1	3	Design Patent, Plant Patent & Utility Patent
24	Patent Licensing	1	3	Actions for Patent rules violations
25	Review Class			
26	Review Class			

Reading Reference:

1. Create or Perish: The Case for Inventions and Patents - Robert HRines
2. Engineering Ethics – Carles E Haris
3. System Safety Engineering and Management - Harold E. Roland , Brian Moriarty

Assessment Methods:

Category	**Marks %**
Class Participation/ Observation	5
Class Attendance	5
Quizzes/class tests	15
Assignment	5
Final Examination (3 hours)	70
Total	**100**

Elective 2

Course Title: Computer Graphics
Course Code: CSE 413, Credit: 3.0, Total hours: 42

Course Description:

1. Study of Standard graphics primitives; Graphics hardware; Graphics pipeline; Coordinate convention;

2. Modeling transformation; Viewing transformation; Projection transformation;
3. Scan conversion; Polygons and polygon meshes; Curves and surfaces; Hidden lines and surface removal;
4. Fractals; Ray tracing; Light models; Color models; Graphics programming.

Course Outcome (CO) Matrix:

At the end of the course, the students should be able to:

		Level of Domain				PO
		C	P	A	S	
CO 1	**Explain** the underlying principles of different graphical transformations.	C2				PO1
CO 2	**Identify** the necessary steps of rasterization pipeline.	C2			CT	PO1
CO 3	**Compare** and **select** suitable modeling algorithms based on their advantage and disadvantages.	C3			CT	PO2
CO 4	**Propose** and **justify** different approaches for designing graphical models.			A3		PO9

C: Cognitive; P: Psychomotor; A: Affective; S: Soft-skills (CT: Critical Thinking, TW: Teamwork)

Mapping of CO and Program Outcomes:

COs	Program Outcomes (POs) (Appendix 1) S = Strong, M = Medium and W = Weak											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	S											
CO3	S											
CO4			M									

Lecture Outline:

Class	Topics/Assignment	COs	Reading Reference	Lecture Outcomes/ Activities
1	Introduction to computer graphics and rasterization pipeline	1	1	Recognize basic steps of rasterzation pipeline
2	Basic concepts of vector operations for computer graphics	1	2	Describe vector operations needed for computer graphics
3	Representation of Lines and Planes	1	2	Convert one representation to another
4	Intersection derivation of lines and planes	1	2	Solve problems to derive line and plane intersection
5	Transformation and homogenous co-ordinates	1,2	1,3	Identify modeling transformation.

6	Translation and scaling	1	1,3	Explain and solve translation and scaling problems
7	**Review**			Lecture 1 - 6
8	Class Test 1			Lecture 1 - 6
9	Rotation, Shear and Mirror reflection	1	1,3	Explain and solve rotation, shear and mirror reflection problems
10	Construction of composite transformations	1	1, 3	Construct composite transformation from simple ones
11	Vector alignment and Rodrigues formula	1	1	Solve alignment problems
12	Problem Solving			Lecture 9 – 11
13	Taxonomy of projection transformation.	1,2	1	Recognize different types of projection transformation
14	Perspective projection	1,2	1, 3	Identify and explain perspective projection models
15	Parallel projection	1,2	1, 3	Identify and explain parallel projection models
16	Viewing transformation	1,2	1	Construct viewing transformation matrices
17	Problem Solving			Lecture 13 – 16
18	Review			Lecture 9 – 16
19	Class Test 2			Lecture 9 – 16
20	Hidden surface removal algorithms: back face culling, painter's algorithm, z-buffer	1,3	1	Compare and apply algorithms for different sceneriosCompare and apply algorithms for different scenarios
21	Scan-line algorithm, BSP tree, depth-sort algorithm	3	1	Compare and apply algorithms for different scenarios
22	Problem Solving			Lecture 20 – 21
23	Clipping: Cohen-Sutherland algorithm	3	1	Explain the algorithm
24	Cyrus-Beck and Sutherland-Hodgman algorithm	3	1	Explain and compare with previous algorithms
25	Anti-aliasing	1	1	Recognize the process of anti-aliasing
26	Problem Solving			Lecture 23 – 25
27	Review			Lecture 20 – 25
28	Class Test 3			Lecture 20 – 25
29	Principles of ray-tracing	1	1	Describe the basic principles

30	Ray-plane and ray-sphere intersection	1	1	Identify and solve intersection problems
31	Illumination	1,3	1	Explain and compare different illumination models
32	**Shading**	1,3	1	Explain and compare different shading models
33	Curve and textures	1	1	Describe different curves and texture
34	Fractals	1	1	Recognize and construct complex fractals from simple ones
35	Project Assignment and Presentation	4		
36	Introduction to scan conversion	1	1	Recognize simple scan conversion algorithms
37	Midpoint line algorithm	3	1	Solve line scan conversion problems
38	Midpoint circle algorithm	3	1	Solve circle scan conversion problems
39	Problem Solving			Lecture 29 – 34 and Lecturer 36 – 38
40	Review			Lecture 29 – 34 and Lecturer 36 – 38
41	Class Test			Lecture 29 – 34 and Lecturer 36 – 38
42	Review Class, Problem Solutions and Suggestion			Lecture 1 – 41

Reading Reference:

1. Computer Graphics Principle and Practice -- James D Foley, Van Dam
2. Computer Graphics Using Open GL – F S Hill J R
3. Schaum's Computer Graphics - Zhigang Xiang, Roy Plastock

Assessment Methods:

Category	**Marks %**
Class Participation/ Observation	5
Class Attendance	5
Quizzes/class tests	15
Assignment	5
Final Examination (3 hours)	70
Total	**100**