Bangladesh University of Business and Technology (BUBT)
Faculty of Engineering& Applied Sciences (FEAS)
Department of Computer Science and Engineering (CSE)

LAB COURSE OUTLINE

1	**Program**	B.Sc. Engg. in CSE
2	**Course Code**	CSE 342
3	**Course Title**	Computer Graphics Lab
4	**Course Type**	Core Course
5	**Academic Session**	Fall 20-21
6	**Credit Hour**	0.75
7	**Intake**	39
8	**Section**	1
9	**Campus**	Permanent Campus
10	**Course Teacher**	**Name:** Sudipto Chaki **Designation**: Lecturer **Specialization**: Artificial Intelligence, Machine Learning, Image processing, Deep Learning, IoT, Software Engineering **Room No. 502/B3** **Email:** sudipto@bubt.edu.bd **Cell No**. 01750742782
11	**Class Schedule**	<table><tr><th>Class Day</th><th>Class Hours</th><th>Class Room</th></tr><tr><td>Thursday</td><td>1:20 PM – 2.50 PM</td><td>418 (B-2)</td></tr></table>
12	**Course Objectives**	This lab course is based on CSE 341, Computer Graphics theory course. This lab course focus on core concept of computer graphics, computer based graphical representation and basic algorithm implementation. In this course student will learn the use of coordinate geometry and linear algebra such as matrix multiplication. Students will able to use the standards based OpenGL or other graphics library in several programming projects illustrating the theory and practice of programming computer graphics applications.
13	**Text Book**	1. Computer Graphics (Schaum's Series) - Roy Plastock
14	**Reference Book**	1. Computer Graphics Using OpenGL - F.S. Hill 2.Computer Graphics Principles and Practice – James D. Foley
15	**Course Outcomes (COs)**	Upon completing this course students will be able to: CO1: **Demonstrate** basic geometric shapes such as point, line, circle, ellipse using various drawing algorithms using OpenGL. CO2: **Design** objects with the help of 2D and 3D transformations using basic OpenGL. CO3: **Implement** composite graphic objects as small scale project by using the idea of projection, illumination, clipping and basic algorithms of line and circle drawing using various Graphics Libraries.

				Mapping of COs to POs										

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√							
CO2			√									
CO3									√			

CO No.	PO No.	Bloom's Domain / Level	Delivery Methods / Activities	Assessment Tools
CO1	PO5	Cognitive / Understanding	Lectures, Lab Task, Assignment.	Lab Performance
CO2	PO3	Cognitive / Applying	Lectures, Lab Task, Assignment.	Lab Performance
CO3	PO9	Psychomotor / Guided Response	Lectures ,Lab Task, Assignment.	Project

16	Teaching Strategy	Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some class notes will be uploaded on the web. White board will be used for most of the time. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.

17	Assessment and Marks Distribution:	Class Attendance	:	10%
		Assignment	:	20%
		Lab Performance	:	30%
		Final Project	:	40%

18	Week	Lab	Topics	Outcome
	Week1	Lab 1	Introduction and **installation** of OpenGL.	
	Week2	Lab 2	Implement DDA line drawing algorithm in C/C++.	
	Week3	Lab 3	Implementation of Mid-Point circle drawing algorithm in C/C++. **Lab Performance Evaluation**	CO1
	Week4	Lab 4	Draw basic shapes e.g. line, rectangle, triangle etc. using OpenGL.	
	Week5	Lab 5	Designing an object with basic geometric 2D shapes. **Lab Performance Evaluation**	CO2
	Week6	Lab 6	Geometric transformation of basic shapes such as rotation, translation, scaling in OpenGL.	
	Week7		**Mid Term Week**	
	Week8	Lab 7	Modeling 2D transformation with keyboard and mouse to control movement of objects. **Lab Performance Evaluation**	CO2

Week9	**Lab 8**	Introduction to 3D shapes drawing in OpenGL.	
Week10	**Lab 9**	Modeling 3D transformation with keyboard and mouse to control movement of objects. **Lab Performance Evaluation**	**CO2**
Week11	**Lab 10**	Assignment on drawing 3D cube and pyramid shapes. **Lab Performance Evaluation**	**CO1**
Week12	**Lab 11**	Introduction to projection, texturing and shading.	
Week13	**Lab 12**	Assignment on projection and shading in designing interior view of a room. **Lab Performance Evaluation**	**CO3**
Week14	**Lab 13**	Discussion about problems and possible overview about project	
Week15		**Project Presentation and Evaluation**	**CO3**

19	**Overall CO Assessment Criteria**	Assessment methods of COs are given below:

Assessment Area	Course Outcomes CO			Assessment Area Mark
	CO1	**CO2**	**CO3**	
Attendance				
Lab Assignment				
Lab Performance	15	15		30
Project Evaluation			40	40
Total Mark	**15**	**15**	**40**	**70**

20	**Lab Performance Assessment Details**	**Lab#**	**Criteria**	**COs**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Unsatisfactory (0-2)**
					Student demonstrates an accurate understanding of the lab objectives and concepts. The student can correctly answer questions and if appropriate, can explain concepts to the course teacher.	Student arrives on time to lab, but may be unprepared. Answers to questions are basic and superficial suggesting that concepts are not	Student tardiness or Unpreparedness makes it impossible to fully anticipate. If able to participate, student has	Student was absent from lab or did not participate. There was no attempt make prior arrangements make up the lab.

								fully grasped.	difficulty explaining key lab concepts.		
		L3	Implementation of Mid-Point circle drawing algorithm in C/C++.	CO1	,,			,,	,,	,,	
		L5	Designing an object with basic geometric 2D shapes.	CO2	,,			,,	,,	,,	
		L7	Modeling 2D transformation with keyboard and mouse to control movement of objects.	CO2	,,			,,	,,	,,	
		L9	Modeling 3D transformation with keyboard and mouse to control movement of objects.	CO2	,,			,,	,,	,,	
		L10	Assignment on drawing cube and sphere.	CO1	,,			,,	,,	,,	
		L12	Assignment on projection and shading in designing interior view of a room.	CO3	,,			,,	,,	,,	

		Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Inadequate (0-2)	Marks	
21	**Lab Project Assessment Details**	Project Demonstration	Student demonstrates the implementation and simulation of the project completely	Student can demonstrate some main parts of the implementation and simulation of the project	Student can explain the implementation and simulation of the project obscurely	Students were either absent or know nothing about the project	5	
		Usage of 2D & 3D transformation	Student uses 2D & 3D transformation appropriately	Student uses 2D & 3D transformation without knowing appropriately	Student has very few understanding of 2D & 3D transformation	Student has no concept of 2D & 3D transformation or they do not use any	10	
		Usage of projection,	Student successfully use	Student use projection,	Student implement the	Student does not use	10	

illumination & texturing	projection, illumination & texturing	illumination & texturing with some minor problems in the Project	project with some missing of projection, illumination & texturing	any projection, illumination & texturing operation to implement the project	
Project Report	Student has the complete understanding of the project and the report. The report is appropriate formatted and no portion of the content is copied.	Student has a basic knowledge of content, but lacks some understanding of some concepts. The report is appropriate formatted with some irregularities although no portion of the content is copied	Student has lack of knowledge about project and the report. The report is not formatted at all and the content of the report is inappropriate.	Student either did not submit the report or the report is copied and totally inappropriate	10
Presentation	Student present his Project presentation perfectly	Student seems unprepared in the presentation but can share his knowledge thoroughly	Student expresses his lack of knowledge in the presentation	Student is absent or the cannot deliver presentation	5

22	**Grading Policy**	The following chart will be followed for grading. This has been customized from the guideline provided by the School of Engineering and Computer Science.

A+	A	A-	B+	B	B-	C+	C	D	F
≥ 80	75-<80	70-<75	65-<70	60-<65	55-<60	50-<55	45-<50	40-<45	<40

23	**Additional Course Policies**	**Assignments**	There will be at least two assignments. Average marks of the assignments will be counted. No late homework will be accepted. *Any kind of copy/manipulation in assignment will carry zero mark.* Two or more copied assignments will carry zero mark in all assignments. **Zero tolerance will be shown in this regard.** Solutions to assignment problems will be provided through web and on hand.
		Lab Performance	There will be at least six lab performance evaluations. These will be taken as per the weekly schedule. During evaluation, following instructions will be strictly maintained: 1. Every student is expected to be regular in Lab classes. 2. Do NOT copy lines of code from anybody else. 3. Do NOT ask to see another student's code. 4. Do NOT pass code or program to other members of the class 5. If the instructor is at all uncomfortable about the originality of student's work, no mark will be given. 6. There will be no make-up evaluation of lab performance (except, at the discretion of the instructor, in the case of documented medical or family emergencies).
		Project	**Introduction** In this course CSE - 342, you will implementing composite graphic objects as small scale project by using the idea of transformation, projection, illumination, clipping and basic algorithms of line and circle drawing using various Graphics Libraries.

25			**Instructions** Your project must contains basic features of transformation, projection and illumination. You can propose your project proposal but that must be up to the standard. Focus on real life problems while finalizing your proposal. **Problem Definition** Your project report must contains: Specify you project scenario How you implement this overall project with detail explanation Mention the features which you use to run the project You need to use minimum features which is already implemented in lab **Design and Implementation** Describe how you doing overall design Mention and describe the functions which you use to run the overall project **GUI Framework** You can use openGL for implementing your project Make sure your graphical User Interface(GUI) does not reflect that you did not put that much effort in your project!! **Team Work** A group can be formed with maximum three members Every member of a group should have equal contribution to the project (N.B. They will be asked about their individual role) **Project Submission** Remember to properly indent your code and add comments as required before submitting your full project source code. You also have to submit your Project report, Project presentation Slide along with your project source code. Note: By following the above points, you will be meeting the basic requirements. Make sure the Project report reflects also good word-processing skills (headers/footers/page numbering, etc.) as marks will be rewarded for that as well in your report.
24	**Additional Information**	a. b. c. d.	Academic Calendar Spring 2021: http://www.bubt.edu.bd/academics/academic-calendar. Academic Policies: http://www.bubt.edu.bd/academics/academic-rules-a-regulations. Grading & Evaluation: http://www.bubt.edu.bd/academics/academic-rules-a-regulations. Proctorial Rules: http://www.bubt.edu.bd/administrator/proctors-office.
25		**Bloom's Taxonomy for Teaching-Learning**	

Bloom's Taxonomy for Teaching-Learning
Bloom's Taxonomy is a set of three hierarchical models used to classify educational learning objectives into levels of complexity and specificity. The three lists cover the learning objectives in Cognitive, Affective and Psychomotor domains.

The Cognitive domain list has been the primary focus of most education and is frequently used to structure curriculum learning objectives, assessments and activities. The three domains and respective levels are illustrated below.

Cognitive [C] (Knowledge-based)	Affective [A] (Emotion-based)	Psychomotor [P] (Action-based)
1. Remembering	1. Receiving	1. Perception
2. Understanding	2. Responding	2. Set
3. Applying	3. Valuing	3. Guided Response
4. Analyzing	4. Organizing	4. Mechanism
5. Evaluating	5. Characterizing	5. Complex Overt Response
6. Creating		6. Adaptation
-		7. Origination

26 **Descriptions of Cognitive Domain (AndersonandKrathwohl'sTaxonomy2001):**
The **cognitive domain** involves the development of our mental skills and the acquisition of knowledge.

Level	Category	Meaning	Keywords
C1	Remembering	Recognizing or recalling knowledge from memory. Remembering is when memory is used to produce or retrieve definitions, facts, or lists, or to recite previously learned information.	Define, describe, draw, find, identify, label, list, match, name, quote, recall, recite, tell, write
C2	Understanding	Constructing meaning from different types of functions be they written or graphic messages or activities like interpreting, exemplifying, classifying, summarizing, inferring, comparing, or explaining.	Classify, compare, exemplify, conclude, demonstrate, discuss, explain, identify, illustrate, interpret, paraphrase, predict, report
C3	Applying	Carrying out or using a procedure through executing, or implementing. Applying relates to or refers to situations where learned material is used through products like models, presentations, interviews or simulations.	Apply,change,choose,compute,dramatize,implement,interview,prepare, produce, role play, select, show, transfer, use
C4	Analyzing	Breaking materials or concepts into parts, determining how the parts relate to one another or how they interrelate, or how the parts relate to an overall structure or purpose. Mental actions included in this function are differentiating, organizing, and attributing, as well as being able to distinguish between the components or parts. When one is analyzing, he/she can illustrate this mental function by creating spreadsheets, surveys, charts, or diagrams, or graphic representations.	Analyze,characterize,classify,compare,contrast,debate,deconstruct,deduce,differentiate, discriminate, distinguish, examine, organize, outline, relate, research, separate, structure
C5	Evaluating	Making judgments based on criteria and standards through checking and critiquing. Critiques, recommendations, and reports are some of the products that can be created to demonstrate the processes of evaluation.	Appraise, argue, assess, choose, conclude, critique, decide, evaluate, judge, justify, predict, prioritize, prove, rank, rate, select, Monitor
C6	Creating	Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing. Creating requires users to put parts together in a new way, or synthesize parts into something new and different creating a new form or product. This process is the most difficult mental function.	Construct, design, develop, generate, hypothesize ,invent, plan, produce, compose, create, make, perform, plan, produce

27 **Descriptions of Affective Domain (Krathwohl, Bloom, Masia, 1973)**
The affective domain includes the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes.

Level	Category	Meaning	Keywords

		Level	Category	Meaning	Keywords	
		A1	Receiving	Awareness, willingness to hear, selected attention.	acknowledge, asks, attentive, courteous, dutiful, follows, gives, listens, understands	
		A2	Responding	Active participation on the part of the learners. Attend and react to a particular phenomenon. Learning outcomes may emphasize compliance in responding, willingness to respond, or satisfaction in responding (motivation).	answers, assists, aids, complies, conforms, discusses, greets, helps, labels, performs, presents, tells	
		A3	Valuing	The worth or value a person attaches to a particular object, phenomenon, or behavior. This ranges from simple acceptance to the more complex state of commitment. Valuing is based on the internalization of a set of specified values, while clues to these values are expressed in the learner's overt behavior and are often identifiable.	appreciates, cherish, treasure, demonstrates, initiates, invites, joins, justifies, proposes, respect, shares	
		A4	Organizing	Organizes values into priorities by contrasting different values, resolving conflicts between them, and creating an unique value system. The emphasis is on comparing, relating, and synthesizing values.	compares, relates, synthesizes	
		A5	Characterizing	Has a value system that controls their behavior. The behavior is pervasive, consistent, predictable, and most important characteristic of the learner. Instructional objectives are concerned with the student's general patterns of adjustment (personal, social, emotional).	acts, discriminates, displays, influences, modifies, performs, qualifies, questions, revises, serves, solves, verifies	

Descriptions of Psychomotor Domain (Simpson, 1972)

28 | **The psychomotor domain** includes physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution.

		Level	Category	Meaning	Keywords	
		P1	Perception	The ability to use sensory cues to guide motor activity. This ranges from sensory stimulation, through cue selection, to translation.	chooses, describes, detects, differentiates, distinguishes, identifies, isolates, relates, selects.	
		P2	Set	Readiness to act. It includes mental, physical, and emotional sets. These three sets are dispositions that predetermine a person's response to different situations (sometimes called mindsets).	begins, displays, explains, moves, proceeds, reacts, shows, states, volunteers.	
		P3	Guided Response	The early stages in learning a complex skill that includes imitation and trial and error. Adequacy of performance is achieved by practicing.	copies, traces, follows, react, reproduce, responds	
		P4	Mechanism	This is the intermediate stage in learning a complex skill. Learned responses have become habitual and the movements can be performed with some confidence and proficiency.	assembles, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches.	
		P5	Complex overt Response	The skillful performance of motor acts that involve complex movement patterns. Proficiency is indicated by a quick, accurate, and highly coordinated performance, requiring a minimum of energy. This category includes performing without hesitation, and automatic performance.	assembles, builds, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches.	
		P6	Adaptation	Skills are well developed and the individual can modify movement patterns to fit special requirements.	adapts, alters, changes, rearranges, reorganizes, revises, varies.	
		P7	Origination	Creating new movement patterns to fit a particular situation or specific problem. Learning outcomes emphasize creativity based upon highly developed skills.	arranges, builds, combines, composes, constructs, creates, designs, initiate, makes, originates.	

29	**Graduate Attributes (Program Outcomes) for B.Sc. in Engineering Program based on Washington Accord**

Program Outcomes (POs) are narrower statements that describe what students are expected to know and be able to do by the

Time of graduation. These relate to the knowledge skills and attitudes that students acquire while progressing through the program. The students of the B.Sc. in CSE program are expected to achieve the following graduate attributes or program outcomes at the time of graduation.

PO1–Engineering knowledge (Cognitive): Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2–Problem analysis (Cognitive): Identify, formulate, research the literature and analyze complex engineering problems and reach substantiated conclusions using first principles of mathematics, the natural sciences and the engineering sciences.

PO3–Design/development of solutions (Cognitive, Affective): Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.

PO4–Investigation (Cognitive, Psychomotor): Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.

PO5–Modern tool usage (Psychomotor, Cognitive): Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6–The engineer and society (Affective): Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO7–Environment and sustainability (Affective, Cognitive): Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.

PO8–Ethics (Affective): Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice.

PO9–Individual work and teamwork (Psychomotor, Affective): Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.

PO10–Communication (Psychomotor, Affective): Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.

PO11–Project management and finance (Cognitive, Psychomotor): Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multidisciplinary environments.

PO12–Life-long learning (Affective, Psychomotor): Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

30	**Social & Moral Capital**

Our promises are based on the three cardinal principles:
  (a) What we do believe (b) What we do practice, and (c) What we will promote

However, students are advised to undertake the following commitments for moral development.

1. To be punctual and attentive in class 2. To maintain inclusive learning environment 3. To ensure mutual respect 4. To be cooperative in group learning. 5. To be innovative and Creative 6. To follow dress code and wearing ID card 7. To be always proactive	8. Try to follow and review day to day class 9. To avoid conspiracy 10. To prioritize honesty & faith 11. To be motivated for asking question and encourage feedback 12. To develop attitude for speaking in English 13. Do not ignore to carry out any assignments or commitments 14. To be clean and decent in all levels.	15. To be sincere for class preparation 16. Do not forget to switch-off the cell phone in class 17. Do not forget to carry course pack and learning stuffs in class 18. To maintain loyalty and trust to the university 19. Must avoid unfair means and plagiarism in exam, reports and assignments 20. Must maintain eco-friendly environment in the campus.