University of the Philippines Baguio
College of Science
Department of Mathematics and Computer Science

COURSE SYLLABUS

CMSC 161
Interactive Computer Graphics

Department of Mathematics and Computer Science
COLLEGE OF SCIENCE
UNIVERSITY OF THE PHILIPPINES BAGUIO
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A. COURSE DETAILS

Course Number:	CMSC 161	
Course Name:	Interactive Computer Graphics	
Course Description:	Graphics systems software & hardware, 2D drawing algorithms, geometrical transformations, surface modeling, 3D viewing, visible surface determination algorithms, illumination & reflection models, shading models for polygons, color theory, ray tracing. Students write their 3D-rendering engine.	
Credit Units:	3 u (2 h lec, 3 h lab)	
Prerequisite:	CMSC 116; or Math 113, Math 122 and Math 182; or Physics 121, Physics 122 and Physics 131.	
Requirements:	Seatwork, Assignments, Quizzes, Machine Exercises, etc	xx%
	Projects	xx%
	Long Exams	xx%
	Finals	xx%
	Total	100%
Passing Grade:	60%	

B. PROGRAM LEARNING OUTCOMES (PLO)

Upon completion of the BS Computer Science program, the students are able to:

PLO 1 Embody professional, social, and ethical responsibilities as an active and participative citizen while developing social and professional skills to build healthy and productive working relationships with peers.

PLO 2 Demonstrate computing, mathematical, and other knowledge domains to address real-world problems using modern computing tools.

PLO 3 Investigate current advances in algorithms and computing in systems and research.

PLO 4 Recommend computing solutions by applying computing and mathematical foundations to formulate an optimal solution or system to a problem based on the requirement specifications and effectively communicate the results.

PLO 5 Develop mastery in the computing and mathematical fundamentals to analyze complex problems and create the computing requirements for an appropriate solution while encouraging lifelong learning towards distinction.

C. COURSE LEARNING OUTCOMES (CLO)

At the end of this course, the students must be able to:

CLO 1 Explain the core concepts of computer graphics and the basic algorithms involved.

CLO 2 Identify the basic structure of computer graphics in reference to mathematical principles such as geometry modeling and linear algebra.

CLO 3 Design and create 2D and 3D models by applying algorithms and graphic techniques.

CLO 4 Be familiar with the issues involved in computer graphics and the corresponding solutions or best practices

D. MAPPING OF CLO with the PLO

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
CLO 1		M			
CLO 2		M		M	
CLO 3		M	M		I
CLO 4	I		F	M	M

LEGEND: **I**-Introduced; **M**-Moderately achieved; **F**-Fully achieved

Introduced [30%, 60%): The course has introduced fundamental concepts necessary for the program objectives.
Moderately Achieved [60%; 85%): The course has developed partial knowledge, somehow prerequisite, for the program objectives.
Fully Achieved [85%, 100%]: The course has developed complete knowledge associated with the program objectives.

E. CLASS RULES

1. Regular attendance and class participation are required. A STUDENT WHO IS ABSENT FOR MORE THAN SIX (6) TIMES AND HAS FAILED TO DROP THE COURSE ON THE DROPPING DATE WILL BE GIVEN A GRADE OF 5.0.
2. THERE WILL BE NO SPECIAL LONG EXAM FOR ANY LONG EXAM MISSED UNLESS THERE IS A VALID REASON (DOCUMENTATION REQUIRED). YOU ARE ONLY ALLOWED TO MISS ONE LONG EXAM. OTHER EXAMS MISSED WILL BE GIVEN A RAW SCORE OF 0 POINTS.
3. STUDENTS MUST TAKE THE FINAL EXAM OR A GRADE OF "INC" WILL BE INCURRED.
4. The projects/problem sets are intended to help the student apply the concepts learned in class to realistic situations and in a realistic computing environment.
5. The student is expected to do his/her own work. Each one may discuss project concepts with classmates but do not discuss specific details nor do any joint work resulting in code. No exchanges of programming codes, either in pieces or in entirety, by any means. These are forms of cheating and will be sanctioned accordingly. CHEATING WILL NOT BE TOLERATED. AN AUTOMATIC GRADE OF 5.0 WILL BE GIVEN TO ANY STUDENT CAUGHT CHEATING.
6. ALL PROJECTS/PROBLEM SETS MUST BE PASSED OR A GRADE OF "INC" WILL BE INCURRED.
7. No make-up machine exercise/quiz will be given.
8. Complaints regarding long exams and MP results will be entertained only up to one week after their release.

F. GRADING SCHEME

The work of students shall be graded at the end of each semester/midyear term in accordance with the following system:

Grade	Interval	Classification:
1.00	[96, 100]	Excellent
1.25	[91, 96)	
1.50	[87, 91)	Very Good
1.75	[82, 87)	
2.00	[78, 82)	Good

2.25	[73, 78)	
2.50	[69, 73)	Satisfactory
2.75	[64, 69)	
3.00	[60, 64)	Pass
4.00	[55, 60)	Conditional
5.00	[0, 55)	Fail
INC		Incomplete
DRP		Dropped

Remark: Clearing of Grades of "Incomplete" or "4"
"4" means conditional failure. It may be made up for by successful repetition of the course, or by passing a removal examination. Students are given a grade of "3" if they pass the re-examination, "5" if they fail. Only one re-examination which must be taken within the prescribed time is allowed. If a student does not remove the grade "4" within the prescribed time, he/she may earn credit for the course only by repeating it and passing it.

The grade of "INC" is given if a student whose class-standing throughout the semester is "Passing," fails to take the final examination or fails to complete other requirements for the course due to illness or other valid reasons. In case the class standing is not passing and the student fails to take the final examination for any reason, a grade of "5" is given. Removal of the "INC" must be done within the prescribed time by passing an examination or meeting all the requirements for the course, after which the student shall be given a final grade based on his/her overall performance.
Taken from: *UPB Academic Catalogue 2019*

G. COURSE OUTLINE

Timeline	CLOs	Topics	Learning Activities	Assessment Tools
Weeks 1 - 3	CLO1 CLO2 CLO4	1. Introduction 2. Geometry Modeling, Transformation, Splines 3. Viewing in a Computer System, Windowing System, Functionality 4. Perspective Transformation	Lectures; Group Discussions; Interactive or Virtual Demonstrations; Problem Solving; Video Tutorials	Quizzes Homework; Practice Exercises; Hands-on Exercise;
FIRST LONG EXAMINATION				
Weeks 4 - 6	CLO1 CLO2 CLO3	5. Color Surfaces 6. 2D graphics 7. Clipping, Filling Polygons 8. Hidden Surface Removal Algorithms	Lectures; Group Discussions; Interactive or Virtual Demonstrations; Problem Solving; Video Tutorials	Quizzes Homework; Practice Exercises; Hands-on Exercise;
SECOND LONG EXAMINATION				
Weeks 7 - 9	CLO1 CLO2 CLO3 CLO4	9. Local Illumination 10. Textures 11. Ray Tracing 12. Anti-aliasing	Lectures; Group Discussions; Interactive or Virtual Demonstrations; Problem Solving; Video Tutorials	Quizzes Homework; Project; Hands-on Exercise;
THIRD LONG EXAMINATION				
FINAL EXAMINATION				

H. REFERENCES

1. Shirley, Peter., Marschner, Steve. Fundamentals of Computer Graphics. United States: CRC Press, (2018).
2. Gambetta, Gabriel. Computer Graphics from Scratch: A Programmer's Introduction to 3D Rendering. United States: No Starch Press, (2021).
3. Qi, Hairong., Snyder, Wesley E.. Fundamentals of Computer Vision. United Kingdom: Cambridge University Press, (2017).
4. Solomon, Justin. Numerical Algorithms: Methods for Computer Vision, Machine Learning, and Graphics. United Kingdom: CRC Press, (2020).
5. Greer, Xury., Baechler, Oscar. Blender 3D By Example: A Project-based Guide to Learning the Latest Blender 3D, EEVEE Rendering Engine, and Grease Pencil. United Kingdom: Packt Publishing, (2020).
6. Blain, John. The Complete Guide to Blender Graphics Computer Modeling and Animation 3rd Ed.. 2016
7. Gannovelli, Fabio and Massimiliano Corsini. Introduction to Computer Graphics: A Practical Learning Approach. 2014
8. Guha, Sumantha. Computer Graphics Through OpenGL: From Theory to Experiments 2nd Ed. 2014
9. Hughes, John, et. al. Computer Graphics Principles and Practice. 2014
10. Xiang, Zhigang. Computer Graphics: Theory and Practice with OpenGL. 2016

Note:Please use this format: https://resource-cms.springernature.com/springer-cms/rest/v1/content/40200/data/References+MathPhys+Style

I. RUBRICS FOR ASSESSMENT

PROBLEM SETS/ QUIZZES/ ASSIGNMENTS/ EXAMINATIONS/ MACHINE EXERCISES

CRITERIA	Poor 1	Fair 2	Satisfactory 3	Very Good 4	Excellent 5
Problem Interpretation 30%	Minimal or little indication of ideas relevant to the problem	Correct but insufficient interpretation of the problem	Correct but with significantly inaccurate or unnecessary concepts used in the solution	Correct but with slightly inaccurate or unnecessary concepts used in the solution	Correct and accurate interpretation of the problem
Proof/Solution Correctness 70%	Incorrect or incoherent solution	Logically sound but incomplete solution	Correct solution but with significantly unnecessary steps or insufficient concepts	Correct solution but with slightly unnecessary steps or insufficient concepts	Well-written, logically correct, and clear solution

ORAL PRESENTATIONS

CRITERIA	Poor 1	Fair 2	Satisfactory 3	Very Good 4	Excellent 5
Content Knowledge 50%	Little understanding of the topic	Understands the topic but unable to answer the	Familiarity of the topic, answers few or some of the	Familiarity of the topic, answers the audience's	Mastery of the topic, discusses minimum key points with the

		audience's questions	audience's questions	questions elaborately	most impact, answers the audience's questions elaborately
Delivery 20%	No script, incomprehensible and inaudible voice	Unfamiliarity of script, clear but monotone voice with several mispronunciations of terms	Familiarity of script, clear voice with few mispronunciations of terms	Familiarity of script, clear voice with correct pronunciation of terms	Mastery of script, clear voice with correct pronunciation of terms
Visuals 15%	Too much text with no visual aids, unreadable presentation with irrelevant information, several typographical errors	Readable presentation but with little visual aids, several typographical errors	Readable presentation, and uses some visual aids vital to the presentation, few typographical errors	Comprehensive presentation, makes use of appealing visual aids vital to the presentation, no typographical error	Comprehensive presentation, makes use of appealing, effective and varying visual aids vital to the presentation, no typographical error
Organization 15%	Untimely and unstructured presentation delivery with no logical flow of information	Structured but with confusing flow of information, or untimely presentation delivery	Structured with logical flow of information, or untimely presentation delivery	Well-structured, timely presentation delivery with logical flow of information	Well-structured, timely presentation delivery with logical and interesting flow of information

Examples of visual aids: Figures, Tables, Graphs, Charts, Videos, etc.

MACHINE PROBLEMS/PROJECTS

CRITERIA	Poor 1	Fair 2	Satisfactory 3	Very Good 4	Excellent 5
Specifications 50%	Does not compile and run	Compiles and runs but does not meet any of the specifications or meets few of the specifications	Compiles and runs, meets some of the specifications	Compiles and runs, meets most of the specifications	Compiles and runs, meets all of the specifications
Efficiency 20%	Extensive use of brute force algorithms, makes use of excessive resources than expected	Makes use of brute force algorithms, makes us of more resources than expected	Makes use of efficient but with some brute force algorithms, makes use of more resources than expected	Makes use of efficient but with few brute force algorithms, makes use of enough resources	Makes use of efficient algorithms and optimizes resource allocation
Readability 10%	Unorganized, not readable, does not follow best coding practices	Unorganized and only readable by the creator, follows few best coding practices	Organized, but only readable by those who know the problem, follows some best coding practices	Organized and readable, follows most best coding practices	Well-organized and very easy to understand
Reusability 10%	Contains multiple instances of redundant code	Contains some instances of redundant code	Makes use of some functions or methods, but contains few redundant code	Extensive use of functions and methods	Makes full use of functions and methods

Documentation 10%	Simple or no comments included in the code, does not help the reader understand the code	Simple and redundant comments that provide little information on the code	Contains comments and some simple header documentation that are useful in understanding the code	Contains clear comments and header documentation that are very useful in understanding the code	Contains clear comments and header documentation that are well-written, explains what the code accomplishes and how it works

The University of the Philippines

UP was founded in 1908 with its first campus in Manila. It was followed soon after by the establishment of constituent universities and campuses all over the country. Over the course of a century, UP has established eight constituent universities distributed across 17 campuses.

Vision

The University of the Philippines (UP) envisions itself to be a leading regional and global university in an environment that sustains 21st-century learning, knowledge, creation, and public service for society and humanity.

Mandates

As the national university, UP is mandated to perform its unique and distinctive leadership in higher education and development, in terms of:

- Setting academic standards and initiating innovation in teaching, research, and faculty development in an environment of academic freedom;
- Serving as a graduate university providing advanced and specialized studies, especially to the faculty members of state and private colleges and universities;
- Serving as a research university in various fields of expertise and contributing to the dissemination and application of new knowledge;
- Leading as a public service university by providing different forms of community, public, and volunteer service to the government, the private sector, and civil society;
- Protecting and promoting the professional and economic right and welfare of its academic and non-academic personnel;
- Providing learning opportunities in various forms to promote such special concerns as responsible citizenship, sustainable development, sports and health development, and cultural development;
- Serving as a hub for regional and global academic networks; and
- Applying the highest standards of academic and institutional governance within a meritocracy based on collegiality, representation, accountability, transparency, and active participation of all constituents.

For more information on the University's Vision and Mission, refer to the UP Strategic Plan 2017-2023.

University of the Philippines' Philosophy of Education and Graduate Attributes

A UP education seeks to produce graduates imbued with an abiding sense of responsibility to their people and nation, the skills and mindsets to improve human life, and a commitment to the freedom and welfare of all.

Aside from mastery of knowledge in their specific disciplines, UP graduates must possess breadth of mind, strength of character, and generosity of spirit, fostered by a firm grounding in both the arts and sciences, and such specialist courses as their programs may require.

They must be prepared to inclusively engage with society and the world at large, mindful of their people's needs and capabilities, and keen to the challenges and opportunities of national development in this century of rapid global change.

UP aims to achieve this through its General Education program, one that develops mind, body and spirit, which familiarize all its students with their culture and history and fosters a sense of shared citizenship, while equipping them with critical thinking, discernment and technical skills they will need to excel in their chosen professions.

The University of the Philippines Baguio

Established through the initiative of UP alumni in Baguio and Benguet, the University of the Philippines Baguio was inaugurated as a degree-granting unit of the University on 22 April 1961. A land grant worked

out by alumni, the City Council, and by then UP President Vicente Cinco situated the College on its present location, a pine clad-hill offering a scenic view of Baguio. The College went on to make its presence felt as it served as the site of the National Arts Festivals in the coming years. Moves were made to strengthen its research capabilities, culminating in the institution of the Cordillera Studies Center in 1983. Directions towards autonomy began with strategic planning in 1996. The following years saw the College working assiduously in the reformulation and strengthening of its academic programs, primarily. Administration of the College likewise oversaw the development in infrastructure and improvement of services and facilities. Such growth led to the elevation of UP College Baguio to full autonomous status, granted by the Board of Regents in December 2002. UP Baguio is now the seventh constituent university of the UP System.

Vision
As a constituent university of the University of the Philippines System, UP Baguio will sustain its lead position in the delivery of tertiary education in the north. It will continue to nurture and develop innovative programs in the arts and sciences. It will also continue to develop the niche it has created over the past decades in Cordillera Studies.

Mission
Our mission, therefore, as a unit of the U.P. System and as the leading institution of higher learning in Northern Luzon, is to spearhead the offering of the highest standard of education and to contribute to the overall upgrading of the quality of instruction in the region. We seek to create an impact by informing our programs with a regional perspective, at the same time that these are informed by a national and global outlook.

For more information on UP Baguio's Vision and Mission, refer to the official UP Baguio webpage.

The College of Science

After the reorganization of UP Baguio during its institution as the seventh constituent university of the UP system in 2002, the College of Science (CS), being one of the three colleges emerging from the reorganization, evolved from the merger of the Division of Natural Sciences and Mathematics and the Sports, Physical Education and Recreation Division. The College offers four undergraduate degree programs: BS Biology, BS Computer Science, BS Mathematics, and BS Physics program. All these programs are regularly reviewed and upgraded to prepare students for careers in education, research, or postgraduate studies.

The CS Dean, together with the Faculty Assembly and in cooperation with the College Executive Board (CEB), leads the Department of Biology, the Department of Physical Sciences, the Department of Mathematics and Computer Science, and the Human Kinetics Program towards academic excellence and public service.

Vision
The College of Science aims to continue offering high standard and relevant quality education through good practices in program implementation that follow innovative pedagogical strategies that utilize appropriate technology in supporting this endeavor. It will further its objectives by initiating interdisciplinary programs anchored on disciplinary specializations in its efforts to enhance the efficiency of research conduct and management. It will continue to encourage and reward scientific productivity by conducting research responsive to the needs of the region, nation, and the global community.

The College envisions itself moving towards a more inclusive and equitable environment that enables faculty members to lead on with exemplary qualifications – mindful of scholarly research and dedicated to public service.

Furthermore, it will support UP Baguio's wellness program for both academic and support staff to guarantee efficiency in service to the university and the society.

Lastly, the College, together with the University, will take initiative to continue, strengthen and widen the reach of its involvement in public service by sharing individual and collective expertise with other academic institutions, local government units, NGOs, peoples' organizations, and indigenous communities in the region and other areas.

Mission
In line with the college's vision, it is our mission, therefore, to produce scientific leaders and civic-minded citizens with high regard for integrity, compassion, and genuine service who lead in a research study that follows ethical standards and excellence in instruction, research, and public service.

It is our mission to improve on basic facilities and design where researchers can work more collaboratively and efficiently. We pursue to guarantee the safety of researchers, to minimize adverse impact to the environment, to respect research protocols involving indigenous communities, and to ensure professional conduct as we encourage good instruction, research, and public service in upholding the University's banner of *Honor and Excellence*.

Goals
In accordance with the mission and vision of the University, the college aims to accomplish the following goals:

- To continue formulating new degree programs while regularly upgrading existing ones;
- To encourage interdisciplinary research across programs;
- To institutionalize the Science Research Center in continuing research responsive to the need of the region, and in the enhancement of interdisciplinary collaboration within the departments of the College and even with other faculty members in other colleges of the University of the Philippines Baguio;
- To have a closer linkage with the Cordillera Studies Center as the university's research center and as an aid in putting up the biodiversity and innovation research center;
- To foster an environment suitable for the growth of the academic and support staff; and,
- To provide public service based on each academic and support staff's specialization.

For more information on CS' Vision, Mission, and Goals, refer to the official CS website.

The Department of Mathematics and Computer Science

The Department of Mathematics and Computer Science (DMCS) grew from a discipline to a department in 2002 when UP Baguio became the seventh constituent university of the UP System. The Department offers two undergraduate programs (BS Mathematics and BS Computer Science) and two graduate programs (MS Mathematics and PhD Mathematics). The Department pioneered the PhD Mathematics Program in Northern Luzon.

Vision
The DMCS adheres to the highest standards of excellence in all aspects of teaching, research, and extension service. It will build and maintain nationally and internationally recognized experts in the core and emerging areas of study in mathematics, statistics, and computer science. It will set the standards for promoting quality instruction, interdisciplinary research, teacher training, and other extension programs within the University, the Northern Luzon region, and the country.

Further, it aspires to become a Center of Excellence in mathematics both in the country and in the ASEAN region.

Mission and Goals
The DMCS is committed to pursuing excellence in teaching, research, and extension service within the University, the Northern Luzon region, and the country.

The Department identified these five major goals to help realize its mission:

1. Strengthen its graduate and undergraduate programs;
2. Aggressively promote and maintain high standards of quality education;
3. Lead in research capability building and research-generating activities in the mathematical and computing sciences and in mathematics education in the region;
4. Upgrade the quality of mathematics and computing education in the primary, secondary, and tertiary levels in Northern Luzon; and
5. Make quality mathematics and computer science education accessible to the people in the region.

The BS Computer Science Program

The BS Computer Science program is one of the undergraduate programs that UP Baguio offers. It was established in 1996 and was based on the UP system program BS Computer Science initiated by UP Los Baños, which was also adopted by UP Mindanao, UP Visayas, and UP Manila. The program strives to (1) to provide students with a solid background in the various areas of Computer Science; (2) to equip students with adequate preparation in computer science to enable them to get into industry, academe or research; (3) to prepare them for graduate studies and research work in this field; and (4) to try and instill in them the initiative, motivation, and ability to keep pace with the most recent developments in computing.

For more information on DMCS' Vision, Mission and Goals, and the BS Computer Science Program, refer to the official DMCS website.

Updated as of February 2023