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Universitas Negeri Surabaya Faculty of Engineering , Information Technology Education Undergraduate Study Program

Document Code

SEMESTER LEARNING PLAN CODE Credit Weight SEMESTER Compilation Courses Course Family Date **Computer Graphics** 8320703020 T=3 P=0 ECTS=4.77 5 July 17 2024 Compulsory Study rogram AUTHORIZATION SP Developer Course Cluster Coordinator Study Program Coordinator Drs. Bambang Sujatmiko, M.T. Drs. Bambang Sujatmiko, M.T. Learning model Project Based Learning Program PLO study program which is charged to the course Learning PLO-8 Mastering the concepts and implementation in developing software engineering, games, intelligent multimedia, and Outcomes network computer engineering (PLO) PLO-13 Able to develop innovative educational products or learning resources using scientific design-based strategies to support teaching activities that can be integrated with ICT. Program Objectives (PO) **PLO-PO** Matrix PLO-8 PLO-13 P.O PO Matrix at the end of each learning stage (Sub-PO) P.O Week 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 This course teaches basic principles and methods in computer graphics and is able to design, implement and analyze correct and good graphics application systems. The material studied in this course is an introduction to computer graphics, primitive drawing, 2D graphic objects, 2D affine transformations, 3D graphic objects, 3D affine transformations, creating complex 3D graphic objects. Short Course Description Main : References 1. Edward Angel. 2009. Interactive Computer Graphics: A Top-Down Approach Using OpenGL , Fifth Edition. Pearson International Inc 2 Edward Angel. 2002. OpenGLTM: A Primer, Third Edition. Addison-Wesley. 3. Hills, Francis S Jr. 2000. Computer Graphics Using OpenGL, Second Edition . New Jersey: Prentice Hall. Supporters: Donald Hearn and M. Pauline Baker. Computer Graphics with OpenGL , 3rd Edition. 1. 2. Alan Watt. 3D Computer Graphics. Addison-Wesley. Drs. Bambang Sujatmiko, M.T. Setya Chendra Wibawa, S.Pd., M.T. Ramadhan Cakra Wibawa, S.Pd., M.Kom. Supporting lecturer Help Learning, Learning methods, Final abilities of Evaluation Student Assignments, [Estimated time] Learning materials each learning Assessment Week-Weight (%) stage [References] (Sub-PO) Indicator Criteria & Form Offline (Online (online)

1	Students are able to explain the basics of graphics systems and graphics pipelines in the graphics library	 Explaining Graphic Systems Explain the meaning of Computer Graphics Identify the formation of graphs/images Identify models and Graphic System Architecture Identify Computer Graphics applications Explains the basics of the Graphics Library Explains the background of the Graphics Library Identify examples of Graphics Library Identify examples of Graphics Library Identify examples of Graphics Library Identifying 3D in Graphic Systems 	Criteria: Cognitive Values, Character Values, and Psychomotor Values Form of Assessment Participatory Activities	Approach: Scientific Model: Problem- based learning Method: Discussion, Presentation, Practical 3 X 50	Approach: Scientific Model: Problem-based learning Method: Discussion, Presentation, 3 x 50 online practicum	Material: 1. Explaining the system and meaning of computer graphics, 2. Identifying the formation of graphics/images, graphics system models and architecture, computer graphics applications, examples of graphics library programs, and 3D in graphics systems. 3. Explaining the basics of graphics libraries, background Graphics Library Library: Edward Angel. 2009. Interactive Computer Graphics: A Top- Down Approach Using OpenGL, Fifth Edition. Pearson International Inc.	2%
2	Students are able to create and demonstrate simple graphics programs	 Explaining Sierpinski Gaskets (2D/3D) Identifying Input and Interaction Explaining Graphics Library Callbacks Applying the Graphic Library to the program code 	Forms of Assessment : Participatory Activities, Project Results Assessment / Product Assessment, Practical Assessment	Approach: Scientific Model: Problem- based learning Method: Discussion, Presentation, Practicum 3 X 50	Approach: Scientific Model: Problem-based learning Method: Discussion, Presentation, online Practicum 3 x 50	Material: Explaining 1. Sierpinski Gasket (2D/3D), 2. Graphics Library Callbacks, 3. Graphics Library in program code, and Identifying Input and Library Interaction: Edward Angel. 2009. Interactive Computer Graphics: A Top- Down Approach Using OpenGL, Fifth Edition. Pearson International Inc.	3%
3	Students are able to create interactive graphic applications	 Identify input, display, menu, and picking devices Apply how to design and build interactive programs with the Graphic Library 	Criteria: Cognitive Values, Character Values, and Psychomotor Values Form of Assessment : Participatory Activities, Practical Assessment	Approach: Scientific Model: Problem- based learning Method: Discussion, Presentation, Practicum 3 X 50	Approach: Scientific Model: Problem-based learning Method: Discussion, Presentation, online Practicum 2 x 50	Material: Identify input, display, menu and picking devices and apply how to design and build interactive programs with Graphic Library Library : Edward Angel. 2009. Interactive Computer Graphics: A Top- Down Approach Using OpenGL, Fifth Edition. Pearson International Inc.	3%

4	Students are able to implement World Windows and Viewport	 Identify and implement World Windows and Viewport Identify and apply clipping lines Identify and apply regular polygons, circles and arcs 	Criteria: Cognitive Values, Character Values, and Psychomotor Values Form of Assessment : Participatory Activities, Practical Assessment	Approach: Scientific Model: Problem- based learning Method: Discussion, Presentation, Practicum 3 X 50	Approach: Scientific Model: Problem-based learning Method: Discussion, Presentation, Online Practicum 2 x 50	Material: Identifying and applying 1. World Windows and Viewport, 2. clipping lines, and 3. regular polygons, circles and arcs Reader: Edward Angel. 2009. Interactive Computer Graphics: A Top- Down Approach Using OpenGL, Fifth Edition. Pearson International Inc.	3%
5	Students can implement vector tools	 Explain vectors Explain dot product Explain the cross product of two vectors Explain the representation of key geometric objects Applying vectors to the Graphic Library program 	Criteria: Cognitive Values, Character Values, and Psychomotor Values Forms of Assessment : Participatory Activities, Project Results Assessment, Product Assessment, Practical Assessment	Approach: Scientific Model: Problem- based learning Method: Discussion, Presentation, Practicum 3 X 50	Approach: Scientific Model: Problem-based learning Method: Discussion, Presentation, Online 2 x 50	Material: Explains 1. vectors, 2. dot product, 3. cross product of two vectors, 4. representation of key geometric objects, and Applying vectors in the Graphic Library program. Bibliography: Edward Angel. 2009. Interactive Computer Graphics: A Top- Down Approach Using OpenGL, Fifth Edition. Pearson International Inc.	3%
6	Students can explain geometry, representation and transformation of objects	Explains geometry, representation, and transformation of objects	Criteria: Cognitive Values, Character Values, and Psychomotor Values Form of Assessment : Participatory Activities	Approach: Scientific Model: Problem- based learning Method: Discussion, Presentation, Practicum 3 X 50	Approach: Scientific Model: Problem-based learning Method: Discussion, Online Presentation 2 x 50	Material: Explaining geometry, representation and transformation of objects. Reference: Edward Angel. 2009. Interactive Computer Graphics: A Top- Down Approach Using OpenGL, Fifth Edition. Pearson International Inc.	3%
7	Students can demonstrate object transformations in interactive graphics programs	 Identify and apply transformations to the Graphics Library Implement model building in the Graphic Library program Implementing an isometric cube in the Graphic Library program 	Criteria: Cognitive Values, Character Values, and Psychomotor Values Form of Assessment : Participatory Activities	Approach: Scientific Model: Problem- based learning Method: Discussion, Presentation, Practicum 3 X 50	Approach: Scientific Model: Problem-based learning Method: Discussion, Online Presentation 2 x 50	Material: Identify and apply 1. transformations in the Graphics Library, 2. building models in the Graphic Library program, and 3. isometric cubes in the Graphic Library program Library: Edward Angel. 2009. Interactive Computer Graphics: A Top- Down Approach Using OpenGL, Fifth Edition. Pearson International Inc.	3%

8	Subsummative Exam / Midterm Exam	1.Subsummative Exam / Midterm Exam 2.Cognitive Values, Character Values, and Psychomotor Values	Criteria: 1.Subsummative Exam / Midterm Exam 2.Cognitive Values, Character Values, and Psychomotor Values Form of Assessment Project Results Assessment / Product Assessment, Test	Subsummative Exam / Midterm Exam 2 X 50	Online Subsummative Exam / Midterm Exam 2 x 50	Material: All material that has been taught from meetings 1 to 7 Reader: Edward Angel. 2009. Interactive Computer Graphics: A Top- Down Approach Using OpenGL, Fifth Edition. Pearson International Inc.	20%
9	Students can model shapes with Polygonal Meshes	 I.Identifying Polyhedra I.Identifying Extruded Shapes I.Identifying Particle Systems Implement Polygonal Meshes modeling in the Graphic Library program 	Criteria: 1.Group assessment (30%) 2.Individual assessment (25 %) 3.Project assessment (25 %) 4.Report Assessment (20%) Forms of Assessment : Participatory Activities, Project Results Assessment, Portfolio Assessment	 Students observe the problem given by the lecturer, referring to the topic that has been agreed upon during the lesson. In groups, students discuss to formulate hypotheses related to the problems they face. 2. Students beynapped beynapped beynapped that has been propare the project that will be worked on to answer the hypothesis that has been prepare d 3. Students prepare a schedule for completing the project that will be worked on 4. Students prepare d 3. Students prepared 3. Students project that will be worked on 4. Students project that will be worked on 4. Students project that will be worked on 4. Students project that has been project that has been project that has been schedule for completing the project that have been carry of the students related to the students related to projects that have been carried out within the specified time period. 6. Students reveal the experiences that have been carried out within the specified time period. 6. Students reveal the experiences that have been carried out within the specified time period. 6. Students reveal the experiences that have been carried out within the specified time period. 6. Students reveal the experinceses thave been carried ou	 Students observe the problems given by the lecturer, referring to the topics agreed upon during the lesson. In groups, students discuss to formulate hypotheses related to the problems they face. Students begin to prepare the project that will be worked on to answer the hypothesis that has been prepared Students prepare a schedule for completing the project that will be worked on Students carry out the stages of the project according to the schedule that they have prepared (the lecturer observes each stage of the student project that is being worked on) Students make reports related to projects that have been carried out within the specified time period. Students reveal the experiences that have been carried out by displaying the outcomes of projects that have been completed. x 50 	Material: 1. identifying Polyhedra, 2. Extruded Shapes, 3. Particle Systems, and 4. Applying Polygonal Meshes modeling in the Graphic Library program Library: Edward Angel. 2009. Interactive Computer Graphics: A Top- Down Approach Using OpenGL, Fifth Edition. Pearson International Inc.	3%

11	Students are able	1 Identify and	Criteria:	1 Students	1 Students observe	Material	5%
	to render faces in	apply shading	1.Group	observe the	the problems given by	Identifying and	570
	visual realism	models	Assessment	problems	the lecturer, referring to	applying 1.	
		2.Identify and	(30%)	given by the	the topics agreed upon	shading models,	
		apply flat	2.Individual	lecturer,	during the lesson. In	flat shading	
		shading and	Assessment (25	referring to the	groups, students	and smooth	
		smooth	%)	topics agreed	discuss to formulate	shading, 3.	
		shading	Project Appraisal	the lesson In	the problems they face	Surface removal	
		Identify and	(25%)	droups	2 Students begin to	4 texture to	
		apply Adding	4.Report	students	prepare the project that	faces. 5.	
		hidden surface	Assessment	discuss to	will be worked on to	shadows of	
		removal	(20%)	formulate	answer the hypothesis	objects	
		4.Identify and	Farma of	hypotheses	that has been prepared	Library: Hills,	
		apply texture to	Assessment	related to the	3. Students prepare a	Francis S Jr.	
		faces	Participatory Activities.	food	scriedule for	2000. Computer	
		5. Identity and	Project Results	2 Students	that will be worked on	OnenGI	
		of objects	Assessment / Product	begin to	4. Students carry out	Second Edition.	
		01 00 je 013	Assessment, Portfolio	prepare the	the stages of the	New Jersey:	
			Assessment, Practical	project that will	project according to the	Prentice Hall.	
			ASSESSMEIL	be worked on	schedule that they		
				to answer the	have prepared (the		
				that has been	stage of the student		
				prepared	project that is being		
				3. Students	worked on)		
				prepare a	5 . Students make		
				schedule for	reports related to		
				completing the	projects that have been		
				he worked on	specified time period		
				4. Students	6. Students reveal the		
				carry out the	experiences that have		
				stages of the	been carried out by		
				project	displaying the		
				according to	outcomes of projects		
				that they have	completed		
				prepared (the	completed.		
				lecturer			
				observes each			
				stage of the			
				student project			
				worked on)			
				5. Students			
				make reports			
				related to			
				projects that			
				nave been			
				within the			
				specified time			
				period.			
				6. Students			
				reveal the			
				that have been			
				carried out by			
				displaying the			
				outcomes of			
				projects that			
				have been			
				3 X 50			
				0,000			

12	Students are able	1	Cuitouio	1 Ctudente	1 Ctudente ebeenve	Matarial	F0/
12	to render faces in	L.Identify and	1 Group	observe the	the problems given hy	Identifying and	3%0
	visual realism	apply shauling	Assessment	problems	the lecturer. referring to	applying 1.	
		2 Identify and	(30%)	aiven by the	the topics agreed upon	shading models.	
		Z.IUEIIUIY allu	2 Individual	lecturer,	during the lesson. In	2. flat shading	
		apply hat	Accosement (25	referring to the	groups, students	and smooth	
		snaulity and	A356351116111 (25 %)	topics agreed	discuss to formulate	shading, 3.	
		shading	3 Assessment of	upon during	hypotheses related to	Adding hidden	
		3 Identify and	nroiects	the lesson. In	the problems they face.	surface removal,	
		annly Adding	undertaken (25%)	groups,	2. Students begin to	4. texture to	
		hidden surface	4.Report	students	prepare the project that	Taces, 5.	
		removal	Assessment	discuss to	answer the hypothesis	shadows of	
		4.Identify and	(20%)	hynotheses	that has been prepared	l ihrary. Hills	
		apply texture to	()	related to the	3 Students prepare a	Francis S Jr	
		faces	Forms of	problems they	schedule for	2000. Computer	
		5.Identify and	Assessment :	face.	completing the project	Graphics Using	
		apply shadows	Participatory Activities,	2. Students	that will be worked on	OpenGL,	
		of objects	Project Results	begin to	Students carry out	Second Edition.	
			Assessment / Product	prepare the	the stages of the	New Jersey:	
			Assessment Dractical	project that will	project according to the	Prentice Hall.	
			Assessment Practice /	be worked on	schedule that they		
			Performance	hypothesis	lecturer observes each		
				that has been	stage of the student		
				prepared	project that is being		
				3. Students	worked on)		
				prepare a	5 . Students make		
				schedule for	reports related to		
				completing the	projects that have been		
				project that will	carried out within the		
				A Students	6 Students royal the		
				carry out the	experiences that have		
				stages of the	been carried out by		
				project	displaying the		
				according to	outcomes of projects		
				the schedule	that have been		
				that they have	completed.		
				prepared (the	3 x 50		
				lecturer			
				stage of the			
				student project			
				that is being			
				worked on)			
				5 . Students			
				make reports			
				related to			
				projects that			
				carried out			
				within the			
				specified time			
				period.			
				6. Students			
				reveal the			
				experiences			
				that have been			
				displaying the			
				outcomes of			
				projects that			
				have been			
				completed.			
				3 X 50			

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13	Students can use tools for raster displays	 Identify and implement pixmaps manipulation processes Identify and apply combinations of pixmaps Identify and apply Bresenham's algorithm Identify and apply define and fill regions of pixels Identify and apply polygon filling Identify and apply aliasing and anti- aliasing techniques 	Forms of Assessment : Participatory Activities, Portfolio Assessment, Practical / Performance	 Students observe the problems given by the lecturer, referring to the topics agreed upon during the lesson. In groups, students discuss to formulate hypotheses related to the problems they face. Students begin to prepare the project that will be worked on to answer the hypothesis that has been prepared Students prepare a schedule for completing the project that will be worked on to answer the hypothesis that has been prepared Students prepare a schedule for completing the project that will be worked on 4. Students carry out the stages of the project according to the schedule that they have prepared (the lecturer observes each stage of the student project that is being worked on) Students make reports related to projects that have been carried out within the specified time period. Students reveal the experiences that have been carried out by displaying the outcomes of projects that have been 	1. Students observe the problems given by the lecturer, referring to the topics agreed upon during the lesson. In groups, students discuss to formulate hypotheses related to the problems they face. 2. Students begin to prepare the project that will be worked on to answer the hypothesis that has been prepared 3. Students prepare a schedule for completing the project that will be worked on 4. Students carry out the stages of the project according to the schedule that they have prepared (the lecturer observes each stage of the student project shat have been carried out within the specified time period. 6. Students reveal the experiences that have been carried out by displaying the outcomes of projects that have been completed. 3×50	Material: Identifying and applying 1. process of manipulating pixmaps, 2. combination of pixmaps, 3. Bresenham algorithm, 4. define and fill region of pixels, 5. filing polygons, 6. aliasing and anti- aliasing techniques Reference: <i>Edward Angel.</i> 2009. Interactive <i>Computer</i> <i>Graphics: A Top-</i> <i>Down Approach</i> <i>Using OpenGL,</i> <i>Fifth Edition.</i> <i>Pearson</i> <i>International Inc.</i>	5%
				completed. 3 X 50			

14	Students can use tools for raster	1.Identify and	Criteria:	1. Students	1. Students observe	Material:	5%
	displays	pixmaps	(30%) 2 Individual Value	problems given by the	the lecturer, referring to the topics agreed upon	applying 1. process of	
		processes 2 Identify and	(25 %) 3 Project Value (25	lecturer, referring to the	during the lesson. In groups, students	manipulating pixmaps, 2.	
		apply	%)	topics agreed upon during	discuss to formulate hypotheses related to	combination of pixmaps, 3.	
		of pixmaps	4.Report Value (20 %)	the lesson. In groups,	the problems they face. 2. Students begin to	Bresenham algorithm, 4.	
		3.Identify and apply	Forms of	students discuss to	prepare the project that will be worked on to	define and fill region of pixels,	
		Bresenham's algorithm	Participatory Activities,	formulate hypotheses	answer the hypothesis that has been prepared	5. filling polygons, 6.	
		4.Identify and apply define	Assessment / Product	related to the problems they	3. Students prepare a schedule for	aliasing and anti- aliasing	
		and fill regions of pixels	Assessment, Practice /	face. 2. Students	completing the project that will be worked on	techniques Reference:	
		5.Identify and apply polygon	1 chomanee	begin to prepare the	4. Students carry out the stages of the	Edward Angel. 2009. Interactive	
		filling 6.Identify and		be worked on	schedule that they	Computer Graphics: A Top-	
		apply aliasing and anti-		hypothesis	lecturer observes each	Using OpenGL,	
		aliasing techniques		prepared	project that is being	Pearson	
				prepare a	5 . Students make		
				completing the project that will	projects that have been carried out within the		
				be worked on 4. Students	specified time period. 6. Students reveal the		
				carry out the stages of the	experiences that have been carried out by		
				project according to	displaying the outcomes of projects		
				the schedule that they have	completed.		
				lecturer	3 X 50		
				stage of the			
				that is being worked on)			
				5 . Students make reports			
				related to projects that			
				have been carried out			
				specified time			
				6. Students			
				experiences that have been			
				carried out by displaying the			
				outcomes of projects that			
				have been completed. 3 X 50			

15	Students can implement curve and surface designs	 I.Identify and apply interactive curve design I.Identify and apply Beziercurve for curve design I.Identify and apply the properties of Bezier curve I.Identify and implement finding better blending function I.Identify and apply B-spline basis functions I.Identify and apply rationalsplines and NURPS curves 	Criteria: 1.Group value (30 %) 2.Individual value (25 %) 3.Project value (25 %) 4.Report value (20 %) Forms of Assessment : Participatory Activities, Portfolio Assessment, Practical Assessment	 Students observe the problems given by the lecturer, referring to the topics agreed upon during the lesson. In groups, students discuss to formulate hypotheses related to the problems they face. Students begin to prepare the project that will be worked on to answer the hypothesis that has been prepared 3. Students prepare a schedule for completing the project that will be worked on the stages of the project that they have prepared (the lecturer observes each stage of the student project that is being worked on) 5. Students make reports related to project shat have been carried out within the specified time period. 6. Students reveal the experiences that have been carried out by displaying the outcomes of completed. 3 X 50 	 Students observe the problems given by the lecturer, referring to the topics agreed upon during the lesson. In groups, students discuss to formulate hypotheses related to the problems they face. Students begin to prepare the project that will be worked on to answer the hypothesis that has been prepared Students prepare a schedule for completing the project that will be worked on Students carry out the stages of the project according to the schedule that they have prepared (the lecturer observes each stage of the student projects that have been carried out within the specified time period. Students reveal the experiences that have been carried out by displaying the outcomes of projects that have been completed. \$ 50 	Material: Identifying and applying 1. interactive curve design, 2. Beziercurve for curve design, 3. properties of Bezier curve, 4. finding better blending function, 5. B- spline basis function, 4. rationalsplines and NURPS curves Reference: Edward Angel. 2009. Interactive Computer Graphics: A Top- Down Approach Using OpenGL, Fifth Edition. Pearson International Inc.	5%
16	Summative Exam / Final Semester Exam	Summative Exam / Final Semester Exam	Criteria: 1.Summative Exam / Final Semester Exam 2.Portfolio value of all projects undertaken Forms of Assessment : Project Results Assessment / Product Assessment, Portfolio Assessment, Tests	Summative Exam / Final Exam Semester 2 X 50	Summative Exam / Final Semester Exam 2 x 50	Material: All projects that have been made are used as final projects for the course and presented. Reader: Edward Angel. 2009. Interactive Computer Graphics: A Top- Down Approach Using OpenGL, Fifth Edition. Pearson International Inc.	26%

Evaluation Percentage Recap: Project Based Learning

	Evaluation i crochage neoupin reject Based Ecanning						
No	Evaluation	Percentage					
1.	Participatory Activities	21.42%					
2.	Project Results Assessment / Product Assessment	26.17%					
3.	Portfolio Assessment	17.09%					
4.	Practical Assessment	11.17%					
5.	Practice / Performance	4.5%					
6.	Test	18.67%					
		99.02%					

Notes

- 1. Learning Outcomes of Study Program Graduates (PLO Study Program) are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
- 2. The PLO imposed on courses are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
- 3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
- 4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
- 5. Indicators for assessing ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
- 6. Assessment Criteria are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
- 7. Forms of assessment: test and non-test.
- 8. Forms of learning: Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
- 9. Learning Methods: Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
- 10. Learning materials are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
- 11. The assessment weight is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
- 12. TM=Face to face, PT=Structured assignments, BM=Independent study.