	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Data Science Undergraduate Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight	SEMESTER	Compilation Date
Digital Image Processing	4920203035	Compulsory Study Program Subjects	T=3 P=0 ECTS=4.77	4	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Hasanuddin Al-Habib, M.Si	Dr. Elly Matul Imah, M.Kom	Yuliani Puji Astuti, S.Si., M.Si.

Learning model	**Project Based Learning**	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	PLO-11	Able to implement data science technology in real problems
	PLO-15	Identify and analyze user needs and consider them in selecting, creating, integrating, evaluating, and administering data science interdisciplinary competency-based systems.
	Program Objectives (PO)	
	PO - 1	Able to understand the basic concepts of digital image processing
	PO - 2	Able to understand image processing algorithms and implement them using programming languages
	PO - 3	Able to apply image processing techniques for more complex image processing applications individually or in groups
	PO - 4	Able to apply digital image processing algorithms in solving problems in the field of data science
	PLO-PO Matrix	

P.O	PLO-11	PLO-15
PO-1		
PO-2		
PO-3		
PO-4		

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
PO-1																
PO-2																
PO-3				✔												
PO-4																

Short Course Description	This course discusses data processing methodology in the form of images or 2D images, as well as the basic concepts of pattern recognition, which can be applied in various fields such as remote sensing, medical diagnosis, document processing, robotics, etc. Topics that will be discussed include basic digital image concepts, image transformation, quality improvement and restoration, color transformation, morphology, compression, segmentation, feature extraction and selection, clustering, image classification, performance evaluation, intelligent multimedia information processing, soft computing, and self-taught learning. Students will be trained with programming assignments	
References	**Main :**	

1. R.C. Gonzalez and R.E. Woods,
2. John C. Russ, “The Image Processing Handbook, Seventh Edition”, CRC Press, 2016
3. Sandipan Dey, "Hands-On Image Processing with Python",Packt Publishing, 2018

Supporters:

Supporting lecturer	Dr. Elly Matul Imah, M.Kom. Hasanuddin Al-Habib, M.Si.

Week-	Final abilities of each learning	Evaluation	Help Learning, Learning methods, Student Assignments, [Estimated time]	Learning materials [References]	Assessment Weight (%)

	stage (Sub-PO)	Indicator	Criteria & Form	Offline (*offline*)	Online (*online*)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	1. Students are able to understand basic concepts in digital image processing 2. Students are able to understand sampling and quantization methods in digital image processing	1. Explain the basic terms in digital image processing 2. Explain the relationship between the fields of Image Processing, Computer Graphics, Pattern Recognition/Computer Vision/Artificial Intelligence, and their applications 3. Explain the basic terms in digital image processing 4. Explains the basic concepts of image acquisition, sampling and quantization methods in digital images	**Criteria:** attendance and activeness in class **Form of Assessment** : Participatory Activities	Introductory lecture, discussion, questions and answers 3 X 50		**Material:** Chapter 1. Introduction **Bibliography:** *RC Gonzalez and RE Woods,* **Material:** Chapter 2. Digital Image Fundamentals **Library:** *RC Gonzalez and RE Woods,*	2%
2	Students are able to understand the process of improving image quality in the spatial domain	1. Students know the basics of image transformation 2. Students are able to apply image quality improvements based on histogram equalization 3. Students are able to understand the concept of spatial domain 4. Students are able to understand the concept of image smoothing	**Criteria:** attendance and activeness in class **Form of Assessment** : Participatory Activities	Lectures, presentations, questions and answers, discussions and problem-based learning 3 X 50		**Material:** Chapter 3. Intensity Transformations and Spatial Filtering **Library:** *RC Gonzalez and RE Woods,*	2%
3	Students are able to understand the process of improving image quality in the frequency domain	1. Students get to know the basics of image transformation in the frequency domain 2. Students are able to understand the concept of Fourier transformation in images 3. Students are able to apply the Fourier transformation to improve image quality	**Criteria:** Activeness in simple practice of image processing in the frequency domain **Form of Assessment** : Practice / Performance	Lectures, presentations, questions and answers, discussions and problem-based learning		**Material:** Chapter 4. Filtering in the Frequency Domain **Library:** *RC Gonzalez and RE Woods,*	5%
4	Students are able to understand the process of image restoration and reconstruction	1. Students know the basics of image restoration 2. Students are able to understand the concept of image restoration in the spatial domain 3. Students are able to apply image restoration methods to reduce noise 4. Students are able to compare the performance of restoration methods in the spatial domain	**Criteria:** Activeness in simple practice of image processing in the spatial domain **Form of Assessment** : Participatory Activities, Practice/Performance	Lectures, presentations, questions and answers, discussions and problem-based learning		**Material:** Chapter 3. Intensity Transformations and Spatial Filtering **Library:** *RC Gonzalez and RE Woods,*	4%
5		Students get to know the basics of image transformation in the frequency domain	**Form of Assessment** : Participatory Activities	Lectures, presentations, questions and answers, discussions and problem-based learning		**Material:** Chapter 4. Filtering in the Frequency Domain **Library:** *RC Gonzalez and RE Woods,*	2%

6	Students are able to understand the process of image restoration and reconstruction	1. Students know the basics of image restoration 2. Students are able to understand the concept of image restoration in the spatial domain 3. Students are able to apply image restoration methods to reduce noise 4. Students are able to compare the performance of restoration methods in the spatial domain	**Criteria:** Activeness in simple practice of image processing in the spatial domain **Form of Assessment** : Practice / Performance	Lectures, presentations, questions and answers, discussions and problem-based learning		**Material:** Chapter 5. Image Restoration and Reconstruction **Reference:** *RC Gonzalez and RE Woods,*	5%
7	Students are able to understand the process of image restoration and reconstruction	1. Students are able to understand the concept of image restoration in the frequency domain 2. Students are able to apply image restoration methods to reduce noise in the frequency domain 3. Students are able to compare the performance of restoration methods in the frequency domain	**Criteria:** Activeness in simple practice of image processing in the frequency domain **Form of Assessment** : Participatory Activities, Practice/Performance	Lectures, presentations, questions and answers, discussions and problem-based learning		**Material:** Chapter 5. Image Restoration and Reconstruction **Reference:** *RC Gonzalez and RE Woods,*	2%
8	Students are able to apply basic concepts and image processing methods to simple problems		**Form of Assessment** : Test	Midterm Written Exam 2 x 50		**Material:** Chapters 1-5 **Reference:** *RC Gonzalez and RE Woods,*	20%
9	Students are able to understand color processing in digital image processing	1. Students are able to understand the basic concepts of RGB, CMY, HSI, YUV, YIQ colors in digital image processing 2. Students are able to understand the color transformation process in digital image processing 3. Students are able to apply the concepts of color intensity and bit slicing for image smoothing and sharpening	**Form of Assessment** : Participatory Activities	Lectures, presentations, questions and answers, discussions and problem-based learning 3 X 50		**Material:** Chapter 6. Color Image Processing **Library:** *RC Gonzalez and RE Woods,*	2%
10	Students are able to understand the image compression process	1. Students are able to understand the concept of image compression 2. Students are able to understand Relative data redundancy, coding redundancy, interpixel redundancy, psychovisual redundancy and image compression models	**Form of Assessment** : Practice / Performance	Lectures, presentations, questions and answers, discussions and problem-based learning 3 X 50		**Material:** Chapter 8. Image Compression and Watermarking **Reference:** *RC Gonzalez and RE Woods,*	5%

11	Students are able to understand the transformation process in digital image processing	1.Students are able to understand the basic concepts of image transformation 2.Students are able to understand the concept of transformation using the Fourier transformation method 3.Students are able to understand the concept of transformation using the Hadamard-Walsh transformation method 4.Students are able to understand the concept of transformation using the Discrete Cosine and Wavelet transform transformation methods 5.Students are able to apply transformation methods in computer programs	**Form of Assessment** : Participatory Activities	Lectures, presentations, questions and answers, discussions and problem-based learning 3 X 50		**Material:** Chapter 7. Wavelet and Other Image Transforms **Library:** *RC Gonzalez and RE Woods,*	2%
12	Students are able to understand the transformation process in digital image processing	1.Students are able to understand the basic concepts of image transformation 2.Students are able to understand the concept of transformation using the Fourier transformation method 3.Students are able to understand the concept of transformation using the Hadamard-Walsh transformation method 4.Students are able to understand the concept of transformation using the Discrete Cosine and Wavelet transform transformation methods 5.Students are able to apply transformation methods in computer programs	**Form of Assessment** : Participatory Activities, Practice/Performance	Lectures, presentations, questions and answers, discussions and problem-based learning 3 X 50		**Material:** Chapter 7. Wavelet and Other Image Transforms **Library:** *RC Gonzalez and RE Woods,* **Material:** Chapter 7. Wavelet and Other Image Transforms **Library:** *RC Gonzalez and RE Woods,*	2%
13	Students are able to understand the concept and implementation of morphological processes in digital image processing	1.Students are able to understand the concept of morphological processes (dilation and erosion) in image processing 2.Students are able to understand the concept of morphological processes (opening and closing) in image processing 3.Students are able to apply morphological processes in computer programs	**Form of Assessment** : Participatory Activities, Practice/Performance	Lectures, presentations, questions and answers, discussions and problem-based learning			2%
14			**Form of Assessment** : Participatory Activities, Practice/Performance				4%
15			**Form of Assessment** : Participatory Activities, Practice/Performance				6%

16			**Form of Assessment** : Project Results Assessment / Product Assessment				35%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	20%
2.	Project Results Assessment / Product Assessment	35%
3.	Practice / Performance	25%
4.	Test	20%
		100%

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.