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

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Genetics and Genomics	4620104210	Genetics and Genomics	T=3	P=1	ECTS=6.36	3	April 27, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model	**Case Studies**	
Program Learning Outcomes (PLO)	**PLO study program which is charged to the course**	
	PLO-5	Able to communicate scientific ideas, both orally and in writing using appropriate communication media according to the target, as a means of lifelong learning for academic self-development.
	PLO-7	Able to work independently and collaboratively, as well as responsibly, in completing various tasks in class, in the laboratory and in the field.
	PLO-12	Able to demonstrate basic knowledge of biology relevant to science and mathematics to understand current scientific phenomena and issues and apply them in problem solving
	Program Objectives (PO)	
	PO - 1	Communicate concepts related to Mendel's Laws and their intersection with various different traits, develop these concepts and use the concepts that have been mastered to explain events in everyday life
	PO - 2	Communicate concepts related to the pseudo-deviation of Mendel's classical comparative numbers and use the concepts that have been mastered to explain events in everyday life.
	PO - 3	Communicate concepts related to multiple alleles, develop these concepts and apply the concepts that have been mastered in everyday life.
	PO - 4	Communicate concepts related to multiple genes/polygenes, develop these concepts and apply them in everyday life.
	PO - 5	Applying the principle of probability and Chi square in genetics and analyzing genetic research results
	PO - 6	Describe the genes in gonosomes and their use in the welfare of organisms, especially humans
	PO - 7	Describe sex determination in various living creatures
	PO - 8	Describe the nature of genetic material and its role in the inheritance of traits
	PO - 9	Describe the organization and structure of the genome, and their implications
	PO - 10	Communicate understanding and skills related to genome analysis techniques (DNA isolation, PCR, gene cloning, genome mapping and sequencing, mutagenesis analysis, gene silencing)
	PO - 11	Describe the applications of genome analysis and genomics in various fields
	PO - 12	Communicate understanding about sequenced genes (gene linkage) and crossing over
	PO - 13	Create a chromosome map of living creatures based on cross-breeding data
	PO - 14	Describe disorders caused by inborn errors of metabolism in humans and how to overcome them
	PO - 15	describes the Hardy-Weinberg equilibrium law and the assumptions used and its application in calculating allele frequencies in populations
	PO - 16	Skilled in carrying out practicum/research related to genetic concepts
	PO - 17	Skilled in carrying out simple DNA isolation
	PLO-PO Matrix	

P.O	PLO-5	PLO-7	PLO-12
PO-1			
PO-2			
PO-3			
PO-4			
PO-5			
PO-6			
PO-7			
PO-8			
PO-9			
PO-10			
PO-11			
PO-12			
PO-13			
PO-14			
PO-15			
PO-16			
PO-17			

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																
PO-5																
PO-6																
PO-7																
PO-8																
PO-9																
PO-10																
PO-11																
PO-12																
PO-13																
PO-14																
PO-15																
PO-16																
PO-17																

Short Course Description

Includes an introductory scope (introduction to terms used in studying genetics, Mendelian genetics (Mendel's Laws I & II, crosses with various different traits, pseudo-deviations from Mendel's Laws), multiple alleles, multiple genes, probability theory, X2 test, linkage and transfer cross-breeding, making chromosome maps, karyotypes in humans and their deviations, biochemical genetics and inborn errors of metabolism, basics of genetic engineering, basics of population genetics, genetic material and its expression, basics of gene & chromosome mutations. This course also provides students related to genomics which includes the organization and structure of the genome, as well as its implications, genome analysis techniques (DNA isolation, PCR, gene cloning, genome mapping and sequencing, mutagenesis analysis, gene silencing) and applications of genome analysis and genomics in various fields lecture activities, wet lab and dry lab practicums and assignments/research and study of cases that occur in everyday life in case methods packaging

References

Main :

1. Gardner, E.J., dkk. 1991. Principles of Genetics. New York: John Willey & Sons.
2. Sarin, C. 2002. Genetics. New Delhi: Tata McGraw-Hill Publishing Company Limited.
3. Susantini, E., Isnawati, Lisdiana L. 2012. Penuntun Praktikum Genetika. Surabaya: University Press
4. Susantini, E., Isnawati, Lisdiana L. 2012. Genetika Berbasis Penemuan. Surabaya: University Press
5. Klug, W.S., Cummings, M.R. et al. 2010. Essentials of Genetics. San Fransisco: Pearson Benjamin Cummings.
6. Primrose SB dan Twyman RM. 2006. Principles of Gene Manipulation and Genomics. Cornwall: Blackwell Publishing

Supporters:

Supporting lecturer	Dr. Isnawati, M.Si. Guntur Trimulyono, S.Si., M.Sc. Lisa Lisdiana, S.Si., M.Si., Ph.D. Ahmad Fudhaili, S.Si., M.Sc., Ph.D. Fitriari Izzatunnisa Muhaimin, B.Sc., M.Sc.

Week-	**Final abilities of each learning stage (Sub-PO)**	**Evaluation**		**Help Learning, Learning methods, Student Assignments, [Estimated time]**		**Learning materials [References]**	**Assessment Weight (%)**
		Indicator	**Criteria & Form**	**Offline (*offline*)**	**Online (*online*)**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Applying concepts related to Mendel's Laws and interactions with various different traits, developing these concepts and using the concepts that have been mastered to explain events in everyday life	a. Describe the meaning of terms commonly used in genetics. b. Explain Mendel's Law I and Mendel's Law II. c. Discover the variations in gametes produced in various individual genotypes. d. Find genotype comparisons and phenotype comparisons in crosses with various different traits. e. Implementing a fast way to find genotype comparisons and phenotype comparisons in crosses with many different traits.	**Criteria:** 1.Criteria 2.· According to the answer key, get the maximum score 3.· Many matches with the answer key get 50% or more of the maximum score 4.· Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5.· Answering incorrectly gets a maximum of 9% of the maximum score 6.· Not answering gets a score of 0 7.Form: test **Form of Assessment** : Participatory Activities, Tests	a. Discussion b. Guided discovery c. Doing practice questions (3 x 50 minutes) 4 X 50	meeting in the SiDia zoom room discussing concepts related to Mendel's Laws and crosses with various 4 x 50 different traits	**Material:** Mendelian Genetics **References:** *Susantini, E., Isnawati, Lisdiana L. 2012. Genetics Practical Guide. Surabaya: University Press*	5%
2	Communicate concepts related to the pseudo-deviation of Mendel's classical comparative numbers and use the concepts that have been mastered to explain events in everyday life.	a. Give examples of crosses where the results of the comparison of phenotype and genotype deviate from Mendel's classic comparison numbers. b. Calculating the phenotype and genotype ratios of several types of crosses whose phylia deviate from Mendel's classic ratio numbers. c. Explain the causes of deviations from Mendel's classic comparison numbers in several types of crosses d. Describe the meaning of pseudo deviation.	**Criteria:** 1.Criteria 2.· According to the answer key, get the maximum score 3.· Many matches with the answer key get 50% or more of the maximum score 4.· Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5.· Answering incorrectly gets a maximum of 9% of the maximum score 6.· Not answering gets a score of 0 7.Form: tests and assignments **Form of Assessment** : Participatory Activities	case study, looking at various cross-breeding results to determine the type of pseudo-crossing Mendel's Law, ending with a presentation of the cross-breeding cases studied 4 X 50	meetings like those held in offline learning but using SiDia zoom	**Material:** pseudo-deviation of Mendel's Laws **References:** *Gardner, EJ, et al. 1991. Principles of Genetics. New York: John Willey & Sons.*	5%

3	Communicate concepts related to multiple alleles, and multiple genes/polygenes, develop these concepts and apply the concepts that have been mastered in everyday life.	a. Describe the position of genes and their alleles on the chromosome. b. Describe the meaning of multiple alleles. c. Give examples of traits controlled by multiple alleles found in plants, animals and humans. d. Describes several crosses involving multiple alleles. e. Explain the meaning of biologically compatible and biologically incompatible marriages. f. Describe a suitable partner for oneself in terms of ABO blood type g. Map in the form of a graph/bar diagram the distribution of phenotypes on traits controlled by multiple genes. h. Describe the meaning of multiple genes. i. Give examples of traits controlled by multiple genes. j. Describes several crosses involving multiple genes. Describe the characteristics of their partner so that they have offspring with certain characteristics controlled by multiple genes (for example in terms of skin color and body height)	**Criteria:** 1.Criteria 2.· According to the answer key, get the maximum score 3.· Many matches with the answer key get 50% or more of the maximum score 4.· Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5.· Answering incorrectly gets a maximum of 9% of the maximum score 6.· Not answering gets a score of 0 7.Form: tests and assignments **Form of Assessment** : Participatory Activities	through case studies examine various phenomena in everyday life to determine the use of the concept of multiple alleles in everyday life and determine the use of the concept of multiple genes/polygenes in everyday life (3 x 50 minutes) 4 X 50	Case study learning activities via zoom meetings at SiDia 4 x 50	**Material:** Double genes and double alleles **Reference:** *Sarin, C. 2002. Genetics. New Delhi: Tata McGraw-Hill Publishing Company Limited.*	5%

4	Applying the principle of probability and Chi square in genetics and analyzing genetic research results	a. Applying the use of a binomial distribution to calculate the probability of an event occurring b. Apply Chi-square test to monohybrid, dihybrid crosses	**Criteria:** 1. Criteria 2. · According to the answer key, get the maximum score 3. · Many matches with the answer key get 50% or more of the maximum score 4. · Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5. · Answering incorrectly gets a maximum of 9% of the maximum score 6. · Not answering gets a score of 0 7. Form: tests and assignments **Form of Assessment** : Participatory Activities, Practical Assessment	a. Discussion b. Practice Presentation of 4 X 50 results	working on a virtual Lab to get data that was tested by Chi square and presented via zoom meeting at SiDia	**Material:** analysis of research results in the field of genetics using Chi-square **Reference:** *Susantini, E., Isnawati, Lisdiana L. 2012. Discovery-Based Genetics. Surabaya: University Press*	5%
5	Describe the concept of sex differences in human, animal and plant gonosomes as well as sex determination in various organisms	a. Explain the various methods of determining sex in various living creatures. b. Apply the method of determining sex to various living creatures	**Criteria:** 1. Criteria 2. · According to the answer key, get the maximum score 3. · Many matches with the answer key get 50% or more of the maximum score 4. · Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5. · Answering incorrectly gets a maximum of 9% of the maximum score 6. · Not answering gets a score of 0 7. Form: tests and assignments **Form of Assessment** : Practice / Performance	a. Discussion. b. Practice c. Doing practice questions (1 x 50 minutes) 4 X 50	lectures with zoom meetings at SiDia	**Material:** Sex differences in humans, animals and humans **References:** *Klug, WS, Cummings, MR et al. 2010. Essentials of Genetics. San Francisco: Pearson Benjamin Cummings.*	5%

6	Describe the nature of genetic material and its replication in the inheritance of traits	a. Explain the structure and function of DNA b. Explain the structure and function of RNA c. Explain the structure and function of chromosomes d. Explain the process of replicating genetic material	**Criteria:** 1.Criteria 2.· According to the answer key, get the maximum score 3.· Many matches with the answer key get 50% or more of the maximum score 4.· Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5.· Answering incorrectly gets a maximum of 9% of the maximum score 6.· Not answering gets a score of 0 7.Form: tests and assignments **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	a. Discussion b. Practice c. DNA model creation as an assignment (1 x 50 minutes) 4 X 50	Online lectures via zoom on SiDia 4 x 50	**Material:** Genetic material in living things **References:** *Primrose SB and Twyman RM. 2006. Principles of Gene Manipulation and Genomics. Cornwall: Blackwell Publishing*	10%
7	Describe gene expression in the inheritance of traits in living things	a. Explain the transcription process b. Explain the translation process c. Explain the regulatory process in gene expression	**Criteria:** 1.Criteria 2.· According to the answer key, get the maximum score 3.· Many matches with the answer key get 50% or more of the maximum score 4.· Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5.· Answering incorrectly gets a maximum of 9% of the maximum score 6.· Not answering gets a score of 0 7.Form: tests and assignments **Form of Assessment** : Participatory Activities	examine cases of disorders and abnormalities in gene expression and the characteristics that appear in the Case Study packaging and the results are presented 4 X 50	carrying out case studies via zoom at SiDia		5%
8	Midterm exam		**Form of Assessment** : Participatory Activities	4 X 50			10%

9	Describe the organization and structure of the genome, and their implications	a. Explain the organization of the genome b. Explain the structure of the genome c. Describe the implications related to the concept of genome organization and structure	**Criteria:** 1.Criteria 2.· According to the answer key, get the maximum score 3.· Many matches with the answer key get 50% or more of the maximum score 4.· Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5.· Answering incorrectly gets a maximum of 9% of the maximum score 6.· Not answering gets a score of 0 7.Form: tests and assignments **Form of Assessment** : Participatory Activities	presentation discussion 4 X 50	lecture via Zoom SiDia	**Material:** Gene expression and its implications for everyday life **References:** *Klug, WS, Cummings, MR et al. 2010. Essentials of Genetics. San Francisco: Pearson Benjamin Cummings.*	5%
10	Communicate understanding regarding genome analysis techniques (DNA isolation, PCR, gene cloning, genome mapping and sequencing, mutagenesis analysis, gene silencing)	a. Describe DNA isolation techniques b. Describe PCR techniques c. Describe gene cloning techniques d. Describe genome mapping and sequencing techniques e. Describe mutagenesis analysis techniques f. Describe gene silencing techniques	**Criteria:** 1.Criteria 2.· According to the answer key, get the maximum score 3.· Many matches with the answer key get 50% or more of the maximum score 4.· Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5.· Answering incorrectly gets a maximum of 9% of the maximum score 6.· Not answering gets a score of 0 7.Form: tests and assignments **Form of Assessment** : Participatory Activities	demonstration, discussion, presentation 4 X 50	learning via zoom at SiDia	**Material:** Gene expression mechanisms **Reference:** *Sarin, C. 2002. Genetics. New Delhi: Tata McGraw-Hill Publishing Company Limited.*	5%
11	Describe the applications of genome analysis and genomics in various fields	a. Describe the applications of genomes and genomics in the medical field b. Describe the applications of genomes and genomics in the field of conservation c. Describe the applications of genomes and genomics in the fields of synthetic biology and biotechnology d. Describe the applications of genomes and genomics in the fields of anthropology and other social sciences	**Criteria:** 1.Criteria 2.· According to the answer key, get the maximum score 3.· Many matches with the answer key get 50% or more of the maximum score 4.· Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5.· Answering incorrectly gets a maximum of 9% of the maximum score 6.· Not answering gets a score of 0 7.Form: tests and assignments **Form of Assessment** : Participatory Activities, Practice/Performance	Case study examines cases of genome and genomic applications in various fields 4 X 50	assignment to study cases of genome and genomics applications asynchronously and present results synchronously via zoom on SiDia 4 x 50	**Material:** Applications of genomes and genomics **References:** *Gardner, EJ, et al. 1991. Principles of Genetics. New York: John Willey & Sons.*	10%

12	Communicate understanding about sequenced genes (gene linkage) and crossing over	a. Explain the meaning of sequenced genes. b. Make a crossover chart for genes that sequence perfectly and imperfectly in c. Calculate the crossover value.	**Criteria:** 1.Criteria 2.· According to the answer key, get the maximum score 3.· Many matches with the answer key get 50% or more of the maximum score 4.· Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5.· Answering incorrectly gets a maximum of 9% of the maximum score 6.· Not answering gets a score of 0 7.Form: tests and assignments **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	reviewing modules, discussions and presentations 4 X 50	learning via zoom at SiDia 4 x 50		5%
13	Apply the principles of making chromosome maps of certain living creatures	a. Determining the distance between genes. b. Draw a relative chromosome map with sequential steps. c. Calculate the interference value.	**Criteria:** 1.Criteria 2.· According to the answer key, get the maximum score 3.· Many matches with the answer key get 50% or more of the maximum score 4.· Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5.· Answering incorrectly gets a maximum of 9% of the maximum score 6.· Not answering gets a score of 0 7.Form: tests and assignments **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	. Discussion b. Presentation c. Create a chromosome map based on the given cross-result data (3 x 50 minutes) 4 X 50	learning via zoom at SiDia 4 x 50	**Material:** Gene sequencing and crossing over **References:** *Klug, WS, Cummings, MR et al. 2010. Essentials of Genetics. San Francisco: Pearson Benjamin Cummings.*	5%

14	Describe disorders caused by inborn errors of metabolism in humans, prevention and how to avoid the appearance of symptoms	a. Explain the metabolic pathway of Phe-Tir. b. Estimating biochemical reaction pathways that influence bacterial growth c. Describe how to prevent and avoid the appearance of symptoms of inherited metabolic diseases	**Criteria:** 1.Criteria 2.· According to the answer key, get the maximum score 3.· Many matches with the answer key get 50% or more of the maximum score 4.· Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5.· Answering incorrectly gets a maximum of 9% of the maximum score 6.· Not answering gets a score of 0 7.Form: tests and assignments **Form of Assessment** : Participatory Activities	reviewing modules, discussions and presentations 4 X 50	learning via zoom at SiDia 4 x 50	**Material:** Congenital metabolic disorders, prevention and treatment **References:** *Susantini, E., Isnawati, Lisdiana L. 2012. Discovery-Based Genetics. Surabaya: University Press*	5%
15	Apply the Hardy-Weinberg balance law and the assumptions used and its application in calculating allele frequencies in populations	a. Explain the assumptions used in the Hardy-Weinberg Law. b. Calculating the frequency of multiple alleles in the ABO blood group system.	**Criteria:** 1.Criteria 2.· According to the answer key, get the maximum score 3.· Many matches with the answer key get 50% or more of the maximum score 4.· Slight conformity with the answer key gets less than 50% to 10% of the maximum score 5.· Answering incorrectly gets a maximum of 9% of the maximum score 6.· Not answering gets a score of 0 7.Form: tests and assignments **Form of Assessment** : Participatory Activities, Tests	a. Discussion. b. Practice c. Conduct a small research to calculate the frequency of alleles in the surrounding community (3 x 50 minutes) 4 X 50	learning via zoom at SiDia	**Material:** Population Genetics **References:** *Klug, WS, Cummings, MR et al. 2010. Essentials of Genetics. San Francisco: Pearson Benjamin Cummings.*	5%
16			**Form of Assessment** : Participatory Activities, Tests	writing test			10%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	67.5%
2.	Project Results Assessment / Product Assessment	10%
3.	Practical Assessment	2.5%
4.	Practice / Performance	10%
5.	Test	10%
		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.