	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
Population Genetics*	4620102083		T=2	P=0	ECTS=3.18	7	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Dr. H. Sunu Kuntjoro, S.Si., M.Si.

Learning model	Project Based Learning	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	PLO-6	Able to apply logical, critical, systematic and innovative thinking in the context of developing or implementing science and/or technology according to their field of expertise.
	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-10	Able to design and conduct experiments in the field of biology, manage, analyze, interpret, document and store research data, to manage biological natural resources
	Program Objectives (PO)	
	PO - 1	Understand concepts related to the introduction and scope of population genetics
	PO - 2	Understand concepts related to the basics of statistics used in population genetics
	PO - 3	Understand concepts related to random mating and calculating changes in allele frequencies with various causes
	PO - 4	Understand concepts related to genetic flow, its causes and simulations
	PO - 5	Understand concepts related to bottle neck population, its causes and consequences
	PO - 6	Understand concepts related to bottle neck population, its causes and consequences
	PO - 7	Understand concepts related to plant population genetics and their use
	PO - 8	Understand concepts related to animal population genetics and their use
	PO - 9	Understand concepts related to microbial population genetics and their use
	PO - 10	Understand concepts related to human population genetics and their implementation
	PLO-PO Matrix	

P.O	PLO-6	PLO-7	PLO-10
PO-1			
PO-2			
PO-3			
PO-4			
PO-5			
PO-6			
PO-7			
PO-8			
PO-9			
PO-10			

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																

Short Course Description	Study of introduction to population genetics, basics of statistics supporting population genetics, random marriage in populations and the Hardy-Weinberg law, changes in gene frequencies due to migration and mutation, changes in gene frequencies due to selection, changes in gene frequencies due to dominance events, changes in gene frequencies due to combinations multiple causes, genetic drift, founder effect, population bottleneck, population genetics in plants, population genetics in animals, population genetics in bacteria, and population genetics in humans. Assessment is carried out through presentations, discussions and metacognition
References	**Main :**

1. Mangoendidjojo, W. 2016. Genetika Populasi. UGM Press, Yogyakarta.
2. Baumberg S, Young J P W, Wellington E M H, and Saunders J R. 1995. Population Genetics of Bacteria. Cambridge University Press, New York.
3. Crowder L V. 2016. Genetika Tumbuhan. UGM Press, Yogykarta.
4. Kor Oldenbroek en Liesbeth van der Waaij. 2014. Animal breeding and genetics for BSc students. Groen Kennisnet, Netherland.
5. Adisewoyo S S. 1998. Genetika Manusia. UGM Press, Yogyakarta.

Supporters:

1. Artikel dari jurnal

Supporting lecturer	Prof. Dr. Endang Susantini, M.Pd. Dr. Isnawati, M.Si. Guntur Trimulyono, S.Si., M.Sc. Lisa Lisdiana, S.Si., M.Si., 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	Understand concepts related to introduction to population genetics.	1. Explain the meaning of population genetics. 2. Explain the scope of population genetics. 3. Describe the scope of genetics and population genetics studies. 4. Demonstrate an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), and UTS (multiplied by 2) **Form of Assessment** : Participatory Activities	Presentation, discussion, and Metacognitive. 2 X 50		**Material:** Mendel and Hardy-Weinberg Laws **Reference:** *Mangoendidjojo, W. 2016. Population Genetics. UGM Press, Yogyakarta.* **Material:** introduction to population genetics **References:** *Articles from journals*	0%
2	Understand concepts related to the basics of statistics supporting population genetics.	1. Skilled in calculating the probability of an event. 2. Skilled in calculating the probability of events in crosses 3. Demonstrating an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), Assignments (multiplied by 2), and UTS (multiplied by 2) **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion, and Metacognitive. 2 X 50		**Material:** Probability of occurrence and crossing **Reference:** *Mangoendidjojo, W. 2016. Population Genetics. UGM Press, Yogyakarta.* **Material:** Chances of occurrence and crossing **Reference:** *Articles from journals*	5%

3	Understand concepts related to Random Marriage in Populations and the Hardy-Weinberg Law.	1. Explain the meaning of random marriage. 2. Skilled in calculating gene and genotype frequencies. 3. Describe the Hardy-Weinberg Law. 4. Demonstrate an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), Assignments (multiplied by 2), and UTS (multiplied by 2) **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion, and Metacognitive. 2 X 50		**Material:** a. Changes in allele frequencies due to migration, mutation, selection and a combination of various events. **Reference:** *Mangoendidjojo, W. 2016. Population Genetics. UGM Press, Yogyakarta.* **Material:** Changes in allele frequencies due to migration, mutation, selection and a combination of various events. **Reference:** *Crowder L V. 2016. Plant Genetics. UGM Press, Yogykarta.* **Material:** Changes in allele frequencies due to migration, mutation, selection and a combination of various events. **Reference:** *Articles from journals*	5%
4	Understand concepts related to Random Marriage in Populations and the Hardy-Weinberg Law.	1. Explain the meaning of random marriage. 2. Skilled in calculating gene and genotype frequencies. 3. Describe the Hardy-Weinberg Law. 4. Demonstrate an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), Assignments (multiplied by 2), and UTS (multiplied by 2) **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Presentation, discussion, and Metacognitive. 2 X 50		**Material:** a. Changes in allele frequencies due to migration, mutation, selection and a combination of various events. **Reference:** *Mangoendidjojo, W. 2016. Population Genetics. UGM Press, Yogyakarta.* **Material:** Changes in allele frequencies due to migration, mutation, selection and a combination of various events. **Reference:** *Crowder L V. 2016. Plant Genetics. UGM Press, Yogykarta.* **Material:** Changes in allele frequencies due to migration, mutation, selection and a combination of various events. **Reference:** *Articles from journals*	5%

5	Understand concepts related to changes in gene frequencies due to selection.	1. Describe the meaning of selection 2. Skilled in calculating changes in gene frequencies due to selection 3. Demonstrate an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), Assignments (multiplied by 2), UTS (multiplied by 2). **Form of Assessment** : Participatory Activities	Presentation, discussion, and Metacognitive. 2 X 50		**Material:** a. Gene flow in human populations and its consequences b. Gene flow in animal populations and its consequences c. Gene flow in plant populations and its consequences d. Gene flow in microbial populations and its consequences **References:** *Baumberg S, Young JPW, Wellington EMH, and Saunders J R. 1995. Population Genetics of Bacteria. Cambridge University Press, New York.* **Material:** a. Gene flow in human populations and its consequences b. Gene flow in animal populations and its consequences c. Gene flow in plant populations and its consequences d. Gene flow in microbial populations and its consequences **References:** *Crowder L V. 2016. Plant Genetics. UGM Press, Yogykarta.* **Material:** a. Gene flow in human populations and its consequences b. Gene flow in animal populations and its consequences c. Gene flow in plant populations and its consequences d. Gene flow in microbial populations and its consequences **Bibliography:** *Kor Oldenbroek en Liesbeth van der Waaij. 2014. Animal breeding and genetics for BSc students. Groen Kennisnet, Netherlands.* **Material:** a. Gene flow in human populations and its consequences b. Gene flow in animal populations and its consequences c. Gene flow in plant populations and its consequences d. Gene flow in microbial populations and its consequences **Bibliography:** *Articles from journals*	0%

6	Understand concepts related to changes in gene frequencies due to selection.	1. Describe the meaning of selection 2. Skilled in calculating changes in gene frequencies due to selection 3. Demonstrate an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), Assignments (multiplied by 2), UTS (multiplied by 2). **Form of Assessment** : Participatory Activities	Presentation, discussion, and Metacognitive. 2 X 50		**Material:** a. Gene flow in human populations and its consequences b. Gene flow in animal populations and its consequences c. Gene flow in plant populations and its consequences d. Gene flow in microbial populations and its consequences **References:** *Baumberg S, Young JPW, Wellington EMH, and Saunders J R. 1995. Population Genetics of Bacteria. Cambridge University Press, New York.* **Material:** a. Gene flow in human populations and its consequences b. Gene flow in animal populations and its consequences c. Gene flow in plant populations and its consequences d. Gene flow in microbial populations and its consequences **References:** *Crowder L V. 2016. Plant Genetics. UGM Press, Yogykarta.* **Material:** a. Gene flow in human populations and its consequences b. Gene flow in animal populations and its consequences c. Gene flow in plant populations and its consequences d. Gene flow in microbial populations and its consequences **Bibliography:** *Kor Oldenbroek en Liesbeth van der Waaij. 2014. Animal breeding and genetics for BSc students. Groen Kennisnet, Netherlands.* **Material:** a. Gene flow in human populations and its consequences b. Gene flow in animal populations and its consequences c. Gene flow in plant populations and its consequences d. Gene flow in microbial populations and its consequences **Bibliography:** *Articles from journals*	0%

7	Understand concepts related to changes in gene frequencies due to a combination of several causes.	1. Skilled in calculating gene frequencies and changes due to a combination of several causes. 2. Demonstrate an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), Assignments (multiplied by 2), UTS (multiplied by 2). **Form of Assessment** : Participatory Activities	Presentation, discussion, and Metacognitive. 2 X 50		**Material:** a. Pharmacogenomics b. Application of fekmakogenomics in the treatment of a disease **References:** *Mangoendidjojo, W. 2016. Population Genetics. UGM Press, Yogyakarta.* **Material:** a. Pharmacogenomics b. Application of fecmacogenomics in the treatment of disease. **References:** *Baumberg S, Young JPW, Wellington EMH, and Saunders J R. 1995. Population Genetics of Bacteria. Cambridge University Press, New York.* **Material:** a. Pharmacogenomics b. Application of fecmakogenomics in the treatment of a disease. **Reference:** *Articles from journals*	5%

8	UTS		**Form of Assessment** : Participatory Activities	2 X 50		**Material:** All material **References:** *Mangoendidjojo, W. 2016. Population Genetics. UGM Press, Yogyakarta.* **Material:** All material **References:** *Baumberg S, Young JPW, Wellington EMH, and Saunders J R. 1995. Population Genetics of Bacteria. Cambridge University Press, New York.* **Material:** All material **Reference:** *Crowder L V. 2016. Plant Genetics. UGM Press, Yogykarta.* **Material:** All material **Bibliography:** *Kor Oldenbroek en Liesbeth van der Waaij. 2014. Animal breeding and genetics for BSc students. Groen Kennisnet, Netherlands.* **Material:** All material **Reference:** *Adisewoyo S S. 1998. Human Genetics. UGM Press, Yogyakarta.* **Material:** All material that has been explained **References:** *Articles from journals*	10%
9	Understand concepts related to genetic flow.	1. Describe the meaning of genetic flow. 2. Explain the causes and consequences of genetic flow. 3. Skilled in simulating genetic flow. 4. Demonstrate an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), Assignments (multiplied by 2), UTS (multiplied by 2). **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussion, PjBL assignment : Determining basic questions, determining the topics raised regarding concepts related to bottle neck population, causes and consequences 2 X 50			10%
10	Understand concepts related to genetic flow.	1. Describe the meaning of genetic flow. 2. Explain the causes and consequences of genetic flow. 3. Skilled in simulating genetic flow. 4. Demonstrate an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), Assignments (multiplied by 2), UTS (multiplied by 2). **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussion, PjBL assignment: Create a project design regarding concepts related to bottle neck population, causes and consequences 2 X 50			10%

11	Understand concepts related to genetic flow.	1. Describe the meaning of genetic flow. 2. Explain the causes and consequences of genetic flow. 3. Skilled in simulating genetic flow. 4. Demonstrate an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), Assignments (multiplied by 2), UTS (multiplied by 2). **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussions, PjBL assignments : Prepare a schedule of activities in writing scientific articles: schedule for preparing, monitoring, presenting, and deadline for submitting articles 2 X 50			10%
12	Understand concepts related to population genetics in plants.	1. Describe the scope of population genetics in plants 2. Describe the benefits of studying population genetics in plants 3. Give examples of cases/phenomena related to population genetics in plants that are beneficial for humans 4. Demonstrate an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), Assignments (multiplied by 2), UTS (multiplied by 2). **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussions, PjBL assignments: Monitoring the progress of article preparation and peer-review 2 X 50			10%
13	Understand concepts related to population genetics in plants.	1. Describe the scope of population genetics in plants 2. Describe the benefits of studying population genetics in plants 3. Give examples of cases/phenomena related to population genetics in plants that are beneficial for humans 4. Demonstrate an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), Assignments (multiplied by 2), UTS (multiplied by 2). **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussions, PjBL assignments: Monitoring the progress of article preparation and peer-review 2 X 50			10%
14	Understand concepts related to population genetics in bacteria	1. Describe the scope of population genetics in bacteria 2. Describe the benefits of studying population genetics in bacteria 3. Give examples of cases/phenomena related to population genetics in bacteria 4. Demonstrate an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), Assignments (multiplied by 2), UTS (multiplied by 2). **Form of Assessment** : Project Results Assessment / Product Assessment	Discussions, PjBL assignments: Monitoring the progress of article preparation and peer-review 2 X 50			5%

15	Understand concepts related to population genetics in humans	1. Describe the scope of population genetics in humans. 2. Describe the benefits of studying population genetics in human plants. 3. Give examples of cases/phenomena related to population genetics in humans. 4. Demonstrate an honest and independent attitude during the learning process.	**Criteria:** Participation (multiplied by 2), Assignments (multiplied by 2), UTS (multiplied by 2). **Form of Assessment** : Participatory Activities	Discussion, PjBL assignment: Conduct results assessment: provide peer-review input on each 2 X 50 article preparation			0%
16	UAS	Investigate information from scientific study references on concepts related to the bottle neck population, its causes and consequences. Produce scientific study articles (articles) on concepts related to the bottle neck population, its causes and consequences. Find appropriate journals for submitting scientific papers related to concepts related to the bottle neck. population, causes and consequences	**Criteria:** UAS multiplied by 3 **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Discussion, PjBL assignment: Conducting evaluation: reflection on experience in preparing and submitting systematical review 2 X 50			15%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	50%
2.	Project Results Assessment / Product Assessment	50%
		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.