	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Chemistry Masters Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Molecular Genetics and Genetic Engineering	4710202024	Biochemistry	T=2	P=0	ECTS=4.48	1	June 20, 2022

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model: Project Based Learning

Program Learning Outcomes (PLO)

PLO study program which is charged to the course

Program Objectives (PO)

PO - 1	Being able to understand the basic concepts of DNA includes understanding: genetic material in terms of structure, function or gene expression, genes-genetic code-mutations, variability/variation of genes in populations/population dynamics and engineering of genetic material.
PO - 2	Able to analyze cloning results based on data obtained from the instruments used such as PCR, Sequencing
PO - 3	Able to design genetic engineering strategies to solve scientific problems by linking inter- or multidisciplinary science

PLO-PO Matrix

P.O
PO-1
PO-2
PO-3

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																

Short Course Description: Study of various techniques in the field of genetics that are widely used in further understanding genetic mechanisms and gene expression in living things. The methods used to study this material are PjBL and case study. To measure the achievement of these lectures using tests, performance assessments and product assessments.

References

Main :

1. Brown, T.A., 1989, Genetics : A Molecular Approach , London : Van Nostrand Reinhold (International) Co. Ltd.
2. Glick, B.R., and Pasternak, J.J., 1994, Molecular Biotechnology : Principles and Application of Recombinant DNA , Washington, D.C : ASM Press

Supporters:

Supporting lecturer: Prof. Dr. Nuniek Herdyastuti, M.Si.

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	1. Basic Concepts of Molecular Genetics and Genetic Engineering 2. Understanding genetic engineering, basic concepts and research developments related to genetic engineering	Students are able to understand the basic concepts of molecular genetics and genetic engineering	**Criteria:** According to assessment guidelines	Lectures, discussions 2 X 50	Student assignment: Development of genetic engineering through GC	**Material:** Basic Concepts of Molecular Genetics and Genetic Engineering **References:** *Glick, BR, and Pasternak, JJ, 1994, Molecular Biotechnology: Principles and Application of Recombinant DNA, Washington, DC: ASM Press*	5%
2	Structure and Function of Genes: DNA as genetic material	Students are able to explain DNA as genetic material	**Criteria:** Discusses the structure of DNA based on the Watson-Crick article **Form of Assessment** : Participatory Activities	Lectures, discussions 2 X 50		**Material:** Structure and Function of Genes: DNA as genetic material **References:** *Glick, BR, and Pasternak, JJ, 1994, Molecular Biotechnology: Principles and Application of Recombinant DNA, Washington, DC: ASM Press*	4%
3	Understanding the stages of processing genetic information and its control: Replication Stage	1. Explain the replication model 2. Explain DNA polymerase 3. Explain the replication mechanism	**Criteria:** Explain the difference between leading strand and lagging strand in visualization form **Form of Assessment** : Project Results Assessment / Product Assessment	Lectures, discussions, questions and answers 2 X 50	Explaining the difference between leading strand and lagging strand in the form of visualization uploaded to GC	**Material:** Replication **Bibliography:** *Glick, BR, and Pasternak, JJ, 1994, Molecular Biotechnology: Principles and Application of Recombinant DNA, Washington, DC: ASM Press*	6%
4	Understanding the stages of processing genetic information and its control: Transcription Stage	1. Explain the initiation stage 2. Explain the elongation stage 3. Explain the termination stage 4. Explain negative control (Lacperon)	**Criteria:** Explaining the differences between repression and induction in transcription control in the form of visualization	Discussion, presentation 2 X 50		**Material:** Transcription **Bibliography:** *Glick, BR, and Pasternak, JJ, 1994, Molecular Biotechnology: Principles and Application of Recombinant DNA, Washington, DC: ASM Press*	5%

5	Understanding the stages of processing genetic information and its control: Translation Stage	1. Explain the initiation stage 2. Explain the elongation stage 3. Explain the termination stage	**Criteria:** Solve questions related to protein formation from replication to translation	Presentation, discussion 2 X 50		**Material:** **Bibliography** translation : *Glick, BR, and Pasternak, JJ, 1994, Molecular Biotechnology: Principles and Application of Recombinant DNA, Washington, DC: ASM Press*	5%
6	Analyzing the occurrence of Mutations	1. Definition of mutation 2. Types of mutation 3. Mechanism of mutation	**Criteria:** Understand the mutations that occur by referring to the related articles **Form of Assessment** : Participatory Activities	Case method 2 X 50		**Material:** Mutations **References:** *Glick, BR, and Pasternak, JJ, 1994, Molecular Biotechnology: Principles and Application of Recombinant DNA, Washington, DC: ASM Press*	4%
7	Able to apply gene variation detection techniques	1. Understand several gene variation detection techniques: PCR, Sequencing, RFLP etc. 2. Apply gene variation detection techniques in certain cases	**Criteria:** Analyzing articles related to gene variation detection **Form of Assessment** : Participatory Activities	Case Method 2 X 50		**Material:** Gene variation detection techniques **References:** *Glick, BR, and Pasternak, JJ, 1994, Molecular Biotechnology: Principles and Application of Recombinant DNA, Washington, DC: ASM Press*	4%
8	Midterm Exam: Material for weeks 1 - 7	Able to understand and complete the UTS test material for weeks 1-7	**Criteria:** Answer all written tests correctly	2 X 50	Online written test 2 x 50		15%
9	Understand the basic concepts of genetic engineering / gene cloning, cloning vectors and restriction enzymes.	1. Be able to explain the meaning of genetic engineering / gene cloning. 2. Be able to explain the definition of recombinant DNA. 3. Able to explain the stages in genetic engineering techniques. 4. Able to understand the role, requirements and types of vectors used in cloning 5. Able to explain how to obtain DNA fragments.	**Criteria:** Analyzing articles related to gene cloning by identifying vectors and cutting DNA genes **Form of Assessment** : Participatory Activities	Case study 2 X 50		**Material:** Gene cloning strategies: Vectors and restriction enzymes **References:** *Brown, TA, 1989, Genetics: A Molecular Approach, London: Van Nostrand Reinhold (International) Co. Ltd.*	5%

10	Understand the basic concepts of genetic engineering / gene cloning, cloning vectors and restriction enzymes.	6. Be able to understand the role of restriction enzymes in obtaining specific DNA fragments. 7. Be able to differentiate between each type of restriction enzyme. 8. Able to analyze the recognition area for restriction enzymes. 9. Be able to explain several examples of typical restriction enzymes in the area of introduction and cutting results as well as their applications.	**Criteria:** Analyze articles related to gene cloning by identifying the enzymes used for cutting and joining target genes **Form of Assessment** : Participatory Activities	Case study 2 X 50		**Material:** gene cloning, cloning vectors and restriction enzymes **References:** *Brown, TA, 1989, Genetics: A Molecular Approach, London: Van Nostrand Reinhold (International) Co. Ltd.*	4%
11	Understand gene cloning strategies using plasmid vectors, especially pBR322 and pUC8 and identify recombinant clones.	1. Be able to explain the basic characteristics of plasmids and the requirements for plasmids as cloning vectors. 2. Be able to explain examples of plasmids that are often used as cloning vectors. 3. Be able to explain the genetic organization of plasmids (pBR322 and pUC8). 4. Be able to explain the advantages of pBR 322 and pUC8 as plasmid vectors.	**Criteria:** Analyze articles related to gene cloning by identifying the vector used **Form of Assessment** : Participatory Activities	Case Study 2 X 50		**Material:** Vectors in Gene Cloning **References:** *Brown, TA, 1989, Genetics: A Molecular Approach, London: Van Nostrand Reinhold (International) Co. Ltd.*	5%
12	Understand gene cloning strategies using plasmid vectors, especially pBR322 and pUC8 and identify recombinant clones.	1. Be able to mention the stages of gene cloning with plasmid pBR322 or pUC8 based on related articles. 2. Able to explain how to overcome problems that arise during the ligation process. 3. Be able to explain the screening and selection system for the pBR322 or pUC8 plasmid based on related articles.	**Criteria:** Analyze articles related to gene cloning by identifying recombinant clones in pBR322 or pUC8. **Form of Assessment** : Participatory Activities	Case Study 2 X 50		**Material:** Identification of recombinant genes **References:** *Brown, TA, 1989, Genetics: A Molecular Approach, London: Van Nostrand Reinhold (International) Co. Ltd.*	3%

13	Understand how to identify genes produced in the cloning process.	1. Able to understand the identification of recombinant genes. 2. Be able to explain the basic concepts of hybridization. 3. Be able to explain the steps in the hybridization process. 4. Able to analyze how to detect hybridization results.	**Criteria:** Analyze articles related to recombinant gene identification referring to related articles **Form of Assessment** : Participatory Activities	Case study, Presentation, discussion 2 X 50		**Material:** Recombinant Gene Identification **References:** *Brown, TA, 1989, Genetics: A Molecular Approach, London: Van Nostrand Reinhold (International) Co. Ltd.*	5%
14	Able to understand in vitro cloning (PCR)	1. Able to explain the basic concepts of PCR. 2. Be able to explain the stages of the PCR reaction in each PCR cycle. 3. Be able to explain PCR amplification with a certain number of cycles. 4. Be able to explain the advantages of the PCR technique. 5. Able to explain the application of PCR in several aspects of life.	**Criteria:** Analyze articles related to the use of PCR in gene cloning **Form of Assessment** : Participatory Activities	Case study, Presentation, discussion 2 X 50		**Material:** PCR **References:** *Brown, TA, 1989, Genetics: A Molecular Approach, London: Van Nostrand Reinhold (International) Co. Ltd.*	5%
15	Applying gene cloning to several life applications	6. Be able to explain the basic concepts of therapeutic cloning. 7. Be able to explain the stages of therapeutic cloning. 8. Be able to explain the uses of therapeutic cloning. 9. Be able to explain in general the molecular structure of the insulin hormone. 10. Be able to explain the stages of cloning the insulin hormone gene.	**Criteria:** Review the gene cloning article by explaining the techniques used to identify it	Case method 2 X 50		**Material:** Articles related to gene cloning applications. **Reference:** *Brown, TA, 1989, Genetics: A Molecular Approach, London: Van Nostrand Reinhold (International) Co. Ltd.*	5%
16	Final exam material for weeks 9-15				Online written test		20%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	39%
2.	Project Results Assessment / Product Assessment	6%
		45%

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.