	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Bachelor of Science Education Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Biophysics	8420103018		T=3	P=0	ECTS=4.77	2	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Prof. Dr. Erman, M.Pd.

Learning model	**Case Studies**	
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**	
	PLO-11	Design and conduct research about learning of integrated science, and acquire, analyze, and interpret the research data
	Program Objectives (PO)	
	PO - 1	Able to use ICT to analyze problems of matter, motion and energy (calculations and making graphs).
	PO - 2	Master the concepts, principles and laws of matter, motion and energy in terms of physics, biology and chemistry and be able to formulate them to solve problems in everyday life.
	PO - 3	Able to carry out simple research on the Motion and Change of an object in a comprehensive manner, in terms of physics, biology and chemistry so that it can be used to provide various alternative solutions to problems in the field of science. Responsible for lecture assignments and preparing practicum results reports.

PLO-PO Matrix

P.O	PLO-11
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	Discussion of cross-disciplinary subjects of biology and physics in living creatures and their environment, including the electrical properties of cells, structure and dynamics of biomolecules, environmental biophysics, and methods in biophysics. Lectures are carried out with modeling, presentations and discussions.

References

Main :

1. Kappen, Bert. 2008. Introduction to Biophysics, Handout. Radboud University Nijmegen.
2. Nölting Bengt. 2006. Methods in Modern Biophysics. Berlin: Springer.
3. Tuszynski, Jack A., dan Kurzynski, Michal. 2003. Introduction to Molecular Biophysics. London: CRC Press.
4. Waigh, Tom A.. 2007. Applied Biophysics . London: John Wiley and Sons, Ltd.
5. Carl J. Payton and Roger M. Bartlett. 2008. Biomechanical Evaluation of Movement in Sport and Exercise . The British Association of Sport and Exercise Sciences Guideline
6. Duane Knudson. 2019. Fundamentals of Biomechanics . New York: Springer.
7. Lubert, Styer. 2000. Biokomia Vol I Edisi 4. Jakarta: EGC.

Supporters:

Supporting lecturer	Prof.Dr. Wahono Widodo, M.Si. Dr. Mohammad Budiyanto, S.Pd., M.Pd. An Nuril Maulida Fauziah, S.Pd., M.Pd. Dhita Ayu Permata Sari, S.Pd., M.Pd. Aris Rudi Purnomo, S.Si., M.Pd., M.Sc. Fasih Bintang Ilhami, S.Kep., M.T., Ph.D. Dyah Permata Sari, S.Pd., M.Pd.

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	Utilizing ICT-based learning resources and learning media to analyze the magnitude of translational motion and curvilinear motion (rotation and rotation) in the motion of living things and their application in everyday life	1. Analyzing the magnitude of translational movement in living things through case studies and graphs 2. Analyzing the magnitude of curved motion (rotation and rotation) in living things through case studies and graphs 3. Apply the concept of translational and curvilinear motion (rotation and rotation) to the motion of living creatures	**Criteria:** Accurate understanding and analysis of translational motion and curvilinear motion (rotation and rotation) in the motion of living creatures and their application in everyday life. **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Material:** Translational and curvilinear motion (projection and rotation) in the Motion of Living Creatures **References:** *Kappen, Bert. 2008. Introduction to Biophysics, Handout. Radboud University Nijmegen.* **Material:** Translational and curvilinear motion (rotation and rotation) in the Motion of Living Creatures **Reference:** *Nölting Bengt. 2006. Methods in Modern Biophysics. Berlin: Springer.* **Material:** Translational and curvilinear motion (rotation and rotation) in the Motion of Living Creatures **References:** *Tuszynski, Jack A., and Kurzynski, Michal. 2003. Introduction to Molecular Biophysics. London: CRC Press.* **Material:** Translational and curvilinear motion (rotation and rotation) in the movement of living creatures. **Reference:** *Waigh, Tom A.. 2007. Applied Biophysics. London: John Wiley and Sons, Ltd.*	5%

2	Utilizing ICT-based learning resources and learning media to analyze the magnitude of translational motion and curvilinear motion (rotation and rotation) in the motion of living things and their application in everyday life	1. Analyzing the magnitude of translational movement in living things through case studies and graphs 2. Analyzing the magnitude of curved motion (rotation and rotation) in living things through case studies and graphs 3. Apply the concept of translational and curvilinear motion (rotation and rotation) to the motion of living creatures	**Criteria:** Accurate understanding and analysis of translational motion and curvilinear motion (rotation and rotation) in the motion of living creatures and their application in everyday life. **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Material:** Translational and curvilinear motion (projection and rotation) in the Motion of Living Creatures **References:** *Kappen, Bert. 2008. Introduction to Biophysics, Handout. Radboud University Nijmegen.* **Material:** Translational and curvilinear motion (rotation and rotation) in the Motion of Living Creatures **Reference:** *Nölting Bengt. 2006. Methods in Modern Biophysics. Berlin: Springer.* **Material:** Translational and curvilinear motion (rotation and rotation) in the Motion of Living Creatures **References:** *Tuszynski, Jack A., and Kurzynski, Michal. 2003. Introduction to Molecular Biophysics. London: CRC Press.* **Material:** Translational and curvilinear motion (rotation and rotation) in the movement of living creatures. **Reference:** *Waigh, Tom A.. 2007. Applied Biophysics. London: John Wiley and Sons, Ltd.*	10%

3	Utilizing ICT-based learning resources and learning media to analyze the magnitude of translational motion and curvilinear motion (rotation and rotation) in the motion of living things and their application in everyday life	1. Analyzing the magnitude of translational movement in living things through case studies and graphs 2. Analyzing the magnitude of curved motion (rotation and rotation) in living things through case studies and graphs 3. Apply the concept of translational and curvilinear motion (rotation and rotation) to the motion of living creatures	**Criteria:** Accurate understanding and analysis of translational motion and curvilinear motion (rotation and rotation) in the motion of living creatures and their application in everyday life. **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Material:** Translational and curvilinear motion (projection and rotation) in the Motion of Living Creatures **References:** *Kappen, Bert. 2008. Introduction to Biophysics, Handout. Radboud University Nijmegen.* **Material:** Translational and curvilinear motion (rotation and rotation) in the Motion of Living Creatures **Reference:** *Nölting Bengt. 2006. Methods in Modern Biophysics. Berlin: Springer.* **Material:** Translational and curvilinear motion (rotation and rotation) in the Motion of Living Creatures **References:** *Tuszynski, Jack A., and Kurzynski, Michal. 2003. Introduction to Molecular Biophysics. London: CRC Press.* **Material:** Translational and curvilinear motion (rotation and rotation) in the movement of living creatures. **Reference:** *Waigh, Tom A.. 2007. Applied Biophysics. London: John Wiley and Sons, Ltd.*	5%

4	Utilizing ICT-based learning resources and learning media to understand human movement systems and their application in everyday life	1. Describe passive movement in humans 2. Describe the molecular components of sarcomeres 3. Describe the role of three proteins in muscle contraction 4. Describe the work of skeletal muscles 5. Distinguish between types of joints 6. Distinguish between various types of movement	**Criteria:** Accurate understanding and analysis related to the concept of movement systems in humans and its application in everyday life. **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Material:** Human movement system and its application in everyday life **Reader:** *Duane Knudson. 2019. Fundamentals of Biomechanics. New York: Springer.* **Material:** Human movement system and its application in everyday life. **Reference:** *Carl J. Payton and Roger M. Bartlett. 2008. Biomechanical Evaluation of Movement in Sport and Exercise. The British Association of Sport and Exercise Sciences Guideline* **Material:** Human movement system and its application in everyday life **References:** *Hamill, J. & Knutzen, KM. 2003. Biomechanical Basis of Human Movement. Second Edition. Philadelphia: Lippincott Williams & Wilkins*	5%

5	Utilizing ICT-based learning resources and learning media to understand human movement systems and their application in everyday life	1. Describe passive movement in humans 2. Describe the molecular components of sarcomeres 3. Describe the role of three proteins in muscle contraction 4. Describe the work of skeletal muscles 5. Distinguish between types of joints 6. Distinguish between various types of movement	**Criteria:** Accurate understanding and analysis related to the concept of movement systems in humans and its application in everyday life. **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Material:** Human movement system and its application in everyday life **Reader:** *Duane Knudson. 2019. Fundamentals of Biomechanics. New York: Springer.* **Material:** Human movement system and its application in everyday life. **Reference:** *Carl J. Payton and Roger M. Bartlett. 2008. Biomechanical Evaluation of Movement in Sport and Exercise. The British Association of Sport and Exercise Sciences Guideline* **Material:** Energy and its use in living things **References:** *Lubert, Styer. 2000. Biokomia Vol I Edition 4. Jakarta: EGC.*	5%
6	Utilize ICT-based learning resources and learning media to understand the concept of energy and its use in living things	1. Explain the process of forming ATP in the electron transport chain 2. Analyzing the energy content of food and its conversion to meet the body‘s movement needs 3. Explain the concept of anaerobic energy acquisition.	**Criteria:** Accurate understanding of the formation of ATP and ADP and energy conversion in food. **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Matter:** Energy and its use in living things. **Reference:** *Carl J. Payton and Roger M. Bartlett. 2008. Biomechanical Evaluation of Movement in Sport and Exercise. The British Association of Sport and Exercise Sciences Guideline* **Material:** Energy and its use in living things **References:** *Lubert, Styer. 2000. Biokomia Vol I Edition 4. Jakarta: EGC.*	10%

7	Utilize ICT-based learning resources and learning media to understand the concept of energy and its use in living things	1. Explain the process of forming ATP in the electron transport chain 2. Analyzing the energy content of food and its conversion to meet the body's movement needs 3. Explain the concept of anaerobic energy acquisition.	**Criteria:** Accurate understanding of the formation of ATP and ADP and energy conversion in food **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Matter:** Energy and its use in living things. **Reference:** *Carl J. Payton and Roger M. Bartlett. 2008. Biomechanical Evaluation of Movement in Sport and Exercise. The British Association of Sport and Exercise Sciences Guideline* **Material:** Energy and its use in living things **References:** *Lubert, Styer. 2000. Biokomia Vol I Edition 4. Jakarta: EGC.* **Matter:** Energy and its use in living things. **Reference:** *Duane Knudson. 2019. Fundamentals of Biomechanics. New York: Springer.*	10%
8	Utilize ICT-based learning resources and learning media to understand the concept of energy and its use in living things	Explain the process of forming ATP in the electron transport chain	**Criteria:** Accurate understanding of the formation of ATP and ADP and energy conversion in food **Form of Assessment** : Participatory Activities, Tests	Midterm Exam 3 X 50	-	**Matter:** Energy and its use in living things. **Reference:** *Carl J. Payton and Roger M. Bartlett. 2008. Biomechanical Evaluation of Movement in Sport and Exercise. The British Association of Sport and Exercise Sciences Guideline* **Material:** Energy and its use in living things **References:** *Lubert, Styer. 2000. Biokomia Vol I Edition 4. Jakarta: EGC.* **Matter:** Energy and its use in living things. **Reference:** *Duane Knudson. 2019. Fundamentals of Biomechanics. New York: Springer.*	0%

9	Utilizing ICT-based learning resources and learning media to understand the kinematics of linear motion and its application in everyday life.	Distinguish between linear, angular and general motion	**Criteria:** Accuracy and understanding between linear, angular and general motion. **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Material:** Linear motion kinematics and its application in everyday life **Reader:** *Duane Knudson. 2019. Fundamentals of Biomechanics. New York: Springer.* **Material:** Linear motion kinematics and its application in everyday life **References:** *Kappen, Bert. 2008. Introduction to Biophysics, Handout. Radboud University Nijmegen.* **Material:** Linear motion kinematics and its application in everyday life **References:** *Tuszynski, Jack A., and Kurzynski, Michal. 2003. Introduction to Molecular Biophysics. London: CRC Press.*	5%
10	Utilizing ICT-based learning resources and learning media to understand the kinematics of angular motion and its application in everyday life.	Explain how the moment of inertia of the human body can be manipulated	**Criteria:** Accuracy and understanding of how the moment of inertia of the human body works **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Material:** Kinematics of angular motion and its application in everyday life. **Reference:** *Duane Knudson. 2019. Fundamentals of Biomechanics. New York: Springer.* **Material:** Kinematics of angular motion and its application in everyday life **References:** *Kappen, Bert. 2008. Introduction to Biophysics, Handout. Radboud University Nijmegen.* **Material:** Kinematics of angular motion and its application in everyday life **Reference:** *Waigh, Tom A.. 2007. Applied Biophysics. London: John Wiley and Sons, Ltd.*	10%

11	Students can apply energy sources and alternative energy in the field of biology.	Applying energy sources and alternative energy (Including EFL experiments on solar cells) in the field of biology	**Criteria:** Accuracy and understanding of energy sources and alternative energy (including EFL experiments on solar cells) in the field of biology **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Material:** Energy sources and alternative energy in the field of biology **References:** *Lubert, Styer. 2000. Biokomia Vol I Edition 4. Jakarta: EGC.* **Material:** Energy sources and alternative energy in the field of biology **References:** *Kappen, Bert. 2008. Introduction to Biophysics, Handout. Radboud University Nijmegen.* **Material:** Energy sources and alternative energy in the field of biology **Reference:** *Waigh, Tom A.. 2007. Applied Biophysics. London: John Wiley and Sons, Ltd.* **Material:** Energy sources and alternative energy in the field of biology **Reference:** *Duane Knudson. 2019. Fundamentals of Biomechanics. New York: Springer.* **Material:** Energy sources and alternative energy in the field of biology **References:** *M Budiyanto, M Yasin. 2017. Cholesterol detection using optical fiber sensor based on intensity modulation. Journal of Physics: Conference Series*	5%

12	Students can apply energy sources and alternative energy in the field of biology.	Applying energy sources and alternative energy (Including EFL experiments on solar cells) in the field of biology	**Criteria:** Accuracy and understanding of energy sources and alternative energy (including experiments on solar cells) in the field of biology **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Material:** Energy sources and alternative energy in the field of biology **References:** *Lubert, Styer. 2000. Biokomia Vol I Edition 4. Jakarta: EGC.* **Material:** Energy sources and alternative energy in the field of biology **Reference:** *Waigh, Tom A.. 2007. Applied Biophysics. London: John Wiley and Sons, Ltd.* **Material:** Energy sources and alternative energy in the field of biology **References:** *FB Ilhami, M Budiyanto. 2023. The Characterization of Salt Level in Mango Fruit Through the Principle of Refraction Index. Science Education and Application Journal* **Material:** Energy sources and alternative energy in the field of biology **References:** *M Budiyanto, M Yasin. 2017. Cholesterol detection using optical fiber sensor based on intensity modulation. Journal of Physics: Conference Series*	10%

13	Students can apply the concepts of the properties of substances and thermodynamics in the field of biology	Applying the concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology	**Criteria:** Accuracy and understanding of the concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology. **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Material:** Concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology. **References:** *Kappen, Bert. 2008. Introduction to Biophysics, Handout. Radboud University Nijmegen.* **Matter:** Concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology. **Reference:** *Waigh, Tom A.. 2007. Applied Biophysics. London: John Wiley and Sons, Ltd.* **Matter:** Concepts of the nature of substances (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology. **Reference:** *Duane Knudson. 2019. Fundamentals of Biomechanics. New York: Springer.*	5%

14	Students can apply the concepts of the properties of substances and thermodynamics in the field of biology	Applying the concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology	**Criteria:** 1.Accuracy and understanding of the concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology 2.biology. **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Material:** concepts of substance properties and thermodynamics in the field of biology **References:** *Kappen, Bert. 2008. Introduction to Biophysics, Handout. Radboud University Nijmegen.* **Material:** concepts of substance properties and thermodynamics in the field of biology **Reference:** *Waigh, Tom A.. 2007. Applied Biophysics. London: John Wiley and Sons, Ltd.* **Material:** concepts of substance properties and thermodynamics in the field of biology. **Reference:** *Duane Knudson. 2019. Fundamentals of Biomechanics. New York: Springer.*	5%

15	Students can apply the concepts of the properties of substances and thermodynamics in the field of biology	Applying the concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology	**Criteria:** Accuracy and understanding of the concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology. **Form of Assessment** : Participatory Activities	Flip learning, student-centered, and 3 X 50 discussions	-	**Material:** concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology. **Reference:** *Kappen, Bert. 2008. Introduction to Biophysics, Handout. Radboud University Nijmegen.* **Matter:** concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology. **Reference:** *Waigh, Tom A.. 2007. Applied Biophysics. London: John Wiley and Sons, Ltd.* **Material:** concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology. **Reference:** *Duane Knudson. 2019. Fundamentals of Biomechanics. New York: Springer.*	10%

16	Students can apply the concepts of the properties of substances and thermodynamics in the field of biology	Applying the concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology	**Criteria:** Accuracy and understanding of the concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology. **Form of Assessment** : Participatory Activities, Tests	3 X 50 Semester Final Exam	-	**Material:** concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology. **Reference:** *Kappen, Bert. 2008. Introduction to Biophysics, Handout. Radboud University Nijmegen.* **Matter:** concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology. **Reference:** *Waigh, Tom A.. 2007. Applied Biophysics. London: John Wiley and Sons, Ltd.* **Material:** concepts of substance properties (liquid, gas, and plasma), and phase changes, temperature, heat, expansion, and thermodynamics in the field of biology. **Reference:** *Duane Knudson. 2019. Fundamentals of Biomechanics. New York: Springer.*	0%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	100%
		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.