| | Universitas Negeri Surabaya<br>Faculty of Mathematics and Natural Sciences<br>Biology Education Masters Study Program | Document Code |
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# SEMESTER LEARNING PLAN

| Courses | CODE | Course Family | Credit Weight | | | SEMESTER | Compilation Date |
|---|---|---|---|---|---|---|---|
| Bio Engineering | 1234502013 | Compulsory Study Program Subjects | T=2 | P=0 | ECTS=4.48 | 3 | August 25, 2023 |

| AUTHORIZATION | SP Developer | Course Cluster Coordinator | Study Program Coordinator |
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| | Prof. Dr. Mahanani Tri Asri, M.Si | Prof. Dr. Mahanani Tri Asri, M.Si | Prof. Dr. Yuliani, M.Si. |

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| **Learning model** | **Case Studies** | |
| **Program Learning Outcomes (PLO)** | **PLO study program that is charged to the course** | |
| | **PLO-6** | Able to show a responsible attitude towards work in their field of expertise by paying attention to academic ethics in carrying out their professional duties, and able to embody the character of faith, intelligence, independence, honesty, caring and toughness in daily behavior. |
| | **PLO-8** | Able to review policies and implement them in the field of Biology and Biology Education through an inter and multidisciplinary approach |
| | **Program Objectives (PO)** | |
| | **PO - 1** | Able to master theories and application theories in the field of bioengineering through the use of information technology; |
| | **PLO-PO Matrix** | |

| P.O | PLO-6 | PLO-8 |
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| PO-1 | | |

**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 | | | | | | | | | | | | | | | | |

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| **Short Course Description** | This course examines the meaning and scope of bioengineering and the timeline for the development of bioengineering research, breakthroughs and trends in bioengineering in monocellular to multicellular organisms, the potential of organisms as bioactive and biophysical sources, exploring the potential of Tropical Biological Natural Resources based on local wisdom to improve life skills as a basis for laying the spirit of Bioecopreneurship through experimentation as a source of bioreagents that can act to improve, update and add to the repertoire of biological knowledge, exploration techniques in the field of bioengineering. This course is presented in theory and assignments. |
| **References** | **Main :** |

1. Ebadi, Manuchair. 2002. Pharmacodynamic Basis of Herbal Medicine. Boca Raton: CRC Press. 2. Evans, W.C. 2002. Trease and Evans P:
2. Evans, W.C. 2002. Trease and Evans Pharmacognosy. Edinburgh: W.B.Saunders. Ragauskas, Arthur J.2014. “Materials for Biofuels” Materials and Energy, Volume 4. New Jersey: World Scientific Publishing, Inc.
3. Dubey, Suresh Kumar, Pandey, Ashok , Sangwan, Rajender Singh. 2016. Current Developments in Biotechnology and Bioengineering. Crop Modification, Nutrition, and Food Production. Elsevier.
4. Soccol, Vanete Thomaz, Pandey, Ashok, Resende, Rodrigo R. 2016. Current Developments in Biotechnology and Bioengineering. Human and Animal Health Applications. Elsevier.
5. Rubin, Andrey B. 2014. Fundamentals of Biophysics. Wiley-Scrivener.
6. Malau, Nya Daniaty, 2019. Modul BioFisika. Jakarta. Program Studi Pendidikan Fisika Fakultas Keguruan dan Ilmu Pendidikan. Universitas Kristen Indonesia.
7. Rosana Dadan. 2020. Biophysycs and Introduction. Yogyakarta. Universitas Negeri Yogyakarta Press.

**Supporters:**

1. Artikel dari jurnal bereputasi yang relevan
2. E-book Anatomi dan Fisiologi Manusia

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| **Supporting lecturer** | Prof. Dr. Mahanani Tri Asri, M.Si.<br>Dr. Nur Ducha, S.Si., 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) |

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| **1** | Understand the material and scope of Bioengineering | 1.1. Explain the meaning of bioengineering<br>2.2. Describe the scope of biophysics A. Bomaterials B. Bioactives C. Biosensors D. Biothermal E. Biooptics F. Biomechanics G. Bioacoustics | **Criteria:**<br>Form: Process assessment Criteria: Indicators are achieved through process assessment during article reviews and discussions<br><br>**Form of Assessment** : Participatory Activities | • Lecturers facilitate student-centered learning through group discussions and are responsible for:<br>1. Finding concepts (based on literature review) regarding the scope of bioengineering including Bomaterials, Bioactives, Biosensors, Biothermal, Biooptics, Biomechanics and Bioacoustics in groups<br>2. Reading and underlining important concepts of bioengineering and creating a resume<br>3. Present the results of the group's work<br>Time: Face to face: 2x50 minutes; Independent: 2x60 minutes Structured: 2x60 minutes | • On-line meetings are held if the students participating in the MK are currently in KKN or MPK (Work Practice Internship) Model: Cooperative Visiting the website to review literature related to the scope of bioengineering • Presentation and discussion of concepts in bioengineering<br>Time: (2 x 50 minutes) | **Material:** Scope of Bioengineering<br>**Literature:** *1. Articles from relevant reputable journals*<br><br>**Material:** Scope of Bioengineering<br>**References:** *Malau, Nya Daniaty, 2019. BioPhysics Module. Jakarta. Physics Education Study Program, Faculty of Teacher Training and Education. Indonesian Christian University.*<br><br>**Material:** Scope of Bioengineering<br>**References:** *Rubin, Andrey B. 2014. Fundamentals of Biophysics. Wiley-Scrivener.* | 1% |
| **2** | Understand biomaterials and their applications in human life | 1. Explain biomaterials: a. History b. Understanding. c. Function. d.Classification 2. Provide examples of the application of biomaterials in the world of (human) health | **Criteria:**<br>Form: Process assessment Criteria: Indicators are achieved through process assessment during case studies, presentations and discussions<br><br>**Form of Assessment** : Participatory Activities | Learning model: Discussion and Case study: Students carry out previous individual activities by reading references about cases using biomaterials in the health sector which have been carried out in a structured manner). Then the lecturer facilitates student-centered learning through group discussions of students about the concept of biomaterials based on case studies that have been carried out.<br>Based on the results of group discussions, students convey ideas and solutions and present the results of discussions to solve problems from cases found every day in the field of biomaterial use in world of health, then a class discussion is held related to the problem and problem solving is produced from the cases found and students make a discussion report<br>Time: Face to face: 2x50 minutes Independent: 2x60 minutes Structured: 2x60 minutes | Online meetings are held if students participating in the MK are currently in KKN or MPK (Work Practice Internship)<br>Learning model: case study<br>1. Visit the website to look for cases about the application of biomaterials in health<br>2. Discussion presentation<br>3. Make a report on the results of the discussion<br>Time: (2 x 50 minutes) | **Material:** basic materials for biomaterials, as well as their applications in human life.<br>**References:** *1. Malau, Nya Daniaty, 2019. Biophysics module. Jakarta. Physics Education Study Program, Faculty of Teacher Training and Education. Indonesian Christian University.*<br><br>**Material:** Basic concepts of Biomaterials, and their applications in human life<br>**References:** *6. Rubin, Andrey B. 2014. Fundamentals of Biophysics. Wiley-Scrivener.*<br><br>**Material:** Application of Biomaterials in human life (in the health sector)<br>**References:** *1. Articles from relevant reputable journals* | 1% |

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| **3** | Designing experimental designs for developing Bomaterials in the medical world | Design an experimental design for the development of biomaterials in the medical world based on the latest literature. 2. Present the results of the experimental design for the development of biomaterials in the medical world. | **Criteria:**<br>Assessment of project results from experimental designs for biomaterial development in the medical world<br><br>**Form of Assessment** :<br>Project Results Assessment / Product Assessment | Learning Model: PJBL<br>Products/Results:<br>1. Experimental design for the development of biomaterials in the medical world<br>2. Presentation and discussion of the results of the design.<br>Time: Face to face: 2x50 minutes<br>Independent: 2x60 minutes Structured: 2x60 minutes | Online meetings are held if students participating in the MK are currently in KKN or MPK (Work Practice Internship)<br>Learning model: PJBL with the final product being<br>1. Experimental design for the development of biomaterials in the medical field<br>2. Presentation and group discussion of the results of the design<br>Time: Face to face: 2x50 minutes<br>Independent: 2x60 minutes Structured: 2x60 minutes | **Material:**<br>Designing an experimental design for developing Bomaterials in the medical world.<br>**References:** *1. Malau, Nya Daniaty, 2019. BioPhysics Module. Jakarta. Physics Education Study Program, Faculty of Teacher Training and Education. Indonesian Christian University.*<br><br>**Material:**<br>Designing experimental designs for the development of Bomaterials in the medical world.<br>**References:** *6. Rubin, Andrey B. 2014. Fundamentals of Biophysics. Wiley-Scrivener.*<br><br>**Material:**<br>Designing an experimental design for Bomaterial development in the medical world.<br>**References:** *1. Articles from relevant reputable journals* | 7% |
| **4** | Understand bioactive compounds produced by microbes and plants and their application to life | Explain bioactive compounds produced by microbes and plants 2. Examples of various bioactive compounds and their applications in life | **Criteria:**<br>Criteria: Indicators are achieved through participatory assessment during case studies about various bioactive compounds that are beneficial for health, presentations and discussions<br><br>**Form of Assessment** :<br>Participatory Activities | Discussion and Case study learning model:<br>1. Students look for references about various cases of the use of beneficial bioactive compounds in the health sector<br>2. Students in their groups discuss the findings of the cases, accompanied by analysis of the solutions<br>3. Students present the results of their group discussions in class and then hold class discussions regarding problems and solutions problems and conclusions<br>4. Students make a report on the results of the discussion<br>Time: Face to face: 2x50 minutes<br>Independent: 2x60 minutes Structured: 2x60 minutes | Online meetings are held if students participating in the MK are currently in KKN or MPK (Work Practice Internship)<br>Case study learning model:<br>Case study: problems and solutions<br>Presentation and discussion of cases related to the use of bioactive compounds in health<br>Time: Face to face: 2x50 minutes<br>Independent: 2x60 Structured minutes: 2x60 minutes | **Material:**<br>Bioactive compounds produced by microbes and plants and their application to life<br>**References:** *1. Malau, Nya Daniaty, 2019. BioPhysics Module. Jakarta. Physics Education Study Program, Faculty of Teacher Training and Education. Indonesian Christian University.*<br><br>**Material:**<br>Bioactive compounds produced by plants and their applications in life<br>**References:** *2. Ebadi, Manuchair. 2002. Pharmacodynamic Basis of Herbal Medicine. Boca Raton: CRC Press. 2. Evans, WC 2002. Trease and Evans P:*<br><br>**Material:**<br>Bioactive compounds produced by microbes and plants and their applications in life<br>**References:** *1. Articles from relevant reputable journals* | 1% |

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| **5** | Designing exploration activities for the use of bioactive compounds as anti-microbials | 1. Design exploration activities for the use of bioactive compounds as antimicrobials 2. Present the results of exploration for the development of bioactive compounds | **Criteria:**<br>Assessment of project results in the form of: experimental design for the use of bioactive compounds as antimicrobials<br><br>**Form of Assessment** :<br>Project Results Assessment / Product Assessment | Learning Model: PJBL<br>Products/Results experimental design for the use of bioactive compounds as antimicrobials<br>Time: Face to face: 2x50 minutes Independent: 2x60 minutes Structured: 2x60 minutes | * Online meetings are held if students participating in the MK are currently in KKN or MPK (Work Practice Internship ) Presentation and group discussion of the results of the design<br>Time: Face to face: 2x50 minutes Independent: 2x60 minutes Structured: 2x60 minutes | **Material:**<br>Designing exploration activities for the use of bioactive compounds as antimicrobials<br>**References:** *1. Malau, Nya Daniaty, 2019. BioPhysics Module. Jakarta. Physics Education Study Program, Faculty of Teacher Training and Education. Indonesian Christian University.*<br><br>**Material:**<br>Designing exploration activities for the use of bioactive compounds as antimicrobials<br>**References:** *2. Ebadi, Manuchair. 2002. Pharmacodynamic Basis of Herbal Medicine. Boca Raton: CRC Press. 2. Evans, WC 2002. Trease and Evans P:*<br><br>**Material:**<br>Designing exploration activities for the use of bioactive compounds as antimicrobials.<br>**References:** *3. Evans, WC 2002. Trease and Evans Pharmacognosy. Edinburgh: WBSaunders. Ragauskas, Arthur J. 2014. "Materials for Biofuels" Materials and Energy, Volume 4. New Jersey: World Scientific Publishing, Inc.*<br><br>**Material:**<br>Designing exploration activities for the use of bioactive compounds as antimicrobials.<br>**References:** *4. Dubey, Suresh Kumar, Pandey, Ashok, Sangwan, Rajender Singh. 2016. Current Developments in Biotechnology and Bioengineering. Crop Modification, Nutrition, and Food Production. Elsevier.*<br><br>**Material:**<br>Designing exploration activities for the use of bioactive compounds as antimicrobials.<br>**References:** *1. Articles from relevant reputable journals* | 10% |

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| **6** | Understand Biosensor material and its application in human life | 1. Explain the Biosensor material: a. Understanding, c. Working principles d. biosensor components e. types of biosensors 2. Give examples of biosensors as diagnostic tools. | **Criteria:**<br>Criteria: Indicators are achieved through participatory assessment during case studies on various cases related to the use of biosensors as diagnostic tools, presentations and discussions<br><br>**Form of Assessment** : Participatory Activities | Case study learning model:<br>1. Students look for references about various cases of using biosensors as diagnostic tools accompanied by the working principles of the various types of biosensors used.<br>2. Students in their groups discuss the findings of the case, accompanied by an analysis of the solution.<br>3. Students present the results of their group discussion in class and then hold a class discussion regarding problems, problem solving and conclusions<br>. 4. Students make a report on the results of the discussion<br>Time: Face to face: 2x50 minutes<br>Independent: 2x60 minutes Structured: 2x60 minutes | Online meetings are held if students participating in the MK are currently in KKN or MPK (Work Practice Internship).<br>Case study learning model:<br>1. Case study: problems and solutions<br>2. Presentation and discussion of cases related to the use of biosensors as diagnostic tools<br>Time: Face to face: 2x50 Independent minutes: 2x60 minutes Structured: 2x60 minutes | **Material:** Basic principles of Biosensors and their application in human life<br>**References:** *1. Malau, Nya Daniaty, 2019. BioPhysics Module. Jakarta. Physics Education Study Program, Faculty of Teacher Training and Education. Indonesian Christian University.*<br><br>**Material:** Basic principles of Biosensors and their applications in human life<br>**References:** *6. Rubin, Andrey B. 2014. Fundamentals of Biophysics. Wiley-Scrivener.*<br><br>**Material:** Application of biosensors in human life<br>**References:** *Articles from relevant reputable journals* | 1% |
| **7** | Understand biothermal materials, as well as examples of their application in human life | Explain the meaning of Biothermal a. Bithelmal principle of thermometer b. Biothermal principles in body regulation 2. The use of heat energy in the health sector. 8. Give an example of the application of Biothermal to humans. | **Criteria:**<br>Criteria: Indicators are achieved through participatory assessment during case studies on various cases related to the application of biothermal/thermal energy in the health sector, presentations and discussions<br><br>**Form of Assessment** : Participatory Activities | Discussion and Case study learning model:<br>1. . Students look at the PPT about the basic principles of biothermal<br>2. Students look for references about various cases of biothermal applications in the health sector accompanied by the working principles of the various types of biothermal equipment used.<br>2. Students in their groups discuss the findings of the case, accompanied by an analysis of the solution.<br>3. Students present the results of their group discussion in class and then hold a class discussion regarding problems, problem solving and conclusions<br>. 4. Students make a report on the results of the discussion<br>Time: Face to face: 2x50 minutes<br>Independent: 2x60 minutes Structured: 2x60 minutes | Online meetings are held if students participating in the MK are currently doing KKN or MPK (Work Practice Internship).<br>Case study learning method/model:<br>1. Students look at ppt about the basic principles of biothermal<br>2. Students do a case study: problems and solutions through relevant references<br>3. Presentation and discussion of cases related to the use of biothermal in the health sector<br>Time: Face to face: 2x50 minutes<br>Independent: 2x60 minutes Structured: 2x60 minutes | **Material:** basic concepts of Biothermal and its application in human life<br>**References:** *1. Malau, Nya Daniaty, 2019. BioPhysics Module. Jakarta. Physics Education Study Program, Faculty of Teacher Training and Education. Indonesian Christian University.*<br><br>**Material:** Basic concepts of Biothermal and its application in human life<br>**References:** *6. Rubin, Andrey B. 2014. Fundamentals of Biophysics. Wiley-Scrivener.*<br><br>**Material:** Biothermal applications in human life<br>**References:** *Articles from relevant reputable journals* | 1% |

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| **8** | Understanding Bioengineering materials and applications in human life (A. Bomaterial B. Bioactive C. Biosensor D. Biothermal) | 1.UTS weighs 30%<br>2.Written exam assessment | **Criteria:**<br>essay writing test<br><br>**Form of Assessment** : Test | Test Write a 100 minute essay | written test (take home essay)<br>100 minutes | **Material:** Material A. Bomaterial B. Bioactive C. Biosensor D. Biothermal<br>**References:** *1. Malau, Nya Daniaty, 2019. BioPhysics Module. Jakarta. Physics Education Study Program, Faculty of Teacher Training and Education. Indonesian Christian University.*<br><br>**Material:** basic principles and applications of bioactives<br>**References:** *2. Ebadi, Manuchair. 2002. Pharmacodynamic Basis of Herbal Medicine. Boca Raton: CRC Press. 2. Evans, WC 2002. Trease and Evans P:* | 20% |
| **9** | Understand Biooptics material, and its applications in life | 1.1. Explain the meaning of biooptics<br>2.2. Analyze processes in the eye in the application of biooptics.<br>3.3. Provide an example of the application of biooptics | **Criteria:**<br>Participation assessment, exam assessment<br><br>**Form of Assessment** : Participatory Activities, Tests | 1. Students discuss Biooptics material based on Biooptics PPT and reference books.<br>2. Students ask questions about biooptics material that they don't understand . 3. Students discuss questions related to biotics together. Lecturers help strengthen answers to the questions discussed.<br>4. Students get authentic problems that have been prepared by the lecturer to be solved and provide solutions.<br>5. Students work in groups independently to solve authentic problems with certain topics related to biooptics.<br>2 X 50 minutes | 1. Students open the material in GC, read the Biooptics material independently.<br>2. Students compose questions and submit questions from material they consider less understandable to be discussed together with students in the same class and the lecturer. Lecturers help clarify answers to students' questions.<br>3. Students get authentic problems that have been prepared by the lecturer to be solved and provide solutions.<br>4. Students work in groups independently to solve authentic problems with certain topics related to biooptics.<br>2 X 50 minutes | **Material:** Biooptics and its Applications<br>**References:** *Rubin, Andrey B. 2014. Fundamentals of Biophysics. Wiley-Scrivener.*<br><br>**Material:** Biooptics<br>**Literature:** *Malau, Nya Daniaty, 2019. BioPhysics Module. Jakarta. Physics Education Study Program, Faculty of Teacher Training and Education. Indonesian Christian University.*<br><br>**Material:** Vision<br>**Reader:** *Rosana Dadan. 2020. Biophysics and Introduction. Yogyakarta. Yogyakarta State University Press.* | 1% |

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| **10** | Designing the development of a simple biooptical experimental design. | 1.1. Present the results of an experimental design for developing simple biooptics for solving problems related to biooptics.<br>2.2. Product resulting from a simple biooptical development experimental design. | **Criteria:**<br>1.1. Presentation assessment.<br>2.2. Product assessment.<br><br>**Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance | 1. Students develop a simple biooptical experimental design independently in groups.<br>2. Students present the results of an experimental design for developing simple biooptics to solve problems related to biooptics.<br>2 X 50 minutes | 1. Students develop a simple biooptical experimental design independently in groups.<br>2. Students present the results of experimental designs for developing simple biooptics to solve problems related to biooptics.<br>2 X 50 minutes | **Material:** 1. Biooptical Products 2. Problems related to biooptics.<br>**References:** *Rubin, Andrey B. 2014. Fundamentals of Biophysics. Wiley-Scrivener.*<br><br>**Material:** Biooptics<br>**Literature:** *Malau, Nya Daniaty, 2019. BioPhysics Module. Jakarta. Physics Education Study Program, Faculty of Teacher Training and Education. Indonesian Christian University.*<br><br>**Material:** Vision<br>**Reader:** *Rosana Dadan. 2020. Biophysics and Introduction. Yogyakarta. Yogyakarta State University Press.* | 10% |
| **11** | Understand Biomechanics material, as well as its application in life | 1.1. Describe the meaning of biomechanics<br>2.2. Analyze various types of biomechanics.<br>3.3. Give an example of the application of biomechanics. | **Form of Assessment** : Participatory Activities, Tests | 1. Students discuss Biomechanics material based on Biooptics PPT and reference books.<br>2. Students provide examples of processes related to Biomechanics.<br>3. Students ask questions related to Biomechanics. Lecturers help strengthen answers to the questions discussed.<br>4. Students get authentic problems that have been prepared by the lecturer to be solved and provide solutions.<br>5. Students work in groups independently to solve authentic problems with certain topics related to Biomechanics.<br>2 X 50 minutes | 1. Students open the material in GC, read the Biomechanics material independently.<br>2. Students compose questions and submit questions from material they consider less understandable to be discussed together with students in the same class and the lecturer. Lecturers help clarify answers to students' questions.<br>3. Students get authentic problems that have been prepared by the lecturer to be solved and provide solutions.<br>4. Students work in groups independently to solve authentic problems with certain topics related to Biomechanics.<br>2 X 50 minutes | **Material:** 1. Basic Principles of Biomechanics<br>**References:** *Rubin, Andrey B. 2014. Fundamentals of Biophysics. Wiley-Scrivener.*<br><br>**Material:** 2. Mechanisms in Biomechanics<br>**Literature:** *Malau, Nya Daniaty, 2019. BioPhysics Module. Jakarta. Physics Education Study Program, Faculty of Teacher Training and Education. Indonesian Christian University.* | 1% |
| **12** | Designing a simple Biomechanics development experimental design | 1.1. Present the results of an experimental design for developing a simple biooptic to solve problems related to biomechanics<br>2.2. Product resulting from a simple biooptical development experimental design. | **Criteria:**<br>Participation assessment, presentation assessment, product assessment<br><br>**Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance | 1. Students develop simple mechanical experimental designs independently in groups.<br>2. Students present the results of experimental designs for developing simple biomechanics for solving problems related to biooptics. | 1. Students develop simple biomechanical experimental designs independently in groups.<br>2. Students present the results of experimental designs for developing simple biomechanics to solve problems related to biomechanics | | 10% |

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| **13** | Understand Bioacoustics material, and its application in life | 1.1. Explain the meaning of bioacoustics<br>2.2. Analyze the hearing process in the ear in relation to bioacoustic mechanisms<br>3.3. Give examples of hearing aid equipment and relate it to bioacoustics. | **Criteria:**<br>Participation assessment<br><br>**Form of Assessment** : Participatory Activities, Tests | 1. Students read PPT on bioacoustics<br>2. Students discuss together things related to bioacoustics in everyday life<br>3. Lecturer gives examples of problems related to bioacoustics<br>4. Students provide solutions to problems presented by the lecturer related to bioacoustics | 1. Students open the material on Google Classroom<br>2. Students read PPT bioacoustics<br>3. Students discuss together things related to bioacoustics in everyday life<br>4. Lecturer gives examples of problems related to bioacoustics<br>5. Students provide solutions to problems delivered by lecturers related to bioacoustics | | 1% |
| **14** | Compile Bioacoustics papers from the results of journal reviews. | 1.1. Present the results of preparing a paper related to solving problems related to bioacoustics<br>2.2. Paper products for solving bioacoustic problems | **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Practices / Performance | 1. Students prepare papers from the results of journal reviews related to bioacoustics independently in groups.<br>2. Students present the results of preparing bioacoustics papers to solve problems related to bioacoustics. | 1. Students prepare papers from the results of journal reviews related to bioacoustics independently in groups.<br>2. Students present the results of preparing bioacoustics papers to solve problems related to bioacoustics. | | 5% |
| **15** | | 1.1. Review the Bioengineering material that has been studied<br>2.2. Provide conclusions about the application of Bioengineering to life | | 1. Students carry out a flashback on the bioengineering material that has been studied, both in the form of theory and practice/assignments.<br>2. Students hold joint discussions facilitated by the lecturer regarding the material they have studied in bioengineering | 1. Students carry out a flashback on the bioengineering material that has been studied, both in the form of theory and practice/assignments.<br>2. Students hold joint discussions facilitated by the lecturer regarding the material they have studied in bioengineering | | 1% |
| **16** | Students understand bioengineering material well | | **Form of Assessment** : Test | Written exam | Written exam | **Material:** Biooptics, Biomechanics, Bioacoustics<br>**Reader:** *Rosana Dadan. 2020. Biophysics and Introduction. Yogyakarta. Yogyakarta State University Press.* | 30% |

**Evaluation Percentage Recap: Case Study**

| No | Evaluation | Percentage |
|---|---|---|
| 1. | Participatory Activities | 14.83% |
| 2. | Project Results Assessment / Product Assessment | 25.33% |
| 3. | Practice / Performance | 8.33% |
| 4. | Test | 51.5% |
| | | 99.99% |

**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.