Document Code



Main :

References

## Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Biology Education Undergraduate Study Program

| Courses            |   | CODE   |   |         |        | Cours             | se Fam  | nily       |        | C      | Credit 1 | Neight    |  | SEN        | IESTER   | !       | Com<br>Date | pilation |
|--------------------|---|--|---|---------|--------|-------------------|---------|------------|--------|--------|----------|-----------|--|------------|----------|---------|-------------|----------|
| cophysiolo         | gy  | 8420502  | 079   |         |        | Study             |         | am Elec    | ctive  | Т      | =2 P     | =0 EC     | TS=3.18  |            | 7        |         | April       | 27, 2023 |
| UTHORIZA           | TION  | SP Deve  | loper   |         | •      | <del>-cours</del> | 55      |            | Cou    | rse Cl | uster    | Coordii   | nator  | Stuc       | ly Prog  | ram Co  | ordina      | tor      |
|                    |   | Dr.Yulian  | ani,M.Si  |         | Dr.Y   | uliani,l          | M.Si    |            |        | Dr.    | Rinie F  | Pratiwi F | Puspitav   | vati, M.Si |          |         |             |          |
| earning<br>odel    | Project Base  | d Learning   |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
| rogram             | PLO study program that is charged to the course   |  |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
| earning<br>utcomes | Program Objectives (PO)   |  |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
| LO)                | PO - 1  | PO - 1 Mastering ecophysiological concepts and their applications (Knowledge)  |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    | PO - 2  | Able to apply E<br>(Knowledge)   | cophys  | iologic | al cor | ncepts            | and t   | echnol     | ogy in | effor  | rts to   | solve     | natural r  | esour      | ce and   | enviro  | nmenta      | l proble |
|                    | PO - 3  | Able to make the right decisions based on information and data analysis, and able to provide guidance in choosing various alternative solutions independently and in groups in the field of ecophysiology (Special Competencies) |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    | PO - 4  Able to design problem solutions by implementing transferable skills in the field of ecophysiology to develop ecopreneum innovation, eco-opportunity, eco-commitment). (Special Competencies) |  |   |         |        |                   |         | ırship (ed |        |        |          |           |  |            |          |         |             |          |
|                    | PO - 5  |  | Able to learn throughout life and work effectively both individually and in groups, have an entrepreneurial spirit and care about the environment (general competencies)  Able to work independently and responsibly, both as an individual and in a group in carrying out tasks related to Ecophysiology |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    | PO - 6  | Able to work ind<br>(Attitude) studies   |   | ntly an | d resp | onsibl            | y, both | as an      | indivi | dual a | ind in   | a group   | in carry   | ring ou    | ıt tasks | related | l to Eco    | physiolo |
|                    | PLO-PO Mat  | trix   |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   | P.O  |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   | PO-1   |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   | PO-2   |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   | PO-3   |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   | PO-4   |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   | PO-5   |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   | PO-6   |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    | PO Matrix at  | t the end of each le   | arning  | stage   | (Sub   | -PO)              |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   |  |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   | P.O  |   | 1       | ı      |                   | ı       |            |        |        | Week     |           | <del>                                     </del> |            | 1        | ı       |             |          |
|                    |   | PO-1   | 1   | 2       | 3      | 4                 | 5       | 6          | 7      | 8      | 9        | 10        | 11   | 12         | 13       | 14      | 15          | 16       |
|                    |   | PO-2   | +   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   | PO-3   |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   | PO-4   |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   | PO-5   |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   | PO-6   |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |
|                    |   |  |   |         |        |                   |         |            |        |        |          |           |  |            |          |         |             |          |

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   Manuel, J.Regosa. 2001. Handbook of Plant Ecophysiology Techniques 2001st Edition. New York: Springer
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## Supporters:

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   Fitter A.H. and R.K.M. Hay. 1998. Environmental Physiology of Plants. (Sri Andani and Purbayanti. Trans) Yogyakarta: Gadjah Mada
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   Larcher, W. 1991. Physiological Plant Ecology. New York: Springer

Help Learning.

## Supporting lecturer

Dr. Raharjo, M.Si. Prof. Dr. Yuliani, M.Si. Dr. H. Sunu Kuntjoro, S.Si., M.Si.

| Week- | Final abilities of each learning stage  | Eval  | uation  | Learni<br>Student  | o Learning,<br>ing methods,<br>: Assignments,<br>imated time] | Learning materials  | Assessment<br>Weight (%) |
|-------|---|---|---|--|---|---|--------------------------|
|       | (Sub-PO)  | Indicator   | Criteria & Form   | Offline ( offline )  | Online ( online )   |   | 3 ( )                    |
| (1)   | (2)   | (3)   | (4)   | (5)  | (6)   | (7)   | (8)                      |
|       | Linking the concept of the physiological impact of an environmental factor with the response strategy carried out by the organism | 1.Linking environmental changes to the physiological impact of a plant in the form of poisoning or fitness 2.Describe the speed of growth rate 3.Explain plant response strategies 4.Distinguish physiological tactics: avoidance, amelioration and tolerance 5.Demonstrate an honest and independent attitude during the learning process based on the observation sheet | Criteria:  1.Reports and practicum products are assessed as ASSIGNMENTS with a weight of 30%. performance is integrated during learning  2.Form: Written Test and Assignment (independent assignments and Practicum) Criteria: Indicators achieved through assignments in independent and structured assignments  Form of Assessment: Participatory Activities, Project Results Assessment / Product Assessment | Case method 1. Pre existing Material. The lecturer asks individual students to read references regarding environmental changes on the physiological impact of a plant in the form of poisoning or suitability, growth rate and response strategies. 2. Activities in groups. The lecturer provides problem cases regarding response strategies and physiological tactics of plants to environmental conditions. Students explore the references obtained to answer various cases of plant responses. In this activity, students can develop ideas or thoughts to solve problems. Individual students in groups can express their opinions 3. Class Room Discussion Lecturers facilitate students to discuss in class, present the results obtained in groups. and classically obtained mass solutions and conclusions from the ersults obtained in groups. and classically obtained mass solutions and conclusions from the results obtained in groups. and classically obtained mass solutions and conclusions from the results obtained in groups. and classically obtained mass solutions and conclusions from the results obtained in groups. and classically obtained mass solutions and conclusions from the references regarding environmental checks. 2 X 50 |   | Material: Organism response strategies: a) Physiological basics of ecology, b). Compatibility and toxicity, c). Meaning of growth rate speed, d) Physiological tactics References: Yuliani, Rahardjo, Sunu Kunijoro. 2019. Ecophysiology 1: Plant Ecophysiology. Surabaya: Unesa Press. | 10%                      |

| environmental influence gioruth and growth and understand the mechanism of plant of deciment with the continuential follows and the continuential follows are accessed as ASS-OMM-METS and Society and the continuential follows and the continuential |     |                 |                   | T                    | •               | T | 1 |     |
|--|-----|-----------------|-------------------|----------------------|-----------------|---|---|-----|
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| students can develop ideas or thoughts to solve problems. Individual students in groups can express their opinions 3. Class Room Discussion Lecturers facilitate students to discuss in class, present the results obtained in groups, and classically obtained problem solving and conclusions from the practicum carried out. Students make practical reports in independent   |     |                 |                   |                      |                 |   |   |     |
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| Individual students in groups can express their opinions 3. Class Room Discussion Lecturers facilitate students to discuss in class, present the results obtained in groups. and classically obtained problem solving and conclusions from the practicum carried out. Students make practical reports in independent   |     |                 |                   |                      |                 |   |   |     |
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| Lecturers facilitate students to discuss in class, present the results obtained in groups. and classically obtained problem solving and conclusions from the practicum carried out. Students make practical reports in independent   |     |                 |                   |                      | 3. Class Room   |   |   |     |
| facilitate students to discuss in class, present the results obtained in groups, and classically obtained problem solving and conclusions from the practicum carried out. Students make practical reports in independent   |     |                 |                   |                      | Discussion      |   |   |     |
| students to discuss in class, present the results obtained in groups. and classically obtained problem solving and conclusions from the practicum carried out. Students make practical reports in independent  |     |                 |                   |                      |                 |   |   |     |
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| present the results obtained in groups. and classically obtained problem solving and conclusions from the practicum carried out. Students make practical reports in independent  |     |                 |                   |                      |                 |   |   |     |
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| in groups. and classically obtained problem solving and conclusions from the practicum carried out. Students make practical reports in independent   |     |                 |                   |                      |                 |   |   |     |
| classically obtained problem solving and conclusions from the practicum carried out. Students make practical reports in independent  |     |                 |                   |                      |                 |   |   |     |
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| problem solving and conclusions from the practicum carried out. Students make practical reports in independent   |     |                 |                   |                      |                 |   |   |     |
| and conclusions from the practicum carried out. Students make practical reports in independent   |     |                 |                   |                      |                 |   |   |     |
| from the practicum carried out. Students make practical reports in independent   |     |                 |                   |                      | problem solving |   |   |     |
| practicum carried out. Students make practical reports in independent  |     |                 |                   |                      |                 |   |   |     |
| carried out. Students make practical reports in independent  |     |                 |                   |                      |                 |   |   |     |
| Students make practical reports in independent   |     |                 |                   |                      |                 |   |   |     |
| practical reports in independent   |     |                 |                   |                      |                 |   |   |     |
| in independent   |     |                 |                   |                      |                 |   |   |     |
|  |     |                 |                   |                      |                 |   |   |     |
| Tassionmenis   |     |                 |                   |                      | assignments.    |   |   |     |
| 2 × 50   |     |                 |                   |                      |                 |   |   |     |
|  |     |                 |                   |                      |                 |   |   |     |

|   |   |   |  |   | <br>  |    |
|---|---|---|--|---|---|----|
| 3 | Understand the fundamental needs of an organism's cellular metabolism and relate them to the patterns of adaptation carried out | 1.Describe the fundamental requirements of cellular metabolism 2.Identify basic strategies of biochemical adaptation 3.Explain the hierarchy of metabolite control related to the quality and quantity of enzymes 4.Differentiate the properties of metabolite control: versatility, speed and sensitivity 5.Explain the adaptation tools that plants must have to survive 6.Provide examples of adaptation patterns carried out by plants based on regional conditions | Criteria:  1.Reports and practicum products are assessed as ASSIGNMENTS with a weight of 30%. performance is integrated during learning  2.Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks  Form of Assessment: Participatory Activities | Case method 1.Pre existing Material. The lecturer asks students to individually read references from books and journals regarding the fundamental needs of an organism's cellular metabolism and relate them to the adaptation patterns carried out. This process is an assignment from a previous meeting which is reinforced by the lecturer. 2. Activities in groups. The lecturer provides problem cases regarding the adaptation of different organisms according to the adaptation tools they have. Students are asked to provide their ideas and opinions based on the references they read. In this activity, students can develop ideas to solve problems. Individual students in groups can express their opinions 3. Class Room Discussion Lecturers facilitate students to discuss in class, present the results obtained in groups. and classically obtained problem solving and conclusions from the activities carried out. Students are asked to make a report on the results of the discussion and read references for the next meeting 2 X 50 | Material: Plant adaptations: metabolism and genetics; Fundamental requirements of cellular metabolism;Basic strategies of biochemical adaptation to the environment to achieve vectorial homeostasis;Hierarchy and nature of metabolic control Versatility, sensitivity and rate; Adaptation tools: genetic expression, enzyme diversity and metabolism; Adaptation patterns: compensatory and exploitative References: Larcher, W. 2003. Physiological Plant Ecology. New York: Springer | 0% |

|   |  |  | T  | 1  | T | ,   |     |
|---|--|--|--|--|---|---|-----|
| 4 | Understand the activities of interacting organisms that influence plant life | 1.explains the activities of interactions between organisms, namely competition, predation and parasites that affect plant growth 2.describe the nature/form of the attack 3.Explain the defenses possessed by plants 4.linking the symbiotic relationship between mycorrhiza, rhizobium and plants 5.distinguish primary and secondary metabolites in plants 6.explain the meaning and mechanism of resistance to allelopathy 7.analyze the role of allelopathy in agriculture 8.Skilled in conducting experiments on allelopathy | Criteria:  1.Reports and practicum products are assessed as ASSIGNMENTS with a weight of 30%. performance is integrated during learning  2.Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks  Form of Assessment: Participatory Activities, Practical Assessment | Presentation discussions, practicum Lecturers facilitate student-centered learning through group discussions and are responsible for finding concepts (based on literature reviews from textbooks and journals) regarding the activities of interacting organisms that influence plant life. Interactions include competition, predation, prarasites, mutualism and allelopathy. Students then present the results of their group work. Lecturer and students conclude the concept of organism interactions. In independent activities, students carry out Allelopathy practicum activities guided by LKM. Students are asked to make a practicum report. Students are also asked to read references that will be used for the next meeting 2 x 50 |   | Material: Interactions between organisms: Competence, Predation, Predation, Paracystism, beneficial associations, allelopathy, nature and forms of attack, plant defense References: Bhatla, SC and Manju AL2018. Plant Physiology, Development and Metabolism. Singapore: Springer | 10% |

| 5 | Understand various                 | 1.explains the                   | Criteria:                | Case method               |   | Material: Response to | 0% |
|---|------------------------------------|----------------------------------|--------------------------|---------------------------|---|-----------------------|----|
| 1 | plant responses to                 | effect of low and                | 1.Reports and            | 1.Pre existing            |   | environmental stress  |    |
|   | environmental                      | high                             | practicum products       | Material. The             |   | Reference: Fitter AH  |    |
|   | stress and be able                 |                                  | are assessed as          | lecturer asks             |   | and RKM Hay. 1998.    |    |
|   | to relate this<br>understanding to | temperatures on                  | ASSIGNMENTS              | students to               |   | Environmental         |    |
|   | various                            | plants and the<br>adaptation of  | with a weight of         | individually read         |   | Physiology of Plants. |    |
|   | mechanisms of                      |                                  |                          | references                |   | (Sri Andani and       |    |
|   | plant resistance to                | plants to these                  | 30%. performance         | regarding                 |   | Purbayanti. Trans)    |    |
|   | toxicity                           | conditions                       | is integrated during     | various plant             |   | Yogyakarta: Gadjah    |    |
|   |                                    | 2.describe the                   | learning                 | responses to              |   | Mada                  |    |
|   |                                    | effect of anoxia                 | 2.Form: Written Test     | environmental             |   |                       |    |
|   |                                    | on plant roots                   | and Assignment           | stress and be             |   |                       |    |
|   |                                    | <ol><li>Describe the</li></ol>   | Criteria: Indicators     | able to relate            |   |                       |    |
|   |                                    | effects of air                   | are achieved             | this                      |   |                       |    |
|   |                                    | pollution on                     | through                  | understanding             |   |                       |    |
|   |                                    | plants                           | assignments in           | to various                |   |                       |    |
|   |                                    | <ol><li>explains plant</li></ol> | independent and          | mechanisms of             |   |                       |    |
|   |                                    | resistance to air                | structured tasks         | plant resistance          |   |                       |    |
|   |                                    | pollution                        |                          | to toxicity. This         |   |                       |    |
|   |                                    | <ol><li>Describe the</li></ol>   | Form of Assessment :     | process is an             |   |                       |    |
|   |                                    | properties and                   | Participatory Activities | assignment                |   |                       |    |
|   |                                    | toxicity of saline,              |                          | from the                  |   |                       |    |
|   |                                    | calcareous,                      |                          | previous                  |   |                       |    |
|   |                                    | acidic and heavy                 |                          | meeting which             |   |                       |    |
|   |                                    | metal                            |                          | is reinforced by          |   |                       |    |
|   |                                    | contaminated                     |                          | the lecturer              |   |                       |    |
| 1 |                                    | soils                            |                          | . 2. Activities in        |   |                       |    |
|   |                                    | 6.provide                        |                          | groups. The               |   |                       |    |
| 1 |                                    | examples of                      |                          | lecturer<br>provides      |   |                       |    |
| 1 |                                    | metal indicator                  |                          | provides<br>problem cases |   |                       |    |
|   |                                    | plants and their                 |                          | regarding the             |   |                       |    |
|   |                                    | coping                           |                          | influence of              |   |                       |    |
|   |                                    |                                  |                          | various                   |   |                       |    |
|   |                                    | mechanisms                       |                          | environmental             |   |                       |    |
|   |                                    | (phytochelatin)                  |                          | factors such as           |   |                       |    |
|   |                                    | 7.skilled in                     |                          | low and high              |   |                       |    |
|   |                                    | carrying out                     |                          | temperatures,             |   |                       |    |
|   |                                    | experimental                     |                          | anoxia, air               |   |                       |    |
|   |                                    | activities on the                |                          | pollution on              |   |                       |    |
|   |                                    | effects of heavy                 |                          | plants and plant          |   |                       |    |
|   |                                    | metals on plants                 |                          | adaptation in             |   |                       |    |
|   |                                    |                                  |                          | these                     |   |                       |    |
|   |                                    |                                  |                          | conditions.               |   |                       |    |
|   |                                    |                                  |                          | Students are              |   |                       |    |
|   |                                    |                                  |                          | asked to                  |   |                       |    |
|   |                                    |                                  |                          | conduct                   |   |                       |    |
|   |                                    |                                  |                          | discussions in            |   |                       |    |
| 1 |                                    |                                  |                          | groups to solve           |   |                       |    |
|   |                                    |                                  |                          | various cases             |   |                       |    |
| 1 |                                    |                                  |                          | given based on            |   |                       |    |
| 1 |                                    |                                  |                          | the references            |   |                       |    |
|   |                                    |                                  |                          | they read. In             |   |                       |    |
| 1 |                                    |                                  |                          | this activity,            |   |                       |    |
| 1 |                                    |                                  |                          | students can              |   |                       |    |
|   |                                    |                                  |                          | develop ideas or          |   |                       |    |
| 1 |                                    |                                  |                          | thoughts to               |   |                       |    |
|   |                                    |                                  |                          | solve problems.           |   |                       |    |
|   |                                    |                                  |                          | Individual                |   |                       |    |
| 1 |                                    |                                  |                          | students in               |   |                       |    |
|   |                                    |                                  |                          | groups can                |   |                       |    |
|   |                                    |                                  |                          | express their             |   |                       |    |
|   |                                    |                                  |                          | opinions<br>3. Class Room |   |                       |    |
|   |                                    |                                  |                          | Discussion                |   |                       |    |
| 1 |                                    |                                  |                          | Lecturers                 |   |                       |    |
|   |                                    |                                  |                          | facilitate                |   |                       |    |
|   |                                    |                                  |                          | students to               |   |                       |    |
| 1 |                                    |                                  |                          | discuss in class,         |   |                       |    |
|   |                                    |                                  |                          | present the               |   |                       |    |
|   |                                    |                                  |                          | results obtained          |   |                       |    |
| 1 |                                    |                                  |                          | in groups. and            |   |                       |    |
|   |                                    |                                  |                          | classically               |   |                       |    |
|   |                                    |                                  |                          | obtained                  |   |                       |    |
| 1 |                                    |                                  |                          | problem solving           |   |                       |    |
| 1 |                                    |                                  |                          | and conclusions           |   |                       |    |
|   |                                    |                                  |                          | from the                  |   |                       |    |
| 1 |                                    |                                  |                          | experiments               |   |                       |    |
|   |                                    |                                  |                          | carried out.              |   |                       |    |
|   |                                    |                                  |                          | Students make             |   |                       |    |
|   |                                    |                                  |                          | reports in                |   |                       |    |
|   |                                    |                                  |                          | independent               |   |                       |    |
|   |                                    |                                  |                          | assignments.              |   |                       |    |
|   |                                    |                                  |                          | 2 X 50                    |   |                       |    |
|   | l .                                |                                  | l .                      | ı                         | 1 | 1                     |    |

|   | T   |   |  |  | T |  |    |
|---|---|---|--|--|---|--|----|
| 6 | Understand the relationship between oxygen availability and animal physiology | 1. Explain the composition of the ancient atmosphere 2. Identify biochemical reactions involving oxygen 3. Classifying the way living creatures adapt is related to the availability of oxygen 4. Skilled in carrying out practical activities on plant responses to electromagnetics | Criteria:  1.Reports and practicum products are assessed as ASSIGNMENTS with a weight of 30%. performance is integrated during learning 2. Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks  Form of Assessment: Participatory Activities | Discussion, analysis of presentation articles Lecturers facilitate student-centred learning through group discussions and are responsible for finding concepts (based on literature reviews from textbooks and journals) regarding the relationship between oxygen availability and animal physiology. Students then present the results of their group work. Lecturer and students conclude the concept of how living creatures adapt is related to the availability of oxygen. Students are asked to read references for the next meeting 2 x 50 |   | Material: Cell biochemical reactions involving oxygen classification of living creatures' strategies. Reference: Carere, C. and Mastripieni, D. 2013. Animal Personalities Behavior, Physiology, and Evolution. Chicago: The University of Chicago Press | 0% |

| 7 | Analyzing animal activities regarding the influence of temperature and environment | 1.Explain the effect of water temperature on animal O2 consumption 2.Distinguish between the activities of ectothermic and endothermic animals under conditions of changes in environmental temperature 3.Describe various winter animal activities 4.explain hibernation activity 5.Skilled in carrying out experimental activities on the effect of water temperature on fish activity | Criteria: Reports and practicum products are assessed as ASSIGNMENTS with a weight of 30%. performance is integrated during learning  Form of Assessment: Participatory Activities, Practical Assessment   | Case method 1.Pre existing Material. The lecturer asks students to individually read references regarding animal activity on the influence of temperature and the environment. This process is an assignment from the previous meeting which is reinforced by the lecturer. 2. Activities in groups. The lecturer provides problem cases regarding the influence of animal activities on temperature and environmental influences. Students are asked to carry out a simple experiment to prove the effect of water temperature on animal O2 consumption based on the LKM guide and the references they read. In this activity, students can develop ideas or thoughts to solve problems. Individual students in groups can express their opinions 3. Class Room Discussion Lecturers facilitate students to discuss in class, present the results obtained problem solving and conclusions from the experiments carried out. Students make practical reports in independent assignments. 2 X 50 | Material: Effect of temperature (air, soil) and environment on animal activity; hibernation activity Bibliography: Rastogi, SC 2008. Essentials of Animal Physiology (4th Edition). New Delhi: New Age International Publishers | 10% |
|---|--|--|--|--|---|-----|
| 8 | UTS  | Form: Written Test<br>and Assignment<br>Criteria: Indicators<br>are achieved<br>through<br>assignments in<br>independent and<br>structured tasks   | Criteria: Reports and practicum products are assessed as ASSIGNMENTS with a weight of 30%. USPerformance questions are integrated during learning. Practical reports and products are assessed as ASSIGNMENTS with a weight of 30%  Form of Assessment: Test | 2 × 50   | Material: Materials 1<br>to 7<br>References:  | 10% |

| 9 | Analyze the effect<br>of ammonia toxicity<br>on animal life | 1. Explain the reactions of protein metabolism in the bodies of aquatic and land animals 2. Explain the body's mechanism for reducing ammonia toxicity. 3. Comparing the mechanisms of ammonia removal in cartilaginous and bony fish. | Criteria: Reports and practicum products are assessed as ASSIGNMENTS with a weight of 30%. performance is integrated during learning  Form of Assessment: Participatory Activities | Presentation discussion The lecturer facilitates student- centered learning through group discussions and is responsible for finding concepts (based on literature review) regarding the effect of ammonia toxicity on aquatic animal life with LKM. Students then | Material: Ammonia toxicity in animal life (protein metabolism reactions in aquatic animals; ammonia removal mechanisms for reducing the toxicity of aquatic animals. Reference: Gordon, 1977. Abimal Physiology: Principles and Adaptation. New York: Macmillan Pub. Co | 5% |
|---|---|--|--|--|---|----|
|   |   | 4.Explain the mechanism of ammonia disposal in land animals.   |  | students then present the results of their group work. Lecturer and students conclude the concept of ammonia toxicity. Students are asked to read references that will be used for the next meeting 2 X 50   |   |    |

| Analyzing the structure and receptor organs are cerebrour products overtebrate receptor organs and conduction of receptor organs and receptor organs are receptor organs and receptor organs in went-brates and extended and particular datasets are added and particular datasets.  Form of Assessment: Participatory Activities and segment or complete and segment organs are added and particular datasets.  Form of Assessment: Participatory Activities and segment organs are added and particular datasets are added and particular datasets and segment organs are added and particular datasets and particular datasets are added and particular datasets are added and particular datasets are added and particular datasets and particular datasets are added and particular datasets and particular datasets are added and particular datasets are added and particular datasets are added and particular datasets and particular datasets are added and particular datasets and particular datasets are added and particular datasets are added and particular datasets are added and particular datasets and particular datasets are added and particular |    |               |                 |                          |                  | <br>           |    |
|--|----|---------------|-----------------|--------------------------|------------------|----------------|----|
| structure and arrangement of vertebraine receptor cognition of the prediction products and extended and chemical products in vertebraines in vertebraines.    Form of Assessment Participatory Activities   Partic | 10 | Analyzing the | 1.Identify the  | Criteria:                |                  |                | 5% |
| werebraite receptor organs and microbin of receptor organs and the state of the common of receptor organs and the temperature, mechanical and chemical in vertebrates in vertebrates and chemical in vertebrates.  Form of Assessment: Participatory Activities  Form of Assessment: Participatory Activities and structure tasks.  Form of Assessment: Participatory Activities and structure and structure tasks.  Form of Assessment: Participatory Activities and structure and str |    |               |                 | 1.Reports and            |                  |                |    |
| Organs  2. Explain the function of functio |    |               | receptor organs | practicum products       |                  |                |    |
| signifying the avesight of a 3. Distringuish temperature, mechanical and chemical receptor organs in vertebrates  Form of Assessments Participatory Activities  Form of Assessments Participatory Physiology, and concentrate Physiology, and concen |    |               |                 |                          |                  |                |    |
| Subsidinguish performance temperature mechanical and chemical receptor organs in vertebrates are achieved assignment and structured tasks.  Form of Assessment Participatory Activities  Form of Assessment Participatory Activities  Activities and advantage and activities are achieved assignment and structured tasks.  Form of Assessment Participatory Activities are achieved assignment and activities are achieved assignment and activities are activities and activities and activities are activities and activities ar |    |               |                 |                          |                  |                |    |
| Substinguish temperature in temperature in temperature in temperature in temperature in temperature in receptor organs in verrebrates in receptor under the complete in temperature in independent and succurred adals.  Form of Assessment: Participatory Activities  Participatory Activities  Form of Assessment: Participatory Activities  In the complete |    |               |                 | •                        |                  |                |    |
| mechanical and chemical receptor organs in vertebrates of invertebrates of independent and structured tasks.  Form of Assessment: Participatory Activities Participatory Activities of the invertebrates of independent and structured tasks.  Form of Assessment: Participatory Activities of the invertebrates of inve |    |               |                 |                          |                  | ,              |    |
| chemical receptor organs and Assignment Criteria Indicators are ancheved through the independent of a districtured tasks.  Form of Assessment: Participatory Activities  Form of Assessment: This process is an assignment of the independent of the independent organs in vertebrates. This process is an assignment of the independent of the  |    |               |                 |                          |                  |                |    |
| and Assignment in vertebrates in vertebrates in vertebrates are achieved through assignments in independent and settlement.  Form of Assignment: Participatory Activities  Form of Assignment in Participatory or organs in vertebrates. In Participatory organs in vertebrates in Participatory organs in vertebrates in Participatory organs in vertebrate in Participatory organs in vertebrates in Ver |    |               |                 |                          |                  |                |    |
| Distinguish are achieved through assignments in independent and structured and succurred and succurr |    |               |                 |                          |                  |                |    |
| are achieved through assignments in independent and structured tasks:  Form of Assessment: Participatory Activities  In process is an assignment from the previous meeting which is reinforced by the lecturer provides problem cases regarding the analysis of the example of the provides problem cases regarding the analysis of the example of the provides problem cases receptor organs. Students are asked to solve problems based or offerences they read in this activity, students can develop ideas or thoughts to solve problems.  Subdents in groups can express their opinions 3. Class Room Discussion Discussion In distillate students to discuss in class, present the results obtained in groups. And option of the problem solving and conclusions from the experiments carried out.   |    |               |                 |                          |                  |                |    |
| through assignments in independent and structured tasks.  Form of Assessment: Participatory Activities:  Form of Assessment: Participatory Activities:  In the provide of t |    |               | iii vertebrates |                          |                  |                |    |
| mechanical and structured tasks.  Form of Assessment: Participatory Activities  Form of Assessment: Participatory Participat |    |               |                 |                          |                  | Chicago i 1633 |    |
| Form of Assessment: Participatory Activities  Form of Assessment: Participatory Activities  Part |    |               |                 |                          |                  |                |    |
| Form of Assessment: Participatory Activities  Participatory Activities  In the process is an assignment from the previous which is reinforced by the lecturer. 2. Activities in the group. The lecturer provide class properly from the structure and sensitivity of vertebrate receptor organs. Students are as a sensitivity of vertebrate receptor organs. Students are as a sensitivity of vertebrate receptor organs. Students are as a sensitivity of vertebrate receptor organs. Students are as a sensitivity of vertebrate receptor organs. Students are as a sensitivity of vertebrate receptor organs. Students are as a sensitivity of vertebrate receptor organs. Students are as a sensitivity of vertebrate receptor organs. Students are as a sensitivity of vertebrate receptor organs. Students are as a sensitivity of vertebrate receptor organs. Students are as a sensitivity of vertebrate receptor organs. Students are as a sensitivity of vertebrate receptor organs. Students are as a sensitivity of vertebrate receptor organs. Students can develop ideas or the references they read. In this activity, students can develop ideas or solve problems. Individual students in groups can express their opinions Solvential and students in groups can express their opinions Solvential and solvential receptor organs. Solvential and solvential receptor organs. Solvential can be a sensitivity of vertebrate receptor organs. Solvential receptor or |    |               |                 | independent and          | chemical         |                |    |
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|  |    |               |                 |                          |                  |                |    |
|  |    |               |                 |                          | 2 X 30           |                |    |

| 11 | Analyzing animal activities regarding the influence of temperature and environment | 1.Explain the effect of water temperature on O2 consumption by fish 2.Distinguish between the activities of ectothermic and endothermic animals under conditions of changes in environmental temperature 3.Describe various winter animal activities 4.explain hibernation activity 5.Skilled in carrying out experimental activities on the effect of water temperature on fish activity | Criteria: Reports and practicum products are assessed as ASSIGNMENTS with a weight of 30%. performance is integrated during learning  Forms of Assessment: Participatory Activities, Practical Assessment, Practical / Performance   | Case method 1.Pre existing Material. The lecturer asked students to individually read references regarding the concept of temperature which influences the life of fish. This process is an assignment from the previous meeting which is reinforced by the lecturer. 2. Activities in the group. The lecturer gave a case of the problem of the influence of temperature on the life of fish (water animals). Students are asked to carry out simple experiments to solve problems. In this activity, students can develop ideas or thoughts to solve problems. Individual students in groups can express their opinions 3. Class Room | Material: Water quality (pH, dissolved oxygen levels, NH3 and heavy metals) and animal survival.  Reference: Rastogi, SC 2008. Essentials of Animal Physiology (4th Edition). New Delhi: New Age International Publishers | 15% |
|----|--|---|--|---|---|-----|
|    |  |   |  | Individual<br>students in<br>groups can<br>express their<br>opinions  |   |     |
| 12 | Understanding the potential of aquatic biota as environmental bioindicators        | 1.Explain the aspects of indicators in aquatic biota. 2.Explain the important role of aquatic biota as environmental bioindicators  | Criteria:  1.Reports and practicum products are assessed as ASSIGNMENTS with a weight of 30%. performance is integrated during learning  2.Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks  Form of Assessment: Participatory Activities | assignments.  2 × 50  Lecturers facilitate student- centered learning through group discussions and are responsible for finding concepts (based on literature reviews) regarding the potential of aquatic biota as environmental bioindicators. Students then present the results of their group work. Lecturer and students conclude the concept of the potential of aquatic biota as environmental bioindicators. Students sconclude the concept of the potential of aquatic biota as environmental bioindicators. Students are asked to read references that will be used for the next meeting 2 × 50                                | Material: Aquatic biota as bioindicators References: Bligh, J. Cloudesley T and McDonald, A. 1976. Environmental Animal Physiology. London: Black well Scientific Pub   | 5%  |

|    | T   |  | 1  | 1   | Г | 1  |     |
|----|---|--|--|---|---|--|-----|
| 13 | Students are able to generalize that water quality affects the life of fish (water animals) | 1.explain the effect of acid on gill damage 2.relate the effect of DO ppm on fish respiration and metabolism 3.explains the effect of NH3 and heavy metal levels on fish activity 4.provide examples of cases of toxicity by heavy metals and other pollutants 5.Skilled in conducting experiments on the effect of dissolved O2 levels on fish activity | Criteria: Reports and practicum products are assessed as ASSIGNMENTS with a weight of 30%. performance is integrated during learning  Form of Assessment: Participatory Activities, Practical Assessment | Case method 1.Pre existing Material. The lecturer asked students to individually read references regarding the concept of water quality which affects the life of fish (water animals). This process is an assignment from the previous meeting which is reinforced by the lecturer. 2. Activities in the group. The lecturer gave a case of water quality problems, namely dissolved oxygen levels which affect the life of fish (water animals). Students are asked to carry out simple experiments to solve problems. In this activity, students can develop ideas or thoughts to solve problems. Individual students in groups can express their opinions 3. Class Room Discussion Lecturers facilitate students to discuss in class, present the results obtained in groups. and classically obtained problem solving and conclusions from the experiments carried out. Students make practical reports in independent assignments. 2 X 50 |   | Material: Water quality (pH, dissolved oxygen levels, NH3 and heavy metals) and animal survival.  Reference: Carere, C. and Mastripieni, D. 2013. Animal Personalities Behavior, Physiology, and Evolution. Chicago: The University of Chicago Press | 10% |
| 14 | Understanding the diversity of estuarine biota  | 1.explain the physical properties of estuaries 2.Explain the characteristics of estuary biota 3.Explain the types of estuary biota 4.Explain the behavior of estuarine biota   | Criteria: Reports and practicum products are assessed as ASSIGNMENTS with a weight of 30%. performance is integrated during learning  Form of Assessment: Participatory Activities                       | Presentation and discussion Lecturers facilitate student-centered learning through group discussions and are responsible for finding concepts (based on literature review) regarding the diversity of estuarine biota. Students then present the results of their group work. Lecturer and students conclude the concept of estuary biota. Students are asked to read the references that will be used for the next meeting 2 X 50  |   | Material: Diversity of Estuarine Biota References: Yuliani, Rahardjo, Sunu Kuntjoro.2019. Ecophysiology 1: Plant Ecophysiology. Surabaya: Unesa Press.   | 0%  |

| 15 | Understand<br>ecophysiological<br>concepts in the<br>fields of animal<br>husbandry,<br>agriculture and<br>fisheries | explains the influence of the environment on animal husbandry, agriculture and fisheries   | 1.Reports and practicum products are assessed as ASSIGNMENTS with a weight of 30%. performance is integrated during learning 2.Form: Written Test and Assignment Criteria: Indicators are achieved through assignments in independent and structured tasks  Form of Assessment: Participatory Activities  | Presentations, discussions, questions and answers Lecturers facilitate student-centered learning through group discussions and are responsible for finding concepts (based on literature reviews) regarding ecophysiological concepts in the fields of animal husbandry, agriculture and fisheries. Students then present the results of their group work. Lecturers and students summarize the concepts of ecophysiology in the fields of animal husbandry, agriculture and fisheries. 2 X 50 | Material: Ecophysiological concepts in the fields of animal husbandry, fisheries and agriculture. Reference: Manuel, J.Regosa. 2001. Handbook of Plant Ecophysiology Techniques 2001st Edition. New York: Springer | 0%  |
|----|---|--|---|--|--|-----|
| 16 | Students are able to understand ecophysiology material and implement it to solve problems                           | Form: Written Test<br>and Assignment<br>Criteria: Indicators<br>are achieved<br>through<br>assignments in<br>independent and<br>structured tasks | Criteria: Performance reports/assessments are assessed as ASSIGNMENTS with a weight of 30%, UTS with a weight of 20%, Student activities and responses during learning activities are assessed as participation, a weight of 20%, UAS with a weight of 30%. Essay and multiple choice questions are accessed together on UTS and UAS. Performance questions are integrated during learning  Form of Assessment: Participatory Activities, Tests | Test method  | Material: Materials 9 to 15 References: Yuliani, Rahardjo, Sunu Kuntjoro. 2019. Ecophysiology 1: Plant Ecophysiology. Surabaya: Unesa Press.   | 10% |

Evaluation Percentage Recan: Project Based Learning

| Evaluation Fercentage Necap. Froject based Learning |   |            |  |  |  |  |
|---|---|------------|--|--|--|--|
| No  | Evaluation                                      | Percentage |  |  |  |  |
| 1.  | Participatory Activities                        | 50%        |  |  |  |  |
| 2.  | Project Results Assessment / Product Assessment | 5%         |  |  |  |  |
| 3.  | Practical Assessment                            | 25%        |  |  |  |  |
| 4.  | Practice / Performance                          | 5%         |  |  |  |  |
| 5.  | Test  | 15%        |  |  |  |  |
|   |   | 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.
- 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.
- 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.
- 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.
- 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.
- 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.

- Learning materials are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
   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%.
   TM=Face to face, PT=Structured assignments, BM=Independent study.