

## Module Handbook: Fisheries and Marine Biotechnology

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| Module designation                               | The field of biotechnology has developed rapidly, including the fisheries and marine sectors. This course provides comprehensive knowledge regarding the basics of biotechnology and the application of biotechnology in aquaculture, management of aquatic resources, and processing of fishery products. This course covers the application of biotechnology and molecular biology, which includes identification and assessment at the species and population level, DNA and genetic engineering for fish breeding, detection of DNA-based diseases (PCR, RT-PCR, LAMP), and immunology. In addition, microalgal biotechnology, fermentation of food and feed ingredients, and enzymes in fish food and feed technology were also studied. |
| Semester(s) in which the module is taught        | First Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Person responsible for the module                | 1. Indun Dewi Puspita, S.P., M.Sc. Ph.D.<br>2. Dr. Dini Wahyu Kartika Sari, S.Pi., M.Si<br>3. Eko Hardianto, S.Pi., M.Si., M.Sc., Ph.D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Language                                         | Indonesian                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Relation to curriculum                           | <i>Compulsory Course</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Teaching methods                                 | Activities:<br>a) Lecture (lecture and discussion)<br>b) Examinations<br>c) Take-home assignments<br>d) Quiz<br>e) Student presentation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Workload (incl. contact hours, self-study hours) | Working hours: 2 credits of theory.<br>Total Workload: 2 SCU (Semester Credit Unit) = 2 x 45 hours within 1 semester = 3.34 ECTS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Credit points                                    | 2 Credit points                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

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| Required and recommended prerequisites for joining the module | <i>None</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Module objectives/intended learning outcomes                  | <p><b>Program Learning Outcomes:</b></p> <p>PLO4 : Developing work networks, adapt, create, contribute, supervise, evaluate, and make decisions to demonstrate independent and group performance and apply knowledge to social life</p> <p>PLO9 : Assess and enhance managerial skills in the fishery business.</p> <p><b>Course Learning Outcomes:</b></p> <p>CLO1: Understanding DNA as genetic material and the process of genetic material alteration in the central dogma as well as basic techniques of genetic engineering. (PLO4) &amp; (PLO9)</p> <p>CLO2: Analyzing the role and benefits of biotechnology applications in the fields of aquaculture, aquatic environments, and fish processing. (PLO4) &amp; (PLO9)</p>                                      |
| Content                                                       | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Basic techniques of Biotechnology</li> <li>3. Fish Breeding Biotechnology</li> <li>4. Biotechnology disease detection</li> <li>5. Microbial engineering</li> <li>6. Enzymes in the fisheries processing industry</li> <li>7. Bioactive compounds from fishery waste</li> <li>8. Fisheries and marine biotechnology for the production of food components</li> <li>9. Molecular identification and assessment of fish at species and population levels</li> <li>10. Biotechnology in fish stock management and fish traceability</li> <li>11. Biotechnology in water quality management</li> <li>12. Group discussion I</li> <li>13. Group discussion II</li> <li>14. Group discussion III</li> </ol> |

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| Examination forms                  | <table><tr><td><i>Evaluation Basis</i></td><td><i>Evaluation Components</i></td><td><i>Percentage s</i></td><td><i>CLO1</i></td><td><i>CLO2</i></td></tr><tr><td rowspan="2"><i>Participatory Activity</i></td><td><i>Group presentation</i></td><td><i>15%</i></td><td></td><td>√</td></tr><tr><td><i>Quiz</i></td><td><i>15%</i></td><td>√</td><td></td></tr><tr><td><i>Project results/case study results</i></td><td><i>Individual/ Group Assignment</i></td><td><i>30%</i></td><td></td><td>√</td></tr><tr><td rowspan="2"><i>Cognitive</i></td><td><i>Mid Exam</i></td><td><i>20%</i></td><td>√</td><td></td></tr><tr><td><i>Final Exam</i></td><td><i>20%</i></td><td></td><td>√</td></tr><tr><td></td><td><i>Total</i></td><td><i>100%</i></td><td></td><td></td></tr></table> |                                     |                     |             |             | <i>Evaluation Basis</i> | <i>Evaluation Components</i> | <i>Percentage s</i> | <i>CLO1</i> | <i>CLO2</i> | <i>Participatory Activity</i> | <i>Group presentation</i> | <i>15%</i> |  | √ | <i>Quiz</i> | <i>15%</i> | √ |  | <i>Project results/case study results</i> | <i>Individual/ Group Assignment</i> | <i>30%</i> |  | √ | <i>Cognitive</i> | <i>Mid Exam</i> | <i>20%</i> | √ |  | <i>Final Exam</i> | <i>20%</i> |  | √ |  | <i>Total</i> | <i>100%</i> |  |  |
|                                    | <i>Evaluation Basis</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <i>Evaluation Components</i>        | <i>Percentage s</i> | <i>CLO1</i> | <i>CLO2</i> |                         |                              |                     |             |             |                               |                           |            |  |   |             |            |   |  |                                           |                                     |            |  |   |                  |                 |            |   |  |                   |            |  |   |  |              |             |  |  |
|                                    | <i>Participatory Activity</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <i>Group presentation</i>           | <i>15%</i>          |             | √           |                         |                              |                     |             |             |                               |                           |            |  |   |             |            |   |  |                                           |                                     |            |  |   |                  |                 |            |   |  |                   |            |  |   |  |              |             |  |  |
|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <i>Quiz</i>                         | <i>15%</i>          | √           |             |                         |                              |                     |             |             |                               |                           |            |  |   |             |            |   |  |                                           |                                     |            |  |   |                  |                 |            |   |  |                   |            |  |   |  |              |             |  |  |
|                                    | <i>Project results/case study results</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <i>Individual/ Group Assignment</i> | <i>30%</i>          |             | √           |                         |                              |                     |             |             |                               |                           |            |  |   |             |            |   |  |                                           |                                     |            |  |   |                  |                 |            |   |  |                   |            |  |   |  |              |             |  |  |
|                                    | <i>Cognitive</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <i>Mid Exam</i>                     | <i>20%</i>          | √           |             |                         |                              |                     |             |             |                               |                           |            |  |   |             |            |   |  |                                           |                                     |            |  |   |                  |                 |            |   |  |                   |            |  |   |  |              |             |  |  |
|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <i>Final Exam</i>                   | <i>20%</i>          |             | √           |                         |                              |                     |             |             |                               |                           |            |  |   |             |            |   |  |                                           |                                     |            |  |   |                  |                 |            |   |  |                   |            |  |   |  |              |             |  |  |
|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <i>Total</i>                        | <i>100%</i>         |             |             |                         |                              |                     |             |             |                               |                           |            |  |   |             |            |   |  |                                           |                                     |            |  |   |                  |                 |            |   |  |                   |            |  |   |  |              |             |  |  |
|                                    | <i>The total percentage of participatory activities and project results/case studies/PBL results is at least 50%.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                     |                     |             |             |                         |                              |                     |             |             |                               |                           |            |  |   |             |            |   |  |                                           |                                     |            |  |   |                  |                 |            |   |  |                   |            |  |   |  |              |             |  |  |
| Study and examination requirements | Students can join the course by registering the study plan (KRS) to enroll in the chosen subjects in each academic semester. The students must meet minimum attendance requirements 70% for joining the final examination.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                     |                     |             |             |                         |                              |                     |             |             |                               |                           |            |  |   |             |            |   |  |                                           |                                     |            |  |   |                  |                 |            |   |  |                   |            |  |   |  |              |             |  |  |
|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                     |                     |             |             |                         |                              |                     |             |             |                               |                           |            |  |   |             |            |   |  |                                           |                                     |            |  |   |                  |                 |            |   |  |                   |            |  |   |  |              |             |  |  |

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| Reading list | <ol style="list-style-type: none"> <li>1. Pandey, P. K., &amp; Parhi, J. (Eds.). (2021). <i>Advances in fisheries biotechnology</i> (p. 521). Springer.</li> <li>2. Gupta, S. K., &amp; Giri, S. S. (Eds.). (2021). <i>Biotechnological advances in aquaculture health management</i>. Springer Singapore, Imprint: Springer.</li> <li>3. Das, S., &amp; Patel, B. (2020). Marine resources and animals in modern biotechnology. In <i>Animal Biotechnology</i> (pp. 567-591). Academic Press.</li> </ol> <p>Additional Journal References:</p> <ol style="list-style-type: none"> <li>1. Hardianto E, Wijayanti DP, Shy J-Y, Mather P, Hughes J, Imai H. 2022. Molecular ecology of the fiddler crab <i>Austruca perplexa</i> H. Milne Edwards, 1852: genetic divergence along a major biogeographical barrier, Wallace's Line. <i>Biological Journal of the Linnean Society</i>, <b>135</b>:310-321.</li> <li>2. Hardianto E, Fukuchi J, Hanamura Y, Wijayanti DP, Sabdono A, Imai H. 2022. Molecular ecology of a shallow water shrimp Hansen 1919: evidence for strongly limited gene flow across the western Pacific. <i>Marine Ecology</i>, <b>43</b>: e12695</li> <li>3. Hardianto E, Hirayama M, Wijayanti DP, Imai H. 2023. Molecular ecology analysis of the Javanese ricefish, <i>Oryzias javanicus</i> (Bleeker): Genetic divergence along the Indonesian Archipelago. <i>Marine and Freshwater research</i>, <b>74</b>(15):1314-1323.</li> <li>4. Hardianto E, Wijayanti DP, Imai H. 2024. Genetic structure of the commercially important Asian monsoon scallops, <i>Amusium Pleuronectes</i> (Linnaeus 1758) across the Indonesian Archipelago. <i>Marine Ecology</i>, <b>45</b>(2):e12793</li> <li>5. Hardianto E, Setyobudi E, Adharini RI, Lestari SM. 2025. Population genetics of the blood cockle, <i>Tegillarca granosa</i> (Linnaeus, 1758): A study of spatial genetic structure across the Indonesian Archipelago. <i>Marine Ecology</i>, <b>46</b>:e70017</li> </ol> |
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