Module Handbook : Smart Sustainable Aquaculture

Module designation	Aquaculture is the fastest-growing agribusiness sector and is evolving more intensively with high densities, high technological inputs, and dependence on artificial feeds. Aquaculture faces major challenges to meet the tremendous increase in demand for fish products. On the other hand, there is a great opportunity to increase cultivation products by implementing industrial technology 4.0. Industrial technology 4.0 is based on automation, digitization, artificial intelligence, and the internet of things. By applying the latest technology, the concept of aquaculture will be transformed into a new concept of smart aquaculture. In addition, major environmental problems are another challenge to ensuring the sustainability of aquaculture. Therefore, Smart and Environmentally Friendly Aquaculture is a course that provides basic concepts and applicable technology for millennial master students to improve their abilities in the industrial era 4.0.
Semester(s) in which the module is taught	1
Person responsible for the module	1. Dr. Susilo Budi Priyono, S.Pi., M.Si. 2. Prof. Dr. Ir. Murwantoko, M.Si. 3. Indah Istiqomah, S.Pi., M.Si., Ph.D.
Language	Indonesian
Relation to curriculum	Compulsory Course

Teaching methods	Activities: a) Lecture (lecture and discussion) b) Examinations c) Take home assignments d) Quiz e) Student presentation
Workload (incl. contact hours, self-study hours)	1. Lecture 2 SKS x 50 minutes x 16 meetings = 1,600 minutes = 26.67 hours = 26.67 hours/30 hours = 0.89 ECTS 2. Structural Assignment 2 SKS x 60 minutes x 16 meetings = 1,920 minutes = 32.00 hours = 32.00 hours/30 hours = 1.07 ECTS 3. Self Study 2 SKS x 60 minutes x 16 meetings = 1,920 minutes = 32.00 hours = 32.00 hours/30 hours = 1.07 ECTS Total Workload = 3.02 ECTS
Credit points	2 Credit points
Required and recommended prerequisites for joining the module	The minimum of student attendance is 70% from total 14 meetings to be eligible to take the final exams.

Module objectives/intended learning outcomes	Program Learning Outcomes: PLO-P1 : Able to demonstrate theory and its application comprehensively in the fields of aquaculture, aquatic resource management, fish product technology. PLO-KK2 : Able to implement management principles in fisheries and marine businesses which include planning, organizing, conducting, monitoring, and evaluating.
Content	1. Fish Genetic Precission and Fish Nutrition Precission 2. The Role of Microbes in Quality Control of RAS Systems 3. Bacterial Diversity in RAS 4. Gen Mapping 5. IoT concept and development
Examination forms	Midterm exam: Examination Final exam: Examination by Simaster, g form, and Elok
Study and examination requirements	Students can join the course by registering the study plan (KRS) to enroll the chosen subjects in each academic semester. The students must meet minimum attendance requirements 70% for joining the final examination.
Reading list	1. C.D. Webster. and B.B. Janna. 2003. Sustainable Aquaculture Global Respectives. International Journal, such as: 1. F. Antonucci & C. Costa. 2020. Precision aquaculture: a short review on engineering innovations. Aquaculture International volume 28, pages 41–57. 2. Tsai, K. L., Chen, L. W., Yang, L. J., Shiu, H. J., & Chen, H. W. (2022). IoT based smart aquaculture system with automatic aerating and water quality monitoring. *Journal of Internet Technology*, *23*(1), 177-184. 3. Chiu, M. C., Yan, W. M., Bhat, S. A., & Huang, N. F. (2022). Development of smart aquaculture farm management system using IoT and AI-based surrogate models. *journal of Agriculture and Food Research*, *9*, 100357.