SEMESTER LESSON PLAN

LESSON PLAN DEVELOPER(S):

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AQUACULTURE MASTER'S PROGRAM
FACULTY OF FISHERIES AND MARINE SCIENCE
UNIVERSITAS BRAWIJAYA
2021

SEMESTER LESSON PLAN

1. Course Identity

Study Program	: Aquaculture Master's Program
Course	: Aquaculture Engineering
Course Code	: PIB 8210
Course Group	: Aquatic Environment
Credit	: 3
Degree	: Master's Degree
Semester	: 2
Pre-requisite	: (*if any, write down the course code*)
Status	: Elective
Lecturers' names and codes	: Dr. Ir. Mohamad Fadjar, M.Sc.
	Dr. Ir. Agoes Soeprijanto, MS.
	Dr. Ating Yuniarti, S.Pi., M. Aqua.
	Dr. Ir. Abd. Rahem Faqih, M.Si.

2. Course Description

This course discusses various techniques in facilities that are used to optimize aquaculture in both brackish and marine waters.

3. Program Learning Outcomes (PLO)

1. Being able to develop the existing concept and create new knowledge in the field of sustainable aquaculture system and in best management practices of aquaculture (CPL 8).

4. **Course Learning Outcomes**

After completing this course, students will be able to:

1. develop the concept of pond construction for optimal use of available resources.
2. understand the basics of aquaculture engineering, construction of ponds, aquaculture tanks.
3. comprehend semi-closed, intensive, integrated and sustainable based cultivation techniques.

5. Lesson Plan

Week	PLO Indicator	Topics	Teaching Strategies	Time (hour)	Learning Activities	Assessment	Learning Sources
1	1.1 Accuracy in explaining the functions of Aquaculture Engineering, the history aquaculture engineering development	- Introduction to Aquaculture Engineering, - The function of Aquaculture Engineering, - History of Aquaculture Engineering development	• Lecture (S)	2	Note Taking (A) Working on assignments (A)	Criteria: Scoring Guidelines Non-test: Summarizing lecture materials(A)	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham: Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp. London: Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies and Development of Land Based Fish Farming. Suisanzoshoku 44, 547–560.

Week	PLO Indicator	Topics	Teaching Strategies	Time (hour)	Learning Activities	Assessment	Learning Sources
2	2.1 Accuracy in explaining the basics of pond construction and aquaculture tanks	- Definition of basics of pond construction and aquaculture tanks	• Lecture (S) • Assignment(A) & Presentation (S)	2	Note Taking (A) Working on assignments (A)	Criteria: Scoring Guidelines - Non-test: Summarizing lecture materials(A) - Group or independent presentation(S)	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham: Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp. London: Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies and Development of Land Based Fish Farming. Suisanzoshoku 44, 547–560.
3	3.1 Accuracy in explaining indoor cultivation technique	- Indoor cultivation technique	• Lecture (S) • Assignment(A) & Presentation (S)	2	Note Taking (A) Working on assignments (A)	Criteria: Scoring Guidelines Non-test: - Summarizing lecture materials(A)	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham: Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment

Week	PLO Indicator	Topics	Teaching Strategies	Time (hour)	Learning Activities	Assessment	Learning Sources
						- Group or independent presentation(S)	and Pond Aquaculture, 348 pp. London: Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies and Development of Land Based Fish Farming. Suisanzoshoku 44, 547–560.
4	4.1 Accuracy in explaining waste recirculation engineering system	- Techniques in waste recirculation engineering system	• quiz 1 (S) • Lecture (S) • Assignment(A) & Presentation (S)	2	Note Taking (A) Working on assignments (A)	Criteria: Scoring Guidelines Non-test: - Summarizing lecture materials(A) - Group or independent presentation(S)	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham: Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp. London: Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies

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							and Development of Land Based Fish Farming. Suisanzoshoku 44, 547–560.
5	5.1 Accuracy in explaining concept of hatchery collector engineering system	- The design concept of hatchery collector engineering system	• Lecture (S) • Assignment(A) & Presentation (S)	2	Note Taking (A) Working on assignments (A)	Criteria: Scoring Guidelines Non-test: - Summarizing lecture materials(A) - Group or independent presentation(S)	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham: Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp. London: Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies and Development of Land Based Fish Farming. Suisanzoshoku 44, 547–560.
6	6.1 Accuracy in explaining the designs of hatchery and	- Designs of hatchery and cooling systems	• Lecture (S) • Lecture (S) • Assignment(A) &	2	Note Taking (A) Working on assignments	Criteria: Scoring Guidelines	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp.

Week	PLO Indicator	Topics	Teaching Strategies	Time (hour)	Learning Activities	Assessment	Learning Sources
	cooling systems		Presentation (S)		(A)	Non-test: - Summarizing lecture materials(A) - Group or independent presentation(S)	Farnham: Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp. London: Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies and Development of Land Based Fish Farming. Suisanzoshoku 44, 547–560.
7	7.1 Accuracy in understanding and explaining the materials delivered in previous week	- The design concept of hatchery collector engineering system - The designs of hatchery and cooling systems	• Lecture (S) • Assignment(A) & Presentation (S)	2	Note Taking (A) Working on assignments (A)	Criteria: Scoring Guidelines Non-test: - Summarizing lecture materials(A) - Group or independent presentation(S)	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham: Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp. London:

Week	PLO Indicator	Topics	Teaching Strategies	Time (hour)	Learning Activities	Assessment	Learning Sources
							Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies and Development of Land Based Fish Farming. Suisanzoshoku 44, 547–560.
8	**MIDTERM EXAM**						
9	9.1 Accuracy in explaining the design of disinfectant system (ozonizer)	- The design of disinfectant system (ozonizer)	• Lecture (S) • Assignment(A) & Presentation (S)	2	Note Taking (A) Working on assignments (A)	Criteria: Scoring Guidelines Non-test: - Summarizing lecture materials(A) - Group or independent presentation(S)	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham: Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp. London: Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies and Development of

Week	PLO Indicator	Topics	Teaching Strategies	Time (hour)	Learning Activities	Assessment	Learning Sources
							Land Based Fish Farming. Suisanzoshoku 44, 547–560.
10	10.1 Accuracy in explaining the advanced design of pond construction	- Advanced pond design	• Lecture (S) • Assignment(A) & Presentation (S)	2	Note Taking (A) Working on assignments (A)	Criteria: Scoring Guidelines Non-test: - Summarizing lecture materials(A) - Group or independent presentation(S)	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham: Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp. London: Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies and Development of Land Based Fish Farming. Suisanzoshoku 44, 547–560.
11	11.1 Accuracy in explaining super intensive shrimp aquaculture	-Pond design for super-intensive shrimp aquaculture	• Lecture (S) • Assignment(A) & Presentation (S)	2	Note Taking (A) Working on assignments (A)	Criteria: Scoring Guidelines	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham:

Week	PLO Indicator	Topics	Teaching Strategies	Time (hour)	Learning Activities	Assessment	Learning Sources
						Non-test: - Summarizing lecture materials(A) - Group or independent presentation(S)	Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp. London: Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies and Development of Land Based Fish Farming. Suisanzoshoku 44, 547–560.
12	12.1 Accuracy in understanding and explaining the materials delivered in previous week	-Design of a disinfectant system (ozonizer) -Advanced pool design - Pond design for super intensive shrimp	• Lecture (S) • Assignment(A) & Presentation (S)	2	Note Taking (A) Working on assignments (A)	Kriteria: Pedoman Penskoran Bentuk non-test: - Summarizing lecture materials(A) - Group or independent presentation(S)	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham: Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp.

Week	PLO Indicator	Topics	Teaching Strategies	Time (hour)	Learning Activities	Assessment	Learning Sources
							London: Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies and Development of Land Based Fish Farming. Suisanzoshoku 44, 547–560.
13	13.1 Accuracy in understanding the concept and implementation of integrative aquaculture	- The concept and implementation of integrative marine aquaculture	• Lecture (S) • Assignment(A) & Presentation (S)	2	Note Taking (A) Working on assignments (A)	Criteria: Scoring Guidelines Non-test: - Summarizing lecture materials(A) - Group or independent presentation(S)	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham: Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp. London: Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies and Development of

Week	PLO Indicator	Topics	Teaching Strategies	Time (hour)	Learning Activities	Assessment	Learning Sources
							Land Based Fish Farming. Suisanzoshoku 44, 547–560.
14	14.1 Accuracy in understanding sustainable periphyton cultivation	- Sustainable periphyton cultivation	• Lecture (S) • Assignment(A) & Presentation (S)	2	Note Taking (A) Working on assignments (A)	Criteria: Scoring Guidelines Non-test: - Summarizing lecture materials(A) - Group or independent presentation(S)	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham: Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp. London: Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies and Development of Land Based Fish Farming. Suisanzoshoku 44, 547–560.
15	15.1 Accuracy in understanding and explaining the materials delivered previous week	- The concept and implementation of marine aquaculture - Sustainable periphyton	• Lecture (S) • Assignment(A) & Presentation (S)	2	Note Taking (A) Working on assignments (A)	Criteria: Scoring Guidelines Non-test:	1) Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham:

Week	PLO Indicator	Topics	Teaching Strategies	Time (hour)	Learning Activities	Assessment	Learning Sources
		cultivation				- Summarizing lecture materials(A) - Group or independent presentation(S)	Fishing News Books. 2) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp. London: Chapman & Hall. 3) Billard R. and Dabbadie L. (1996). Technologies and Development of Land Based Fish Farming. Suisanzoshoku 44, 547–560.
16	**FINAL EXAM**						

Notes: S = Synchronous, A = Asynchronous, all soft skills achievement will be scored based on the analysis referring to the Learning Management System

6. References

Beveridge M. C. M., 1987. Cage Aquaculture, 352 pp. Farnham: Fishing News Books.

1) Boyd C. E. 1995. Bottom Soils Sediment and Pond Aquaculture, 348 pp. London: Chapman & Hall.
2) Billard R. and Dabbadie L. (1996). Technologies and Development of Land Based Fish Farming. Suisanzoshoku 44, 547–560.
3) Harrison E. 1994. Aquaculture in Africa, Socio-Economic Dimension, pp. 240–299. J. Muir and J. Roberts, eds. Recent advances in aquaculture V. Institute of Aquaculture Stirling UK.
4) Haylor G. S. (1994). Fish Production From Engineered Water in Developing Countries, pp. 1–103. J. Muir and J. Roberts, eds. Recent advances in aquaculture V. Institute of Aquaculture Stirling UK.
5) Troell M., Halling C., Nilsson A., Buschmann A. H., Kautsky N., and Kautsky L. (1997). Integrated Marine Cultivation of Gracilaria chilensis (Gracilariales, Rhodophyta) and Salmon Cages for Reduced Environmental Impact and Increased Economic Output. Aquaculture, 156, 45–61.

7. Appendices

Appendix 1. *Learning Materials*

PPT 1 : Introduction
PPT 2 : Introduction to Aquaculture Engineering
PPT 3 : The functions of Aquaculture Engineering
PPT 4 : History of Aquaculture Engineering
PPT 5 : The basics aquaculture pond and tank design
PPT 6 : Indoor cultivation technique
PPT 7 : Waste recirculation engineering system
PPT 8 : The conceptual design of collector hatchery engineering system
PPT 9 : Designs of hatchery and cooling system
PPT 10 : Designs of disinfectant system (ozonizer)
PPT 11 : Advanced pond design
PPT 12 : Super intensive shrimp pond design
PPT 13 : Concept and implementation of integrated marine aquaculture
PPT 14 : Sustainable periphyton cultivation
Online learning resources: (URL/link)
and other learning resources: (URL/link)

Appendix 2. *Media*
Zoom Meeting: (*URL/link*)
Google Meet: (*URL/link*)

Appendix 3. *Assessment Instrument*

Scoring Rubric

Oral Presentation

Close to the Expectation **(score 1-2)**	**Meeting the Expectation** **(score 3-4)**	**Exceeding the Expectation** **(score 5)**
1) Presentation is not organized and not well developed 2) Material is not well-explained well 3) Theories and concepts are not thoroughly discussed	1) Presentation is rather well -organized and developed 2) Fair comprehension of the material being delivered 3) Theories and concepts are fairly	1) Presentation is very well organized and creatively developed 2) Very strong knowledge regarding the material being presented 3) Theories and concepts are very

4) Presentation is not clear and not fluent 5) Lack of confidence in delivery, mostly note reading 6) Voice is unclear 7) Presentation does not attract audiences' attention 8) Inadequate responses to questions, inadequate comprehension of the material 9) Unsynchronized presentations 10) Exceeding the time limit, failing to complete the presentation	discussed thoroughly 4) Presentation is fairly clear and fluent 5) Showing fairly strong confidence and speakers read notes wisely 6) Voice is quite clear 7) Able to engage audience's attention 8) Fairly good in responding to questions, showing excellent comprehension of the material being presented 9) Good synchronization of presentation flow 10) Exceeding the time limit yet presenters managed to complete the presentation	thoroughly-discussed 4) Presentation is very clear and smooth 5) Excellent confidence in delivery, reading notes very wisely 6) Voice is very clear 7) Adequately attracts audiences' attention well 8) Responding to questions very well, very strong comprehension of the material being delivered 9) Very clear synchronization in presentation flow 10) Not exceeding the time limit, presentation is completed

Written Assignments

Essay

Under the average (score 1 – 4)	**Within the Average (score 5 – 8)**	**Above the Average (score 9 – 12)**	**Perfect (score 13 – 15)**
1) Not using the right analytical method 2) Incorrect data analysis 3) Making wrong conclusions 4) No critical analysis of the data available 5) No references 6) Unmatched literature review (theory, research) and questions 7) Using non-standardized language and poor cohesion 8) No explanation about the implications of the topics being discussed 9) Essay is not systematically-	1) Using acceptable analytical methods 2) Data are well analyzed 3) Making relevant conclusions 4) There is a fairly critical analysis of the data 5) There are only one or two references yet irrelevant 6) Matching literature review (theory, research) and question 7) Using standard language with good cohesion between sentences 8) The implications of the topics being discussed are explained yet less thoroughly	1) Using a relatively precise analysis method 2) Proper data analysis 3) Making the right conclusion 4) Critical analysis of the data is found 5) There are many references yet irrelevant at this point 6) Matching literature review (theory, research) and questions 7) Using standard language and sentences are cohesive 8) There is a unique and critical explanation of the implications of the topics	1) Using the correct analytical method 2) Effective data analysis 3) Making strongly effective conclusions 4) There is a strong critical analysis of the data 5) There are many references with strong relevancy 6) Strongly matching literature review (theory, research) and questions 7) Using standard language with strong cohesion between sentences 8) There is a unique and very critical explanation of the implications of the topics

structured	9) Essay is not systematically-structured	being discussed 9) Essay is systematically-arranged	being discussed 9) Essay is systematically and neatly arranged

Report

Under the average (score 1 – 4)	**Within the Average (score 5 – 8)**	**Above the Average (score 9 – 12)**	**Perfect (score 13 – 15)**
1) Not using the right analytical method 2) Incorrect data analysis 3) Making wrong conclusions 4) No critical analysis of the data available 5) No references 6) Unmatched literature review (theory, research) and questions 7) Using non-standardized language and poor cohesion 8) No explanation about the implications of the topics being discussed 9) Report is not systematically-structured	1) Using acceptable analytical methods 2) Data are well analyzed 3) Making relevant conclusions 4) There is a fairly critical analysis of the data 5) There are only one or two references yet irrelevant 6) Matching literature review (theory, research) and question 7) Using standard language with good cohesion between sentences 8) The implications of the topics being discussed are explained yet less thoroughly 9) Report is relatively not systematically-structured	1) Using a relatively precise analysis method 2) Proper data analysis 3) Making the right conclusion 4) Critical analysis of the data is found 5) There are many references yet irrelevant at this point 6) Matching literature review (theory, research) and questions 7) Using standard language and sentences are cohesive 8) There is a unique and critical explanation of the implications of the topics being discussed 9) Report is systematically-arranged	1) Using the correct analytical method 2) Effective data analysis 3) Making strongly effective conclusions 4) There is a strong critical analysis of the data 5) There are many references with strong relevancy 6) Strongly matching literature review (theory, research) and questions 7) Using standard language with strong cohesion between sentences 8) There is a unique and very critical explanation of the implications of the topics being discussed 9) Report is systematically and neatly arranged