Khulna University, Khulna

Master of Science

School: Life Science **Discipline:** Fisheries and Marine Resource Technology **Program:** ~~BSc in Fisheries (Hon's)~~ in Aquaculture

Year: ~~3rd~~ MS **Term:** ~~II~~ I **Examination Year:** 2026 **Session:** 2025-2026

Course Code: 0831 06 Aqua 5101 **Course Title:** Advanced Freshwater Aquaculture

Total Marks: 60 **Time:** 3 Hours **Credit:** 03

Instructions: Use Separate answer script for each section

Section A **Marks**

There are FOUR (04) questions in this section. Answer any Three (03) questions.

1. a) Compare between advanced freshwater aquaculture and freshwater aquaculture. (L2, CLO1) 03
   b) Analyze the challenges of advanced freshwater aquaculture in Bangladesh. (L4, CLO1) 03
   c) Select three advanced aquaculture technologies in the world and explain their prospects and application procedures in Bangladesh. (L5, CLO1) 04

2. a) Why is polyculture preferred for carp fishes? (L1, CLO2) 02
   b) Write down the characteristics of a carp culture pond. (L2, CLO2) 03
   c) Discuss the carp polyculture system with reference to species-wise stocking density, feed management, and health management. (L5, CLO2) 05

3. a) What do you mean by IoT-based aquaculture? (L2, CLO2) 02
   b) Water and soil are the prime issues for aquaculture success—justify your opinion. (L3, CLO2) 04
   c) Explain the paddy-cum-prawn culture procedure that is practiced in the Khulna region of Bangladesh. (L4, CLO3) 04

4. a) How does integrated fish farming enhance sustainability and profitability? (L4, CLO3) 03
   b) How many prawns PL will you release in a 1.75 hectares pond with a stocking density of 30,000 PL/acre? (L3, CLO3) 03
   c) Which precautions need to be addressed in transportation, acclimatization, and stocking of fish fingerlings for aquaculture purposes? (L3, CLO4) 04

Section B

There are FOUR (04) questions in this section. Answer any THREE (03) questions.

5. a) Describe the culture technique of tilapia in a Recirculating Aquaculture System (RAS). (L2, CLO5) 04
   b) Identify the challenges of implementing RAS technology in Bangladesh. (L3, CLO5) 03
   c) Evaluate the environmental risks associated with cage culture and propose sustainable management strategies to mitigate them. (L5, CLO4) 03

6. a) Develop a labeled process flow diagram of a simple aquaponics system and briefly explain its working principle. (L, CLO5) 04
   b) Explain the advantages of aquaponics as a sustainable food production model. (L2, CLO5) 03
   c) Which fish and plant species are considered most suitable for aquaponics farming? (L3, CLO5) 03

7. a) State the concept of biofloc technology. (L1, CLO5) 02
   b) Analyze the role of heterotrophic bacteria in nutrient recycling and water quality management in a Biofloc Technology. (L4, CLO5) 03
   c) A 12 m^3 indoor biofloc tank is stocked with tilapia at a density of 70 kg/m^3. The tilapia are fed daily at 3% of their total biomass with a feed containing 35% crude protein. It is assumed that 75% of the feed nitrogen is released into the water. To maintain a carbon-to-nitrogen (C:N) ratio of 10:1 in the biofloc system, sugar containing 42% carbon is added as an external carbon source. Calculate the daily amount of sugar required. (L3, CLO5) 05

8. a) Write down the core principles of IMTA in the context of Bangladesh aquaculture. (L2, CLO5) 02
   b) Outline the criteria for selecting compatible species in IMTA systems. (L2, CLO5) 02
   c) How may artificial intelligence (AI), automation, and IoT transform freshwater aquaculture management in the future? (L4, CLO6) 03
   d) Discuss the future prospects of sustainable freshwater aquaculture entrepreneurship in Bangladesh. (L5, CLO6) 03

School: Life Science **Discipline:** Fisheries and Marine Resource Technology **Program:** Master of Science in Aquaculture

Year: MS 1st **Term:** 1st **Examination Year:** 2026 **Session:** 2025-2026

Course Code: 0831 06 Aqua 5103 **Course Title:** Fish Feed and Nutrition

Total Marks: 60 **Time:** 3 Hours **Credit:** 03

Instructions: *The figure in the margin indicates full marks. *Use separate answer script for each section.

SECTION – A

[There are **FOUR** questions in this section. Answer any **THREE** questions.]

Q.1	a)	Narrate how aquaculture practices influence aqua feed production globally. [L-1, CLO-1]	02
	b)	Summarize nutritional requirements of brood and larvae of *Penaeus monodon*. [L-2, CLO-1]	04
	c)	Does an increase in feeding rate above the optimum level influence FCR and SGR, and should farmers practice feeding a bit above the optimum level? -justify your opinion. [L-3, CLO-1]	04
Q.2	a)	What is bioenergetics? Sketch and discuss energy flow in an aquatic organism. [L-1,2, CLO-2]	1+5=06
	b)	Why is specific dynamic action considered as crucial factor in fish growth? -explicate. [L-2, CLO-2]	02
	c)	Criticize feeding an eel fish with feed containing less protein but higher carbohydrate percentage. [L-4, CLO-2]	02
Q.3	a)	Enlist the digestive enzymes secreted by stomach and intestine of fishes. [L-1, CLO-2]	02
	b)	Which is the most important organ in fish in context of diverse enzyme secretion? -expound. [L-1,2, CLO-2]	02
	c)	Analyze that TCA cycle is the central hub of nutrient metabolism. [L-2, CLO-2]	03
	d)	What determines positive correlation between cellulase activity and amount of plant detritus in the stomach of cyprinids? -analyze. [L-4, CLO-2]	03
Q.4	a)	Enlist live food commonly used in fish hatchery. [L-1, CLO-3]	02
	b)	Classify artificial feed being used in shrimp aquaculture. [L-2, CLO-3]	02
	c)	Compare nutritional requirement of freshwater fish and marine fish to formulate artificial feed. [L-2, CLO-1]	03
	d)	Discuss shortcomings of live food, and suggest how these shortcomings can be adapted. [L-5, CLO-3]	03

SECTION – B

[There are **FOUR** questions in this section. Answer any **THREE** questions.]

Q.5	a)	Analyze the current challenges facing the aquafeed industry regarding the availability and production of traditional fish meal. [L-2, CLO-4]	03
	b)	Identify potential protein-based alternatives to fishmeal for aquaculture feeds in Bangladesh. [L-3, CLO-4]	02
	c)	Discuss the potential for replacing fish meal with seaweed and biofloc meals in various aquaculture species. [L-3, CLO-5]	05
Q.6	a)	Why is balancing feed cost and nutritional quality important in commercial aquaculture? [L-2, CLO-4]	02
	b)	As a fish feed expert, you are approached by an entrepreneur in the feed manufacturing sector who seeks your expertise in developing a Nile tilapia diet enriched with 35% protein (DMB). The formulation of this diet will utilize specific ingredients, each characterized by its defined protein and moisture content as follows: Formulate the diet using all the ingredients mentioned above and follow the 'Pearson Square' method. Ensure that the inclusion of wheat flour does not exceed 30% of the BFI and that fish meal must be incorporated at 15% in the final diet. [L-2, CLO-4]	08

Ingredients	Protein (%) (RMB)	Moisture (%)
Corn flower	09	08
Rice bran	12	13
Meat & bone meal	55	10
Fish meal	65	11
Wheat flour	14	09
Soybean meal	42	10
Rapeseed meal	35	12

Q.7 a) Write down the significance of pellet buoyancy and water stability in relation to the feeding behavior of cultured aquatic species. [L-2, CLO-5] 02

b) Define fermentation in the context of aquafeed processing. Discuss the limitations and challenges of scaling up microbial fermentation for commercial aquafeed production. [L-1,4, CLO-4] 05

c) Outline the major parameters commonly measured during biological evaluation of aquafeeds. [L-4, CLO-7] 03

Q.8 a) Discuss the various types of natural feed additives used in aquaculture and their functions. [L-2, CLO-4] 04

b) Outline the standards and analytical methods used for determining nutrient composition in fish feed according to the 'Fish Feed Act 2024'. [L-3, CLO-6] 03

c) Evaluate the effectiveness of the 'Fish Feed Act 2024' in controlling adulterated and substandard aquafeeds. [L-5, CLO-6] 03

Khulna University			
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Year: MS 1st	**Term: 1st**	**Examination Year:** 2026	**Session:** 2025-2026
Course Code: 0831 06 Aqua 5105	**Course Title:** Brood Management and Breeding Technique		
Total Marks: 60	**Time:** 3.0 hrs	**Credit:** 03	
NB: The rightmost two columns indicate levels of Bloom's cognitive domain and course learning outcomes.			

Section A

[There are **FOUR** questions in this section. Answer any **Three** questions.]

			Marks	Level (L1-L6)	CLO No.
Q.1	a)	What can be the behavioral responses to domestication of fishes?	02	2	1
	b)	What is sexual dimorphism? What characteristics are considered to distinguish male and female sexes?	1+2 =03	3	2
	c)	How does selective breeding play an important role in aquaculture? – discuss.	05	2	1
Q. 2	a)	Narrate why a mating design for a breeding program is to be prepared.	03	2	2
	b)	Briefly describe the two most significant techniques for mating design.	04	2	2
	c)	'No single mating design is optimal for all situations.' Justify the statement.	03	4	2
Q. 3	a)	What are the environmental factors affecting the reproduction of fish? – discuss.	04	2	2
	b)	What do you mean by androgenesis and gynogenesis?	02	1	2
	c)	Which breeding technique will you use to produce all female fish offspring? Describe the procedure.	04	4	2
Q. 4	a)	Narrate the undesirable side effects produced by fish breeding programs.	05	2	2
	b)	Analyze the factors that may change the breeding goal in aquaculture.	03	4	3
	c)	Mention the issues influencing the cost of seed production.	02	4	3

Section B

[There are **FOUR** questions in this section. Answer any **Three** questions.]

Q. 5	a)	Mention the importance of conserving fish gametes in aquaculture and fisheries management.	02	2	4, 5, 6
	b)	Briefly explain the breeding mechanisms of any carp fish.	05	2	4, 5, 6
	c)	'Broodstock management is essential for a successful induced breeding'. Justify the statement.	03	5	4, 5, 6
Q. 6	a)	Discuss how broodstock nutrition influences fecundity in aquatic fish species?	05	5	4, 5, 6
	b)	Describe the techniques used for induced spawning in clams.	03	3	4, 5, 6
	c)	Write a short note on sex reversal techniques in tilapia.	02	2	4, 5, 6
Q. 7	a)	Explain the spawning and fertilization processes in mussels.	04	2	4, 5, 6
	b)	Describe the breeding technique of mud crab.	03	2	4, 5, 6
	c)	What problems are crab hatchery in Bangladesh facing? How will you mitigate the problems?	03	3	4, 5, 6
Q. 8	a)	Briefly describe the methods of seed production in seabass.	07	3	4, 5, 6
	b)	How can the sexes of mature broodfish be distinguished based on external characteristics?	03	4	4, 5, 6