ST. ALBERT'S COLLEGE (AUTONOMOUS),

ERNAKULAM

Affiliated to Mahatma Gandhi University, Kottayam, Kerala

SYLLABUS FOR UNDERGRADUATE VOCATIONAL PROGRAMMES

FACULTY OF AQUACULTURE

EXPERT COMMITTEE FOR AGRICULTURE AND SUSTAINABILITY

B.VOC (HONOURS) COMMERCIAL AQUACULTURE

Syllabus Index

Name of the Minor: Commercial Aquaculture

Semester: 1

Course Code	Title of the Course	Type of the Course	Credit	Hours/ week	Hour Distribution /week		
					L	P	O
25SACVCQ1MP101	Introduction to Aquatic Life	MPC	4	5	3	2	0

L — Lecture, P — Practical/Practicum , O — On the Job Training

Semester: 2

Course Code	Title of the Course	Type of the Course	Credit	Hours/ week	Hour Distribution /week		
					L	P	O
25SACVCQ2MT101	Introduction to Aquaculture Practices	MPC	4	4	4	0	0

L — Lecture, P — Practical/Practicum , O — On the Job Training

Semester: 3

Course Code	Title of the Course	Type of the Course	Credit	Hours/ week	Hour Distribution /week		
					L	P	O
25SACVCQ3MP201	Ornamental Fish Production and Aquarium Fabrication	MPC	4	5	3	2	0

L — Lecture, P — Practical/Practicum , O — On the Job Training

Semester: 4

Course Code	Title of the Course	Type of the Course	Credit	Hours/ week	Hour Distribution /week		
					L	P	O
25SACVC Q4MP201	Fish Nutrition and Feed Preparation	MPC	4	5	3	2	0

L — Lecture, P — Practical/Practicum , O — On the Job Training

Semester: 5

Course Code	Title of the Course	Type of the Course	Credit	Hours/ week	Hour Distribution /week		
					L	P	O
25SACVC Q5MT301	Value Added Fishery Products	MPC	4	4	4	0	0

L — Lecture, P — Practical/Practicum , O — On the Job Training

Semester: 6

Course Code	Title of the Course	Type of the Course	Credit	Hours/ week	Hour Distribution /week		
					L	P	O
25SACVC Q6MT302	Sea Food Quality Assurance	MPC	4	4	4	0	0

L — Lecture, P — Practical/Practicum , O — On the Job Training

Department of Fisheries and Aquaculture
St. Albert's College (Autonomous), Ernakulam

Faculty/ Discipline	**Aquaculture**				
Programme	**B.Voc (Honours) Commercial Aquaculture**				
Course Name	**Introduction to Aquatic Life**				
Type of Course	**MPC**				
Course Code	**25SACVCQ1MP101**				
Course Level	**100-199**				
Course Summary	This course will provide the students with a knowledge on major aquatic biomes, including freshwater (lakes, wetlands, streams, and rivers) and marine (estuaries, intertidal zones, oceanic pelagic zones, marine benthic zones, and coral reefs) ecosystems. It will help students to understand aquatic biodiversity and animal association including its role in maintaining ecosystem stability, supporting food webs, and providing ecosystem services.				
Semester	1	**Credits**		4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Practical**	**OJT**	
		3	1	0	75
Pre-requisites, if any	Knowledge on basic biology.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
1	Identify and describe the major aquatic biomes — including lakes, wetlands, streams and rivers, estuaries, intertidal zones, oceanic pelagic zones, marine benthic zones, and coral reefs	K	PO1, PO2, PO3
2	Classify aquatic organisms into freshwater and marine forms, with emphasis on major ecological groups such as phytoplankton, zooplankton, nekton, benthos, freshwater plants, seagrasses, and aquatic weeds.	K	PO1, PO2, PO3
3	Characteristics of diverse marine organisms, deep sea environments, midwater communities, hydrothermal vents, and marine vertebrates.	U	PO1, PO2, PO3, PO6
4	Demonstrate practical skills in observing, recording and interpreting different animal associations.	U	PO1, PO2, PO3, PO10
5	Understand the importance of aquatic biodiversity and the need for conservation and sustainable management of aquatic ecosystems.	U	PO1, PO3, PO6, PO7, PO10

CO-PO ARTICULATION MATRIX

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	2	2	3	0	0	0	0	0	0	0
CO 2	2	2	3	0	0	0	0	0	0	0
CO 3	2	2	3	0	0	3	0	0	0	0
CO 4	2	2	3	0	0	3	0	0	0	0
CO 5	2	0	2	0	0	3	3	0	0	3

'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	**Aquatic Biomes**		**15**	
	1.1	Brief introduction of the aquatic biomes: Lakes, wetlands, streams and rivers, estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.	5	1,5
	1.2	Intertidal ecology: Adaptations of Intertidal community – Rocky, Sandy, Muddy shores.	2.5	1
	1.3	Organism classification based on zones – Littoral/riparian, limnetic and profoundal.	2.5	1
	1.4	Practical - Report of field visit to a Lake/River/Marsh/Rocky shore/sandy shore	5	1,5
2	**Aquatic Biology**		**20**	
	2.1	Classification of organisms - Freshwater and Marine forms. Plankton (Phyto and Zooplankton), freshwater plants, seagrasses and weeds, nekton and benthos.	10	2
	2.2	Aquatic food web and food chain with examples.	5	2
	2.3	Practical Identification of phytoplankton, zooplankton, benthos, freshwater plants, seagrasses and weeds.	5	2
	Marine Biology		**20**	
3	3.1	Deep sea environmental characteristics, adaptations of deep sea organisms.	5	3
		Midwater community. Hydrothermal vents.		
	3.2	Marine Vertebrates - Marine Reptiles, Birds and Mammals. Diversity, Distribution and Conservation.	5	3
	3.3	Practical – Identification of midwater community species, deep sea organisms, marine reptiles, birds and mammals.	10	3
4	**Animal associations**		**20**	

	4.1	Different types of associations including mutualism, commensalism, parasitism, predation, and competition, with relevant ecological examples.	5	4,5
	4.2	Composition, Value of association.	5	4
	4.3	Practical – Identification of different animal associations and their composition through fieldwork, specimen analysis, and ecological surveys.	10	4
5	**TEACHERS SPECIFIC CONTENT**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** **Direct instructions** **Lecture** **E-Learning** **Interactive instructions** **Group assignments** **Group discussion** **Practicals**
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory**

Total Mark: 25	
Assessment methods	
Assignment	10
Seminar/ Quiz/ Group Discussion	5
Test	10

Practical

Total Mark: 15
Assessment methods

Involvement	5
Punctuality	5
Record/PPT	5

B. End Semester Evaluation (ESE)
Theory

Total mark: 50		
Assessment methods: Written Exam		
Duration of Examination: 1.5 hrs		
Pattern of Examination: Non-MCQ		
Part A	1 mark	Answer any 15 out of 17
Part B	5 mark	Answer any 3 out of 5
Part C	10 mark	Answer any 2 out of 4

Part A can be objective type, fill in the blanks, multiple choice etc.

Practical

Total mark: 35	
Duration of Examination: 2 hrs	
Assessment methods	
Theory/ Procedure/ Understanding	10
Skill and Performance/ Data Collection	10
Calculation/ Analysis and Result	10
Viva	5

REFERENCES

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- George, J. D., Karleskint, G., Turner, R., & Small, J. (2012). *Lab manual: Introduction to marine biology* (4th ed.). Brooks Cole.
- Hawkins, S. J., Bohn, K., Firth, L. B., & Williams, G. A. (2019). *Interactions in the marine benthos*. Cambridge University Press.
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- Reymont, J. E. G. (19XX). *Plankton and productivity in the oceans* (Vols. 1–2). Macmillan.
- Seshappa, G. (1992). *Indian marine biology*. South Asia Books.
- Sverdrup, H. U., Johnson, M. W., & Fleming, R. H. (1968). *The oceans: Their physics, chemistry, and general biology*. Prentice-Hall.

SUGGESTED READINGS

https://marinespecies.org/

https://coml.org/

https://obis.org/

https://www.sealifebase.ca/

Department of Fisheries and Aquaculture
St. Albert's College (Autonomous), Ernakulam

Faculty/ Discipline	**Aquaculture**				
Programme	**B.Voc (Honours) Commercial Aquaculture**				
Course Name	**Introduction to Aquaculture Practices**				
Type of Course	**MPC**				
Course Code	**25SACVCQ2MT101**				
Course Level	**100-199**				
Course Summary	Aquaculture is the cultivation of aquatic organisms under controlled conditions to ensure food security and sustainable resource use. This course provides a foundational understanding of aquaculture as a scientific and environmentally responsible practice for the production of fish, shellfish, and other aquatic organisms. Learners will gain knowledge on hatchery site selection, design, and basic components, including water sources, intake and drainage systems, broodstock, spawning, hatching, larval rearing, nursery tanks, live feed culture units, and filtration and aeration systems.				
Semester	2	**Credits**		4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Practical**	**OJT**	
		4	0	0	60
Pre-requisites, if any	Need to know basic biology				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
1	Define the principles, scope, and significance of aquaculture as a food-producing sector.	K	PO1
2	List appropriate species for different culture environments (freshwater, brackishwater, marine).	K	PO1, PO2
3	Analyse the suitability of each aquaculture system by applying scientific reasoning to evaluate species requirements, site conditions, and resource availability.	An	PO2, PO7
4	Understand basic hatchery management practices for seed production of finfish and shellfish. and appreciate the role of sustainable aquaculture practices that support local communities, and protect aquatic ecosystems.	U	PO1,POPOPO6, 7, PO10
5	Develop skills in maintaining water quality, handling broodstock, and larval care.	S	POPO1, 2, PO10

CO-PO ARTICULATION MATRIX

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	2	0	0	0	0	0	0	0	0	0

CO 2	2	2	0	0	0	0	0	0	0	0
CO 3	0	3	0	0	0	0	1	0	0	0
CO 4	1	0	0	0	0	1	3	0	0	2
CO 5	1	3	0	0	0	0	0	0	0	2

'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	**Fundamentals of aquaculture**		**15 hours**	
	1.1	Definition and scope of aquaculture, History of aquaculture, Culture and capture fisheries, Importance of aquaculture in food security and employment. Selection criteria of fish species for aquaculture.	3	1
	1.2	Types of ponds for fish culture- nursery pond, rearing pond, grow out pond, stocking pond, broodstock pond. Pond preparation- site selection, pond layout, pre stocking management- dewatering, drying, ploughing/desilting, predators, weeds and their control measures.	7	1, 2, 5

	1.3	Liming and fertilization. Water quality parameters optimum for culture- temperature, salinity, pH, oxygen, turbidity, ammonia.	5	1, 2, 5
2	**Cultivable aquatic organisms**		**15 hours**	
	2.1	Salient features of Cultivable Freshwater fin fishes- carps- indigenous and exotic species. Air breathing fishes (Clarias batrachus, channa), Cold water fishes (Rainbow trout,	5	2
	2.2	Brackishwater fishes (Pearl spot, mullets, milkfish). Marine fishes (cobia).	4	2
	2.3	Cultivable Shellfishes – Salient features of cultivabe crustaceans- Fresh water prawn, Shrimps, Crab, Molluscs- Mussels, Pearl oyster, Edible oyster, clams. Cultivable Sea weeds (*Gracillaria edulis, sargassam, ulva*).	6	2
3	**Aquaculture systems**		**15 hours**	
	3.1	Extensive and Intensive methods of Aquaculture. Fresh water, brackish water and mariculture.	4	3

		Monoculture, Monosex culture, Polyculture, composite fish culture.		
	3.2	Pond culture, ra ceway culture, Tank culture, floating cages, Pen culture, Rack, raft culture, long line culture, On Bottom Culture.	4	3
	3.3	Recent trends- sewage- fed fish culture. Recirculatory Aquaculture Systems, Biofloc technology. IMTA (Integrated multitrophic Aquaculture).	4	3
	3.4	Aquaponics and Hydroponics. Integrated aquaculture systems. Poultry-cum-fish culture. Integrated fish farming with duck and pig.	3	3
4	**Basics in hatchery management**		**15 hours**	
	4.1	Definition and importance of hatchery in aquaculture. Site selection for hatchery.	2	4
	4.2	Basic components- water source, intake system, tanks (broodstock, spawning, hatching, larval rearing, nursery). Live feed culture unit.	3	4, 5
	4.3	filtration system, aeration, drainage. Fish seed,	6	4, 5

		broodstock-selection of broodstock, seed production and breeding, induced breeding techniques-hypophysation, stripping, eyestalk ablation, Use of chemicals.		
	4.4	Methods of egg collection. Types of incubators (happas, jars, trays). Packing and transportation of seed.	4	4, 5
5	**TEACHERS SPECIFIC CONTENT**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lectures, Presentations, Group Discussions
Assessment Types	**MODE OF ASSESSMENT**
	A. Continuous Comprehensive Assessment (CCA) **Theory**

Total Mark: 30	
Assessment methods	
Assignment	10
Seminar/ Quiz/ Group Discussion	10

Test	10

B. End Semester Evaluation (ESE)

Theory

Total mark: 70		
Assessment methods: Written Exam		
Duration of Examination: 2 hrs		
Pattern of Examination: Non-MCQ		
Part A	1 mark	Answer any 25 out of 27
Part B	3 mark	Answer any 5 out of 7
Part C	10 mark	Answer any 2 out of 4

Part A can be objective type, fill in the blanks, multiple choice etc.

REFERENCES

- Arvind Kumar. (2016). *A textbook of applied aquatic biology*. Daya Publishing House.
- Biswas, K. P. (1995). *Ecological and fisheries development in wetlands: A study of Chilka Lagoon* (1st ed.). Daya Publishing House.
- Closs, G., Lake, P. S., & Quinn, G. P. (2004). *Freshwater ecology: A scientific introduction*. Wiley-Blackwell.
- FAO. (2007). *Manual for operating a small scale recirculation freshwater prawn hatchery*. FAO.
- ICAR. (2006). *Handbook of fisheries and aquaculture*. ICAR.
- Nybakken, J. W. (2004). *Marine biology: Ecologic[illegible]approach*. Benjamin–Cummings Publishing Co.
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- Pillay, T. V. R., & Kutty, M. N. (2005). *Aquaculture: Principles and practices* (2nd ed.). Blackwell Publishing.
- Vasanthakumar, B., & Sakhare, V. B. (2014). *Advances in aquatic ecology*. Daya Publishing House.
- Verma, P. S., & Agarwal, V. K. (1983). *Environmental biology (Principles of ecology)*. S. Chand Publishing.

SUGGESTED READINGS

- CABI. (n.d.). *Aquaculture eBook*. https://www.cabi.org/wp-content/uploads/Aquaculture-eBook.pdf

Department of Fisheries and Aquaculture

St. Albert's College (Autonomous), Ernakulam

Faculty/ Discipline	**Aquaculture**
Programme	**B.Voc (Honours) Commercial Aquaculture**
Course Name	**Ornamental Fish Production and Aquarium Fabrication**
Type of Course	**MPC**
Course Code	**25SACVCQ3MP201**
Course Level	**200-299**
Course Summary	This course combines the art and science of breeding and rearing ornamental fish with the technical skills required to design and fabricate aquariums. Students will learn about the principles of ornamental fish production, including breeding, nutrition, and health management, as well as the design and construction of aquariums for showcasing these beautiful aquatic species. By integrating theoretical knowledge with practical skills, this course will equip students with the expertise to succeed in the ornamental fish industry, whether in breeding, aquaculture, or aquarium design and fabrication.

Semester	3	**Credits**		4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Practical**	**OJT**	
		3	1	0	75

Pre-requisites, if any	Basic knowledge in general science.

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
1	Create functional and aesthetically pleasing aquariums for various applications.	C	PO2, PO9, PO10
2	Maintain optimal water quality and aquatic life support systems in aquariums.	C	PO2, PO10
3	Create thorough knowledge on ornamental fin fishes and its characterstics.	C	PO3, PO6
4	Develop knowledge on the ornamental fish and its industry, including market trends, business planning, and entrepreneurship opportunities.	C	PO10
5	Create a skill in ornamental fish culture and breeding.	C	PO9, PO10

CO-PO ARTICULATION MATRIX

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	0	2	0	0	0	0	0	0	3	3
CO 2	0	3	0	0	0	0	0	0	0	3
CO 3	0	0	3	0	0	0	0	0	0	3
CO 4	0	0	0	0	0	0	0	0	0	10
CO 5	0	0	0	0	0	0	0	0	3	3

'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**INTRODUCTION TO AQUARIUM**	**20 Hrs**	
	1.1	Introduction to aquarium. Parts of an aquarium. Advantages and disadvantages of aquarium, types of aquarium.	3	1, 5
	1.2	Introduction to ornamental fishes and ornamental aquarium accessories: substrates, aerators, light, heaters, protein skimmers etc.	4	1, 5
	1.3	Design and construction of marine and freshwater aquarium. – types of filters, pebbles, plants, drift wood, ornamental objects.	5	1, 5
	1.4	Setting up of an aquarium. Setting up of various equipments in aquarium.	8	1
2		**AQUARIUM MANAGEMENT**	**19 Hrs**	
	2.1	Selection of fishes for aquarium. Criteria for selection of fishes for aquarium	4	2
	2.2	Aquarium maintenance and water quality requirements. Water quality parameters:	4	2

		temperature, salinity, dissolved oxygen, pH. Quarantine measures. Control of snail and algal growth.		
	2.3	Handling and care of ornamental fishes. Anesthetics and tranquilizers used. Temperature acclimation, oxygen packing.	4	2
	2.4	Laboratory analysis of water quality parameters of aquarium water.	7	2
	FRESH WATER ORNAMENTAL FISHES		**18 Hrs**	
3	3.1	Species of ornamental fishes; their taxonomy and biology. guppy, platy, swordtail, mollies, gold fishes and koi carps, gouramies, barbs and tetras. Cichlids - angel fish, oscars, orange chromide.	3	1, 3
	3.2	Maturation, secondary sexual characters of male and female fish. Breeding habits- Live bearers, egg layers- egg scatters, egg depositors, egg buriers, nest builders. Spawning, parental care, fertilization and development of eggs. Hatching, larval rearing and their health.	4	3
	3.3	Indigenous ornamental fishes of Kerala: *Puntius denisonii puntius fasciatus, Devario malabaricus, Garra mullya, Bariliua bakeri*	4	3
	3.4	Identification of ornamental fishes of commercial importance.	7	3
4	**COMMERCIAL PRODUCTION OF ORNAMENTAL FISHES**		**18 Hrs**	
	4.1	Requirements and design for the commercial production units of ornamental fishes	3	4
	4.2	Commercial production of ornamental fishes	3	4
	4.3	Major marine ornamental fish resources of India.	4	3, 4

	4.4	Collection and identification of marine ornamental fishes.	8	3, 4
5	Teacher specific content			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** **Direct instructions** **Lecture** **Interactive instructions** **Group assignments** **Group discussion** **Practicals**
Assessment Types	**MODE OF ASSESSMENT** **Mode of Assessment** **A. Continuous Comprehensive Assessment (CCA)** **Theory**

Total Mark: 25	
Assessment methods	
Assignment	10
Seminar/ Quiz/ Group Discussion	5
Test	10

Practical

Total Mark: 15	
Assessment methods	
Involvement	5
Punctuality	5
Record/PPT	5

B. End Semester Evaluation (ESE)

Theory

Total mark: 50		
Assessment methods: Written Exam		
Duration of Examination: 1.5 hrs		
Pattern of Examination: Non-MCQ		
Part A	1 mark	Answer any 15 out of 17
Part B	5 mark	Answer any 3 out of 5
Part C	10 mark	Answer any 2 out of 4

Part A can be objective type, fill in the blanks, multiple choice etc.

Practical

Total mark: 35

		Duration of Examination: 2 hrs	
		Assessment methods	
		Theory/ Procedure/ Understanding	10
		Skill and Performance/ Data Collection	10
		Calculation/ Analysis and Result	10
		Viva	5

REFERENCES

- Ghosh, A., Mahapatra, B. K., & Datta, N. C. (2003). Ornamental fish farming-successful small scale aqua business in India. *Aquaculture Asia*, *8*(3), 14-16.
- Jain, A. K., Behera, B. K. & Saini, V. P. Ornamental Fish and Aquarium Industry of India: A Rapidly Growing Economic Activity. In *Ornamental Fisheries and Aquarium Keeping* (pp. 71-90). CRC Press.
- Miller, S. M. & Mitchell, M. A. (2009). Ornamental fish. In *Manual of exotic pet practice* (pp. 39-72). WB Saunders.
- Pandey, P. K., & Mandal, S. C. (2017, May). Present status, challenges and scope of ornamental fish trade in India. In *Conference: aqua aquaria India, at Mangalore* (pp. 1-10).

SUGGESTED READINGS

1. Hems, J &Hervy, G F - Gold fish
2. Srivastava, CBL - Aquarium fish keeping

3. Srivastava, CBL - Aquarium fish keeping
4. Amit Saxena – Aquarium management
5. Shinekumar, D (Dr.) Varnamatsyangalumvalarthumatsyangalum : vinodhathinumvarumanathinum
6. Meenakshi Jindal (Dr.) et.al. – Freshwater ornamental fishes

	Department of Fisheries and Aquaculture **St. Albert's College (Autonomous), Ernakulam**

Faculty/ Discipline	**Aquaculture**
Programme	**B.Voc (Honours) Commercial Aquaculture**
Course Name	**Fish Nutrition and Feed Preparation**
Type of Course	**MPC**
Course Code	**25SACVC04MP201**
Course Level	**200-299**
Course Summary	This course explores the nutritional requirements of fish and the art of preparing feeds that promote optimal growth, health, and sustainability in aquaculture. Students will learn about the principles of fish nutrition, feed formulation, and manufacturing processes, as well as strategies for optimizing feed efficiency and minimizing environmental impacts. By combining theoretical knowledge with practical skills, this course will equip students with the expertise to develop and implement effective feeding strategies in aquaculture, enhancing the productivity and sustainability of fish farming operations.

Semester	4	**Credits**		4	**Total Hours**
Course Details	**Learning Approach**	**Lecture**	**Practical**	**OJT**	
		3	1	0	75
Pre-requisites, if any	Basic knowledge in science.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
1	To understand the nutritional requirements of various species.	U	PO1, PO10
2	To identify the types of feeds used in aquaculture.	K	PO1
3	Discuss the importance of live feeds, To understand the types of live food organisms and its importance in aquaculture.	U	PO3
4	Formulated feed manufacturing, packing, storing and transportation. Quality problems in fish feed.	U	PO3, PO6
5	Implement practical knowledge in manufacturing feed for aquatic organisms.	A	PO10

CO-PO ARTICULATION MATRIX

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	2	0	0	0	0	0	0	0	0	3
CO 2	2	0	0	0	0	0	0	0	0	0
CO 3	0	0	0	0	0	0	0	0	0	0
CO 4	0	0	2	0	0	2	0	0	0	0
CO 5	0	0	0	0	0	0	0	0	0	3

'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		**NUTRITIONAL REQUIREMENTS OF FISHES**		
	1.1	Various nutrient components in aquaculture. Nutritional requirements of cultivable fin fishes and shellfishes: Major and minor nutrient component. functions of major nutrients	1	1, 5
	1.2	Different types of feeds used in aquaculture. Types of feeds (Wet, Moist and Dry feeds - advantages and disadvantages). Different size and grades of fish / shrimp feeds - starter, grower and finisher feeds. Larval feeds. Different forms of feed.	2	1
	1.3	Characterisitics of pellet feed and its importance: shape and size, texture, buoyancy, texture, nutritional contents.	3	1, 5
	1.4	Collect and identify the composition of different types of feeds available in the market.	3	1
2		**AQUACULTURE FEED INGREDIENTS**		
	2.1	Preparation of fish feed using different ingredients.: Commonly used feed ingredients in aqua feeds, novel feed ingredients.	3	2
	2.2	Estimation of quality of fish feed ingredients. : Commonly used feed ingredients in aqua feeds, novel feed ingredients, estimation of quality of feed ingredients, qualities of feed ingredients that determine feed quality, selection of ingredients,	2	2

		formulation of feeds, feed processing and making. Different feed preparation methods.		
	2.3	Different methods of fish feed preparation. Dry pelleting, exreusion, moist pelleting.	3	2
	2.4	Visit to fish feed mills to analyse and study the process of manufacturing fish feed.	2	2, 5
	LIVE FEED			
3	3.1	Importance of live feed in aquaculture. Qualities of live feed, advantages of live feed.	3	1,3
	3.2	Candidate species of phytoplankton and zooplanktons used in aquaculture.	4	3
	3.3	Proximate composition of live feeds.	3	1, 3
	3.4	Laboratory culture of live feed organisms.	3	3
4	**FEED MANUFACTURE**			
	4.1	Feed Manufacture Feed formulation and processing.	3	4
	4.2	Shipping and storage of fish feed. Quality problems in fish feed, storage of fish feed, transportation of fish feed.	3	4
	4.3	Quality problems of fish feed. Mycotoxins and their effects in feeds.	4	4
	4.4	Commercial scale production of fish feed. Imfrastructure required.	4	4
5	**TEACHER SPECIFIC CONTENT**			

<table>
<tr><td>Teaching and Learning Approach</td><td>Classroom Procedure (Mode of transaction)
Direct instructions
Lecture
Interactive instructions
Group assignments
Group discussion
Practicals</td></tr>
<tr><td rowspan="2">Assessment Types</td><td>MODE OF ASSESSMENT</td></tr>
<tr><td>Continuous Comprehensive Assessment (CCA)
Continuous Comprehensive Assessment (CCA)
Theory
<table><tr><td colspan="2">Total Mark: 25</td></tr><tr><td colspan="2">Assessment methods</td></tr><tr><td>Assignment</td><td>10</td></tr><tr><td>Seminar/ Quiz/ Group Discussion</td><td>5</td></tr><tr><td>Test</td><td>10</td></tr></table>Practical
<table><tr><td colspan="2">Total Mark: 15</td></tr><tr><td colspan="2">Assessment methods</td></tr><tr><td>Involvement</td><td>5</td></tr><tr><td>Punctuality</td><td>5</td></tr></table></td></tr>
</table>

Record/PPT	5

B. End Semester Evaluation (ESE)

Theory

Total mark: 50
Assessment methods: Written Exam
Duration of Examination: 1.5 hrs
Pattern of Examination: Non-MCQ

End Semester Evaluation (ESE)

Part A	1 mark	Answer any 15 out of 17
Part B	5 mark	Answer any 3 out of 5
Part C	10 mark	Answer any 2 out of 4

Part A can be objective type, fill in the blanks, multiple choice etc.

Practical

Total mark: 35	
Duration of Examination: 2 hrs	
Assessment methods	
Theory/ Procedure/ Understanding	10
Skill and Performance/ Data Collection	10

		Calculation/ Analysis and Result	10
		Viva	5

REFERENCES

- Cho, C. Y. (1990). Fish nutrition, feeds, and feeding: with special emphasis on salmonid aquaculture. *Food Reviews International*, *6*(3), 333-357.
- Gatlin, D. I. (2010). Principles of fish nutrition.
- Lovell, T. (1989). *Nutrition and feeding of fish* (Vol. 260). New York: Van Nostrand Reinhold.
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- Tacon, A. G., & De Silva, S. S. (1997). Feed preparation and feed management strategies within semi-intensive fish farming systems in the tropics. *Aquaculture*, *151*(1-4), 379-404.

SUGGESTED READINGS

1. "Fish Nutrition" by John E. Halver and Ronald W. Hardy - A comprehensive textbook on fish nutrition, covering topics such as nutrient requirements, feed formulation, and feeding strategies.
2. "Feed Preparation for Aquaculture" by Guillaume Fleurence and Mickael Le Gouvello - A practical guide to feed preparation for aquaculture, including feed formulation, manufacturing processes, and quality control.
3. "Aquaculture Nutrition: Gut Health, Probiotics and Prebiotics" by Daniel L. Merrifield and Einar Ringø - A book focusing on the importance of gut health in aquaculture and the use of probiotics and prebiotics in fish nutrition.

Department of Fisheries and Aquaculture

St. Albert's College (Autonomous) Ernakulam

Faculty/ Discipline	**Aquaculture**
Programme	**B.Voc (Honours) Commercial Aquaculture**
Course Name	**Value Added Fishery Products**
Type of Course	**MPC**
Course Code	**25SACVCQ5MT301**
Course Level	**300-399**
Course Summary	This course provides an overview of the principles, techniques, and significance of producing value-added products from fish and shellfish. It covers the classification, preparation, preservation, packaging, and quality control of various value-added products designed to enhance the market value and shelf life of aquatic resources.

Semester	5	**Credits**	{options: 3,4}	
Course Details	**Learning Approach**	**Lecture**	**Practical**	**OJT**	**Total Hours**
		4	0	0	60

Pre-requisites, if any	Students will attain knowledge and understanding of value-added product development in the seafood sector.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
1	Explain the principles and significance of value addition in the seafood industry, and recognize its role in promoting sustainable use of fishery resources and ensuring responsible seafood production.	U	PO1,PO3 ,PO6,PO 7
2	Understand the principles and processes involved in the production of fish mince, surimi, and coated fishery products, including their merits, equipment, raw materials, and role of cryoprotectants	U	PO1,PO2 ,PO10
3	Analyze and evaluate the processes involved in preparing a wide range of value-added fishery products and by-products, and design innovative approaches for their production, quality improvement, waste utilization, and enhancement of market potential.	E	PO1,POP O2,PO10

4	Develop innovative approaches for improving the shelf life, sensory quality, and market value of various value-added fishery products, including thermally processed, frozen and cured products.	C	PO2,PO10
5	Create and formulate innovative value-added fishery and shellfish products and by-products by applying advanced processing, preservation, packaging, and waste utilization techniques, ensuring enhanced product quality, extended shelf life, sustainability, and market competitiveness.	S	PO1, PO2, PO10

CO-PO ARTICULATION MATRIX

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	2	0	1	0	0	3	3	0	0	0
CO 2	2	2	0	0	0	0	0	0	0	2
CO 3	2	2	0	0	0	0	0	0	0	2
CO 4	0	2	0	0	0	0	0	0	0	3
CO 5	1	2	0	0	0	0	0	0	0	3

'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.

1	**Value addition in seafoods**		**15 hours**	
	1.1	Definition of value addition. status of value addition in Indian seafood sector. Present market trends and consumer preferences.	4	1
	1.2	Advantages of value addition. Significance of value addition in the seafood industry. Scope of value addition.	5	1, 5
	1.3	Different types of value-added products from fish and shell fish (IQF shrimp frozen fish steaks, ready to eat (fish pickles, cutlets), ready to cook products (fish fillets).	6	1, 3
2	**Fish mince based and coated products**		**15 hours**	
	2.1	Fish mince and Surimi. Production of fish mince – merits and demerits. Production of surimi with flowchart, Equipment, raw material for surimi, Role of cryoprotectants in surimi production.	6	2
	2.2	Analog and fabricated products- crab analogue,	4	2

		kamaboko, chikuwa, fish tofu.		
	2.3	Preparation of coated fishery products – Different types of batter and breading and its applications – Packaging and storing of coated products – Quality evaluation.	5	2
3	**Value added products and byproducts**		**15 hours**	
	3.1	Preparation of value added products- fish / prawn pickle, fish wafers, prawn chutney powder, fish soup powder, fish protein hydrolysate, extruded fish products, fillets, fish curry, fish cutlet, mussel products, marinated products.	6	3, 5
	3.2	Preparation of by- products- Production of chitin, chitosan and glucosamine hydrochloride from shrimp shell waste.	4	3, 5
	3.3	Preparation of fish silage. Uses of silage. Isinglass, shark fin rays, gelatin from fish waste, Ambergris, beche-de-mer, squalene, fish meal and oil.	5	3, 5

4	**Spoilage and quality**		**15 hours**	
	4.1	Factors affecting quality of fresh fish: intrinsic and extrinsic factors. Spoilage in thermal processed products – Quality evaluation of thermal processed products .	5	4, 5
	4.2	Curing and drying of fish – Spoilage in dry fish products. Chilling and freezing.	5	4, 5
	4.3	Quality assessment of frozen products. Quality assessment of surimi, Packaging (vacuum/MAP, retort pouch/ canning). Good manufacturing practices (GMP)	5	4, 5
	Teacher centric			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lectures, Presentations, Group Discussions
Assessment Types	**MODE OF ASSESSMENT**

A. Continuous Comprehensive Assessment (CCA)

Theory

Total Mark: 30	
Assessment methods	
Assignment	10
Seminar/ Quiz/ Group Discussion	10
Test	10

C. End Semester Evaluation (ESE)

Theory

Total mark: 70		
Assessment methods: Written Exam		
Duration of Examination: 2 hrs		
Pattern of Examination: Non-MCQ		
Part A	1 mark	Answer any 25 out of 27
Part B	5 mark	Answer any 5 out of 7
Part C	10 mark	Answer any 2 out of 4

Part A can be objective type, fill in the blanks, multiple choice etc.

REFERENCES

- Balachandran, K. K. (2001). *Postharvest technology of fish and fish products*. Daya Publishing House.
- Faridi, A. Z. (2008). *Convenience products from fish*. Directorate of Information and Publications on Agriculture (ICAR).
- Gopalakrishna Iyer, T. S. (Ed.). (2000). *Quality assurance in seafood processing*. Society of Fisheries Technologists (India).
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- Hall, G. M. (2008). *Fish processing technology*. CBS Publishers and Distributors Pvt. Ltd.
- Hui, Y. H., Pierson, M. D. & Gorham, J. R. (Eds.). (2001). *Foodborne disease handbook: Diseases caused by bacteria* (Vol. 1, 2nd ed.). Marcel Dekker.
- Nollet, L. M. L. (Ed.). (2024). *Handbook of seafood and seafood products analysis* (2nd ed.). CRC Press.
- Sen, D. P. (2025). *Advances in fish processing technology*. Allied Publishers.
- Wheaton, F. W. (1985). *Processing aquatic food products*. Wiley–Blackwell.
- Windsor, M., & Barlow. (1981). *Introduction to fishery by-products*. Fishing New Books.

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SCERT Kerala. (n.d.). *Manual of fishery science and processing*. https://scert.kerala.gov.in/wp-content/uploads/2020/06/15-mfsp.pdf

	Department of Fisheries and Aquaculture **St. Albert's College (Autonomous) Ernakulam**

Faculty/ Discipline	**Aquaculture**			
Programme	**B.Voc (Honours) Commercial Aquaculture**			
Course Name	**Seafood Quality Assurance**			
Type of Course	**MPC**			
Course Code	**25SACVCQ6MT30**			
Course Level	**300-399**			
Course Summary	This course provides a comprehensive overview of seafood quality assurance practices, focusing on spoilage mechanisms, hygienic post-harvest handling, quality assessment techniques, and consumer awareness. Students will gain basic knowledge and practical understanding of how to evaluate seafood freshness and qualities using sensory indicators, recognize spoilage, and follow proper handling and packaging methods. The course is tailored for undergraduate students to ensure they grasp essential food quality and safety practices applicable in fish markets, processing units, and household settings.			
Semester	6	**Credits**	4	**Total Hours**

Course Details	Learning Approach	Lecture	Practical	OJT	
		4	0	0	60
Pre-requisites, if any	Basic awareness of fish and seafood handling practices and interest in seafood safety and quality.				

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
1	Understand the causes of seafood spoilage and the role of freshness in quality assurance.	U	PO1,PO2 ,PO3
2	Apply hygienic practices in post-harvest handling, storage, and sanitation to reduce spoilage.	A	PO2,PO3 ,PO6,PO 8
3	Identify and evaluate sensory quality indicators used in seafood quality assurance.	A	PO2,PO4 ,PO9
4	Demonstrate awareness of safe seafood packaging, storage, and basic consumer quality checks.	S	PO6,PO7 ,PO8,PO 10
5	Appreciate the importance of seafood hygiene, quality standards, and consumer education.	Ap	PO6,PO7 ,PO8,PO 10

CO-PO ARTICULATION MATRIX

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	0	0	0	0	0	0	0
CO 2	0	3	2	0	0	2	0	2	0	0
CO 3	0	3	0	2	0	0	0	0	2	0
CO 4	0	0	0	0	0	2	2	2	0	2
CO 5	0	0	0	0	0	3	2	2	0	2

'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
	Introduction to Seafood Quality and Spoilage (15 hours)			
1	1.1	Seafood as a perishable commodity – Importance of freshness and quality in seafood	5	1, 5
	1.2	Spoilage mechanisms – Overview of autolysis (self-degradation), microbial growth, and oxidation	5	1
	1.3	Factors affecting spoilage – Role of time, temperature, and handling; signs such as changes in color, odor, and texture	5	1, 2

2	**Post-Harvest Handling and Hygiene (15 hours)**			
	2.1	Hygienic handling of seafood – General post-harvest practices like icing, sorting and packing to maintain freshness	5	2
	2.2	Use of clean materials in fish handling – Importance of using clean containers, ice, and water; prevention of contamination	5	2
	2.3	Personal hygiene and sanitation – Basic hygiene practices for workers and sanitation of facilities during fish handling at markets and seafood processing units.	5	2, 5
3	**Seafood Quality Indicators (15 hours)**			
	3.1	Sensory indicators of seafood quality – Smell, appearance, texture, firmness, and colour as freshness indicators	5	3

	3.2	Basic quality assessment methods- Observation–based scoring and grading techniques without laboratory instruments	5	3
	3.3	Sensory quality assessment techniques- Introduction to objective and subjective sensory evaluation methods used in seafood quality assurance.	5	3, 4
4	**Packaging, Storage, and Consumer Awareness (15 hours)**			
	4.1	Common seafood packaging materials – Packaging types used in local seafood sales(plastic covers, trays, and thermocol boxes)	5	4
	4.2	Hygienic seafood storage – Clean storage practices at shops, stalls, and homes to maintain freshness and avoid spoilage.	5	4
	4.3	Consumer awareness in seafood selection – Simple guidelines for choosing fresh seafood; reading label	5	4, 5

		information and recognizing certification logos.		
5	**TEACHER SPECIFIC CONTENT**			

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lectures, Presentations, Group Discussions
Assessment Types	**MODE OF ASSESSMENT**

Continuous Comprehensive Assessment (CCA)

Theory

Total Mark: 30	
Assessment method	
Assignment	10
Seminar/ Quiz/ Group Discussion	10
Test	10

End Semester Evaluation (ESE)Theory

Total mark: 70		
Assessment methods: Written Exam		
Duration of Examination: 2 hrs		
Pattern of Examination: Non-MCQ		
Part A	1 mark	Answer any 25 out of 27

Part B	5 mark	Answer any 5 out of 7
Part C	10 mark	Answer any 2 out of 4

Part A can be objective type, fill in the blanks, multiple choice etc.

REFERENCES

1. Connell, J. J. (1995). *Control of fish quality* (4th ed.). Wiley-Blackwell.
2. Balachandran, K. K. (2001). *Post-harvest technology of fish and fish products* (Reprint ed.). Daya Publishing House.
3. Gopakumar, K., & Sankar, T. V. (2002). *Textbook of fish processing technology*. Indian Council of Agricultural Research.
4. Amerine, M. A., Pangborn, R. M., & Roessler, E. B. (1965). *Principles of sensory evaluation of food*. Academic Press.
5. Chichester, C. O., & Graham, H. D. (1973). *Microbial safety of fishery products*. Academic Press.
6. Desrosier, N. W., & Tressler, D. K. (1977). *Fundamentals of food freezing*. AVI Publishing Company.
7. Tu, A. T. (Ed.). (1988). *Handbook of natural toxins: Marine toxins and venoms* (Vol. 3). M. Dekker.

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8. ICMSF (2020). *Seafood Safety: A Practical Handbook*.
9. Myers, K. et al. (2019). "Sensory Methods for Assessing Seafood Quality." *Journal of Food Science*.
10. Ozogul, Y. & Hamed, I. (2018). *Handbook of Analysis of Edible Animal By-products*.

11. FAO (2009). *Codes of Practice for Fish and Fishery Products – Hygiene and Quality*.
12. Kramer, L. & Taylor, S.L. (2021). "Consumer Perceptions of Seafood Freshness: Packaging and Labelling." *Foods Journal*.
13. https://www.mpeda.gov.in – Indian export standards and seafood handling guidelines.
14. https://fssai.gov.in – Food Safety and Standards Authority of India – seafood regulations.
15. https://www.icmsf.org – International Commission on Microbiological Specifications for Foods.
16. https://www.ifst.org – Institute of Food Science & Technology – sensory and packaging resources.
17. https://www.fao.org/fishery/quality.html – FAO seafood quality and safety portal.