



University of Kerala

Discipline	ZOOLOGY				
Course Code	UK5DSEZOO302				
Course Title	Fisheries Science III- Culture of Finfishes and Shellfishes				
Type of Course	DSE				
Semester	V				
Academic Level	300 -399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2	5
Pre-requisites	Class XII pass				
Course Summary	<p>The students will be provided a comprehensive overview of aquaculture practices in freshwater, brackish water, and marine environments, covering systems, candidate species, culture techniques, and emerging trends. It Covers global production trends and prospects of freshwater aquaculture. Examines key farming systems including ponds, tanks, lakes, and reservoirs. Introduces specialized systems like wintering ponds, quarantine ponds, and isolation ponds. The coastal aquaculture and mariculture with a global overview of sea farming and shore-based systems. Reviews farming systems used in India such as cage, pen, extensive, modified extensive, semi-intensive, and intensive systems, Pokkali, Basabadha, and Bheries. It also covers sea ranching and artificial reefs, including their processes, benefits, advantages, and disadvantages. The syllabus describes culture techniques for commercially important brackish water and marine species including finfish such as Sea bass, Pearl spot, Tiger shrimp, mud crab, mussels, oysters, pearl oysters and seaweeds. The syllabus cover Bio floc Technology, Integrated Multi-Trophic Aquaculture (IMTA), Partitioned Aquaculture Systems (PAS) and Aquaponics. Furthermore, the syllabus identifies major pathogen groups in aquaculture such as viruses, bacteria, fungi, protozoans, parasitic crustaceans, and trematodes and diseases affecting cultured species. The syllabus also covers state and central agencies promoting aquaculture.</p>				

Detailed Syllabus: Culture of Finfishes and Shellfishes
Theory: Credit - 3 (Total 45 hours)

Module	Unit	Content	45 Hrs
		Freshwater Aquaculture	12
I	1.1	Fresh water Aquaculture: Production trends and prospect in different parts of the world. Freshwater aquaculture Farming systems: Ponds, Tanks, Lakes and Reservoirs. Specialized culture systems: Wintering ponds, Quarantine ponds and Isolation ponds.	4

	1.2	Selection of candidate species for freshwater aquaculture. Traits of important cultivable fresh water species: Indian major carps, Exotic carps (Silver carp, Grass carp, Common Carp), Air breathing fishes (<i>Heteropneustes fossilis</i> , <i>Clarias batrachus</i>), Tilapia, Cold water fishes (Trout, Salmon) Freshwater prawn (<i>Machrobrachium rosenbergii</i>). (Mention Biological characters, Economic importance).	3
	1.3	Culture of candidate species for freshwater aquaculture Indian major carps, Exotic carps (Silver carp, Grass carp, Common Carp), Air breathing fishes (<i>Heteropneustes fossilis</i> , <i>Clarias batrachus</i>), Tilapia, Cold water fishes (Trout, Salmon) and Freshwater prawn (<i>Machrobrachium rosenbergii</i>). (Mention Seed Collection, Stocking, Feed management and Harvesting)	5
	Coastal Aquaculture and Mariculture		10
II	2.1	Principles of coastal aquaculture and mariculture. Overview of sea farming and shore-based aquaculture in different parts of the world. Coastal Aquaculture and Mariculture Farming systems: Cage, Pen, extensive, modified extensive, semi-intensive and intensive systems in India (Mention brief account only). Traditional culture systems: Pokkali, Basabadha and Bheries,	4
	2.2	Traits of important cultivable marine and Brackish water species. Fishes: Seabass (<i>Lates calcarifer</i>), Mullet (<i>Mugil cephalus</i>), Pearl spot (<i>Etroplus suratensis</i>). Shrimp: Tiger shrimp (<i>Fenneropenaeus monodon</i>) White shrimp (<i>Fenneropenaeus indicus</i>) Crab: Mud Crab (<i>Scylla serrata</i>) Mussel: Green Mussel (<i>Perna viridis</i>), Brown mussel (<i>Perna indica</i>). Oysters: Indian backwater oyster: <i>Crassostrea madrasensis</i> Pearl oyster: <i>Pinctada fucata</i> Lobster: <i>Panulirus homarus</i> Seaweeds: Green algae (Ulva), Brown algae (Sargassum)	4
	2.3	Sea ranching: Process, Target species and Benefits. Artificial reef: Advantage and Disadvantage.	2
	Culture practices of brackish and marine species		11
III	3.1	Culture of finfishes – <i>Lates calcarifer</i> and <i>Etroplus suratensis</i>. (Mention Seed collection, Rearing, Stocking, feed management, Harvesting).	2
	3.2	Culture of Tiger shrimp (<i>Fenneropenaeus monodon</i>). (Mention Selection of brood stock, Brood stock management, Spawning, Larval rearing, Stocking, Feed management and Harvesting) Mud crab: <i>Scylla serrata</i> (Mention selection of stock, Rearing, feeding management, Harvesting). Crab fattening (Brief account only).	3
	3.3	Mussel and Oyster Culture: Mention Spat collection, Culture practices (rack culture, Raft culture, Longline culture, Bottom culture), Harvesting. Pearl culture technique: Site selection, collection of mother oysters, farming techniques, monitoring of growth and harvesting. Pearl production: Mention Conditioning, nucleus implantation, Culture and harvesting of pearl.	3

	3.4	Culture of Seaweed. Species cultured, Site selection, Culture methods (Raft method, Monoline method, Tube net method) Rearing and Harvesting. An over view of sea weed culture: Economic importance of sea weeds (Mention only). Culture of sea cucumbers: Seed collection, Larval rearing, Rearing and Harvesting (mention only).	3
IV	Recent trends and Disease management in Aquaculture		8
	4.1	Recent trends in Aquaculture Biofloc Fish Culture: Mention principle, Design, Nutrient recycling in a biofloc system.	1
	4.2	Integrated Multi Trophic Aquaculture (IMTA) and Partitioned Aquaculture Systems (PAS): Mention principle and importance.	1
	4.3	Aquaponics: Mention Principle, component and design, Nutrient recycling in Aquaponics systems and zero discharge of nutrients.	2
	4.4	Disease and management in Aquaculture Major Pathogen: viruses, bacteria, fungi, protozoans, parasitic crustaceans, Trematode. Major diseases of aquaculture species: Viral diseases: Mention two disease: Infectious pancreatic necrosis (IPN), Carp pox. Bacterial diseases: Mention two disease: Bacterial gill disease (BGD), Vibriosis. Fungus diseases: Mention two disease: Branchiomycosis, Saprolegniasis. Protozoan diseases: Mention two disease: Ichthyophthiriasis, Whirling disease. Copepod infections: Mention Argulosis. Trematode infections: Mention Dactylogyrosis.	4
V	Agencies promoting aquaculture		4
	5.1	Agencies promoting aquaculture: ICAR., ADAK, Matsya fed, FFDA's and BFFDA's, FIRMA, KSCADC Ltd. (Kerala State Coastal Development Corporation).	2
	5.2	Central Institutes involved in aquaculture research and development - CIFA, NBFGR, CIBA, CMFRI, RGCA, MPEDA.	2

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14. Huet, M. 1986. Textbook of Fish culture. Breeding and Cuoltivation of Fish. 2nd ed. Fishing News Books, Oxford.
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PRACTICUM

Credit – 1 (Total 30 Hours)

(Wherever wet lab experiments are not possible, the principles and concepts can be demonstrated through any other material or medium, including videos/virtual labs, etc.)

1.	Identification of Fresh water, Brackish water and Marine Fishes: Catla, Rohu, Mrigal, Seabass (<i>Lates calcarifer</i>), Mullet (<i>Mugil cephalus</i>), Pearl spot (<i>Etroplus suratensis</i>). (Minor)
2.	Identification of marine and Fresh water prawn (<i>Fenneropenaeus monodon</i> , <i>Fenneropenaeus indicus</i> , Freshwater prawns (<i>Machrobrachium rosenbergii</i>). (Minor)
3.	Identification of Mud crab (<i>Scylla serrata</i>), Green Mussel (<i>Perna viridis</i>), Brown mussel (<i>Perna indica</i>). Edible oyster: <i>Crassostrea madrasensis</i> , Pearl oyster (<i>Pinctada fucata</i>), Lobster (<i>Panulirus homarus</i>), Sea cucumber. (Minor)
4.	Identification of Seaweeds: Green algae (<i>Ulva</i>), Brown algae (sargassum)(Minor).
5.	Determination of Dissolved oxygen in pond water using Winkler's method (Major).
6.	Determination of Carbon dioxide in pond water by using titration method (Major).
7.	Visit a Biofloc/ RAS / Aquaponics Systems and submit a report (Major).
8.	Visit a research institute (National /State level) and submit a report (Major).

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10. Wheaton, F.W. 1977. Aquaculture Engineering. Wiley Interscience, New York.

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Remember, understand, and apply knowledge of freshwater aquaculture systems, and analyse and evaluate the principles, techniques, culture practices, and species suitable for sustainable aquaculture production.	R,U,Ap,An, E,C	1,2
CO-2	Understand and apply knowledge of coastal aquaculture and mariculture systems, cultivable marine and brackish water species, sea ranching, and artificial reefs, and analyse and evaluate their significance, techniques, and effectiveness in sustainable aquaculture development.	R,U,Ap,An, E,C	2.3.4.
CO-3	Remember, understand, and apply knowledge about the breeding and culture of economically important brackish water species, and analyse and evaluate their culture practices, management techniques, harvesting methods, and economic significance in sustainable aquaculture.	R,U,Ap,An, E,C	1,3,4.
CO-4	Understand and apply knowledge about recent trends and diseases in aquaculture; analyse and evaluate their causes, impacts, and management strategies.	R,U,Ap,An, E,C	4
CO-5	Remember, understand, and apply knowledge about agencies and institutions promoting aquaculture, and analyse and evaluate their roles in aquaculture development, research, training, and sustainable resource management.	U, R, Ap, An, E, C	5

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create
Name of the Course: Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Remember, understand, and apply knowledge of	PO1, 2,3,7/PS	R,U,Ap,An,E,C	C, P, M	L	P

	freshwater aquaculture systems, and analyse and evaluate the principles, techniques, culture practices, and species suitable for sustainable aquaculture production.	O1,2				
2	Understand and apply knowledge of coastal aquaculture and mariculture systems, cultivable marine and brackish water species, sea ranching, and artificial reefs, and analyse and evaluate their significance, techniques, and effectiveness in sustainable aquaculture development.	PO2,3,7/ PSO, 2,3,4	R,U,Ap,A n,E,C	C, P, M	L	
3	Remember, understand, and apply knowledge about the breeding and culture of economically important brackish water species, and analyse and evaluate their culture practices, management techniques, harvesting methods, and economic significance in sustainable aquaculture.	PO1, 2,3/PSO1 ,3.4	R,U,Ap,A n,E,C	C, P, M	L	P
4	Understand and apply knowledge about recent trends and diseases in aquaculture; analyse and evaluate their causes, impacts, and management strategies.	PO2,3,5, 7/PSO4	R,U,Ap,A n,E,C	C, P, M	L	
5	Remember, understand, and apply knowledge about agencies and institutions promoting aquaculture, and analyse and evaluate their roles in aquaculture development, research, training, and sustainable resource management.	PO1,2,3, 7/PSO5	R,U,Ap,A n,E,C	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6	PS O7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	1	1	-	-	-	-	-	1	2	3	-	-	-	3	-
CO 2	-	1	2	3	3	-	-	-	2	3	-	-	-	3	-
CO 3	1	-	2	3	-	-	-	1	2	3	-	-	-	-	-
CO 4	-	-	-	3	-	-	-	-	2	3	-	3	-	3	-
CO 5	-	-	-	-	3			1	2	3	-	-	-	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Suggested Assignments/ Seminar topics

1. Prepare an account on cultivable fresh water, marine and brackish water species in Kerala with photographs.
2. Constraints and advantages of biofloc fish farm.
3. Explore the hatchery techniques of marine shrimp.
4. Prepare a model of any culture system

Continuous comprehensive assessment

1. Assignment
2. Seminars
3. Submission of report
4. Submission of field report
5. Test

End Semester Evaluation

1. Multiple Choice Questions
2. Very short Answer Questions
3. Short answer Questions
4. Essay type Questions

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓	✓	✓