



University of Kerala

Discipline	ZOOLOGY				
Course Code	UK4DSEZOO201				
Course Title	Fisheries Science II - Principles of Aquaculture				
Type of Course	DSE				
Semester	IV				
Academic Level	200 -299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2	5
Pre-requisites	Pass in Class XII				
Course Summary	This course will provide the basics and history of aquaculture to the students. A wide range of aspects of aquaculture like aquaculture practices, design and construction of hatcheries, pond management, selection of candidate species for aquaculture, study of monoculture, polyculture and integrated culture systems etc. are dealt in this course.				

Detailed Syllabus:

Module	Unit	Content	45Hrs
I	Introduction to Aquaculture		10
	1.1	Present status and Scope of aquaculture in India and Kerala, Consumption scenario and Emerging trends in Aquaculture.	3
	1.2	Criteria for the selection of sites (nutrient and soil quality, water supply and water circulation, water quality, Environment Impact Assessment) for various aquaculture practices, (Freshwater, Brackishwater and Marine Water)	3
	1.3	Criteria for selection of species for culture – biological, economic and market considerations.	1
	1.4	Commercially important common cultivable species and introduction of exotic species (Brief account only)	3
II	Systems of aquaculture		8
	2.1	Type of farming Methods: - pond culture, tanks, raceways, pen culture, cage culture and zero water exchange system.	3
	2.2	Different Systems of Aquaculture: Traditional, extensive, semi-intensive, intensive and super intensive aquaculture in freshwater, brackish water and marine environments.	3

	2.3	Types of culture systems - Monoculture, polyculture, Sewage fed Farming, Integrated culture systems, Recirculated aquaculture Systems (RAS) Related activity - Visit any one aquaculture system and submit a report	2
III	Design and construction of farm and hatchery		7
	3.1	Size, shape, lay out of pond farms, dike design and construction, water supply and drainage system.	2
	3.2	Pond productivity, estimation, physical, chemical and biological factors affecting productivity of ponds	2
	3.3	Types, design and construction of hatcheries	3
IV	Pond Preparation, Stocking and Management		15
	4.1	Pre-stocking Pond management – sun drying, repairing, desiltation, ploughing, liming, eradication of predators and weeds, water filling, fertilization. Importance of bloom	3
	4.2	Seed resources – wild collection, induced breeding of fishes, shrimps and bivalves in hatcheries	4
	4.3	Transportation, acclimatisation of seeds and release, species combinations, stocking density	2
	4.4	Feed management – Types of feed, formulated feed, feeding rate, feed conversion ratio, feed additives, binders, microencapsulated feeds, nutraceuticals, brooder diet and Live Feed. (Brief accounts only)	2
	4.5	Monitoring physical and chemical parameters of water, Rate and time of water exchange.	2
	4.6	Monitoring health of stock, regular sampling and disease management.	2
V	Harvesting and sustainability		5
	5.1	Harvesting of drainable and undrainable ponds, cages, molluscan farms. Handling and preservation.	2
	5.2	Sustainability and environmental management	3

References

1. Ahilan, B., Ravaneshwaran, K., Kumaravel, P., 2011. Integrated Aquaculture. Daya Publishing House
2. Allan, G. and Burnell, G. 2013. Advances in Aquaculture Hatchery Technology. Woodhead Publishing Limited.
3. Bardach JE. 1997. Sustainable Aquaculture. John Willey and Sons.
4. Bardach JE, Rhyther JH and Mc. Larney WO. 1972. Aquaculture Farming and Husbandry of Freshwater and Marine Organisms. John Wiley and Sons.
5. Beets WC. 1990. Raising and Sustaining Productivity of Small- Holder Farming Systems in the Tropics. Agbe Publ.
6. Bose AN. 1991. Coastal Aquaculture Engineering. Oxford and IBH Publ.
7. Bregnballe J. 2015. A Guide to Recirculation Aquaculture. FAO Publ.
8. Burnell G, Allan G. 2009. New Technologies in Aquaculture. 1st Edition. Woodhead Publishing House.
9. Boyd, C. E. and Tucker, C. S. 1992. Water Quality and Pond Soil Analyses for Aquaculture, Alabama Agricultural Experimental Station, Auburn University
10. Creed R. 2017. Aquaculture and Fish Farming. Syrawood Publ
11. Davion A. 2018. Recirculating Aquaculture Systems: a Guide to Farm Design and Operations.

12. Edwards P, Little DC and Demaine H. (Eds.). 2002. Rural Aquaculture. CABI.
13. FAO 2001. Planning and Management for Sustainable Coastal Aquaculture Development. FAO.
14. ICAR. 2006. Handbook of Fisheries and Aquaculture. ICAR
15. Imai T. 1978. Aquaculture in Shallow Seas. Progress in Shallow Sea Culture. Amerind Publ.
16. Ivar LO. 2007. Aquaculture Engineering. Daya Publ. House.
17. James PM. 1983. Handbook of Mariculture. Vol. I. Crustacean Aquaculture. CRC Press.
18. Jhingran VG and Pullin RSV. 1985. Hatchery Manual for the Common, Chinese and Indian Major Carps. ICLARM, Philippines.
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20. Lekang O, I. 2013. Aquaculture Engineering. Wiley-Blackwell Publ.
21. Leung P, Lee CS and O'Bryen JP. (Eds.). 2007. Species and System Selection for Sustainable Aquaculture. Blackwell Publ.
22. Midlen and Redding TA. 1998. Environmental Management for Aquaculture. Chapman and Hall.
23. Muthu MS. 1983. Culture of Live Feed Organisms. Tech. Paper 14. Summer Institute in Hatchery Production of Prawns Seeds. CMFRI, Cochin.
24. Pillay TVR and Kutty MN. 2005. Aquaculture- Principles and Practices. Blackwell.
25. Sharma LL, Sharma SK, Saini VP and Sharma BK. (Eds.). 2008. Management of Freshwater Ecosystems. Agrotech Publ. Academy.
26. Selvamani BR and Mahadevan RK. 2008. Aquaculture, Trends and Issues. Campus Books International. FAO, 2011. Code of conduct for responsible fisheries. FAO special edition
27. Thomas L. 1995. Fundamentals of Aquacultural Engineering. Chapman and Hall
28. Tidwell JH. (Ed.). 2012. Aquaculture Production Systems. Wiley-Blackwell.
29. Timmons MB, Guerdat, T, Vinci, BJ. 2019. Recirculating Aquaculture. Ithaca Publishing Comp.
30. Yoram, A., 2015. Biofloc Technology: a Practical Guidebook. WAS Publ

Practicum Component (Credit :1 , 30 Hrs)

Practicum		
Sl. No	Content	30 Hrs
1.	Determination of soil texture using soil trigon method/field method (Major)	3
2.	Determination of pH in soil and water samples (Minor)	2
3.	Calculation of lime requirement for brackish water pond (Minor)	3
4.	Determination of primary productivity (Light and dark bottle method) (Major)	3
5.	Estimation of salinity in water sample using titration and refractometer (Major)	3
6.	Determine transparency of pond water using Secchi Disc (Minor)	2
7.	Fish feed formulation (Square method) and preparation (Major)	5
8.	Collection and identification of aquatic weeds, insects, weed fish and predatory fish (any two in each category) (Minor)	6
9.	Identification of live feeds – Paramecium, Rotifer, Daphnia, Moina, Artemia, Copepod (Any three) (Minor)	3

References:

1. Kungvankij P. and T.E. Chua. 1986. Shrimp Culture, Pond Design, Operation and Management. NACA Training Manual Series. 2. FAO, NACA and RLCP.
2. Elvira A. Baluyut. 1989. Aquaculture Systems and Practices: A Selected Review. UNDP, FAO.
3. Judith Betsy. C and S. Felix. 2019. Principles of Aquaculture: Practical Manual. Narendra Publishing House.
4. Rather, M. 2024. Technical Guide to Carp Culture. Narendra Publishing House.

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the scope of aquaculture, status of aquaculture in India and Kerala and criteria for selection of sites and species for culture and commercially important common cultivable species	U, R, An	1,3
CO-2	Understand different types and systems of aquaculture and different types of aquaculture practices.	U, R, An,C	2,5
CO-3	Acquire knowledge in design and construction of culture systems and hatcheries	R, U, An,C	4,5
CO-4	To get familiarised with pre-stocking pond management, seed resources , seed stocking , feed management and monitoring parameters and health of stock	AP, An, E,C	4,5
CO-5	To get an awareness on post stocking management practices for a profitable culture.	U, Ap,An,C	4,5,7

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	Understand the scope of aquaculture, status of aquaculture in India and Kerala and criteria for selection of sites and species for culture and commercially important	PO2,3,7/ PSO4,5	U, R, An	C, P, M	L	

	common species	cultivable					
2	Understand different types and systems of aquaculture and different types of aquaculture practices.	PO2,3,7/ PSO4,5	U, R, An,C	C, P, M	L		
3	Acquire knowledge in design and construction of culture systems and hatcheries	PO2,3,7/ PSO4,5	R, U, An,C	C, P, M	L		
4	To get familiarised with pre-stocking pond management, seed resources , seed stocking , feed management and monitoring parameters and health of stock	PO2,3,7/ PSO4,5	Ap, An, E,C	C, P, M	L		
5	To get an awareness on post stocking management practices for a profitable culture.	PO1,2,3, 7/PSO4,5	U, Ap,An,C	F, C, P	L		

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	-	-	-	3	3	-	-	-	2	3	-	-	-	3	-
CO 2	-	-	-	3	3	-	-	-	2	3	-	-	-	3	-
CO 3	-	-	-	3	3	-	-	-	2	3	-	-	-	3	-
CO 4	-	-	-	3	3	-	-	-	2	3	-	-	-	3	-
CO 5	-	-	-	3	3			3	2	3	-	-	-	3	-

Correlation Levels:

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

Assessment Rubrics:

Assignment / Seminar topics

1. Aquaculture vs Agriculture
2. Environmental Impact Assessment (EIA)
3. Water quality management
4. Multiple uses of water in aquaculture
5. Use of agro-industrial waste and biofertilizer in aquaculture

Field activities

1. Visit to aquaculture farms & submission of report on cultivable species
2. Make a report on any systems of aquaculture by visiting the culture areas and submit the report

Continuous comprehensive Assessment

1. Assignment/ Quiz/ Discussion / Seminar
2. Submission of specimen collection report
3. Submission of Field report

End semester Evaluation

1. Very short answer questions
2. Short answer questions
3. Essay type questions
4. Practical examinations

Mapping of COs to Assessment Rubrics :

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