



University of Kerala

Discipline	ZOOLOGY				
Course Code	UK2DSCZOO103				
Course Title	Aquatic Ecosystems and Sustainable Management				
Type of Course	DSC				
Semester	II				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre-requisites	Pass in class XII				
Course Summary	This course shall provide a comprehensive understanding of the structure, function, and dynamics of aquatic ecosystems and enable the student to understand the classification of aquatic fauna and their adaptations. The goal of this course is to comprehend and investigate the challenges that aquatic ecosystems face as well as their conservation tactics. Techniques for the sustainable use and management of aquatic resources are also covered in the course.				

Detailed Syllabus

Module	Unit	Content	60 hrs
I		Aquatic Ecosystems	12
	1.1	Introduction, definition and types of aquatic ecosystems (freshwater, marine and brackish water ecosystems)	2
	1.2	Freshwater ecosystems- Lentic and Lotic environments (Pond, Lakes and Reservoirs).	2
	1.3	Marine ecosystems – Intertidal zone, Neritic zone and oceanic zone (Brief description)	2
	1.4	Brackish water ecosystems – Estuaries, backwaters - example Vembanad	2
	1.5	Marine benthic zones- Coral reefs and their significance	2

	1.6	Mangrove ecosystem – Sunderbans and Kunhimangalam, Kannur	2
II	Fauna of Aquatic Ecosystems		12
	2.1	Classification - Plankton, Nekton , Neuston and Benthos (Brief account only) Adaptations of Planktons, deep sea fishes and marine mammals	6
	2.2	Major Bioindicators- Definition and importance in aquatic ecosystems (plankton, mayflies, mussels)	6
III	Challenges and Conservation Strategies		12
	3.1	Challenges to Aquatic Ecosystems: Sand Mining, Ocean Acidification, Overfishing, Habitat destruction and Oil Pollution (oil seepage and shipping).	6
	3.2	Conservation Strategies in Aquatic Ecosystem Restoration- Mangrove restoration program, Sea ranching Program, Bioremediation using superbugs, Ramsar sites in Kerala, Marine protected areas (MPAs) – Gulf of Mannar, Sundarbans. (Related Activities- Visit to Mangrove/Ramsar sites)	6
IV	Utilization of Aquatic Resources		12
	4.1	Bioprospecting of aquatic ecosystems in the field of food, industry, and medicine – Green algal extract, Cytarabin, Single Cell Protein (Spirulina), Chitin.	6
	4.2	Value Addition of Aquatic resources - Nutraceuticals developed by CMFRI (Cadalmine Green Mussel extract and Cadalmine Antidiabetic extract), Value added seafood products from MPEDA (any two), Water hyacinth as value added product (Mention Center for Research on Aquatic Resources, Alappuzha).	6

V	Sustainable Management - Issues and Innovations		12
	5.1	Integrated Water Resource Management(IWRM)-Ecosystem – based management(EBM).	3
	5.2	Blue economy ,Blue Carbon and Water budget	3
	5.3	Climate change and Aquatic ecosystems-Impact on Biodiversity, Sea level rising, Coral bleaching.	3
	5.4	Innovative Technologies in Management – Remote sensing, GIS and bio- monitoring techniques.	3

References

1. Allan, J.D and Castillo.M.M.2009, Stream Ecology (Second Ed.) Springer, Netherlands
2. Wetzel, R. G. (2001). Limnology: Lake and River Ecosystems (3rd ed.). Academic Press.
3. Odum, E.P. 1971. Ecology. Holt Riehart& Winston Inc., USA, 152 pp.
4. Sharma, B. K. (2016). Environmental Science: Water Pollution and Management. Rastogi Publications.
5. Kalff, J. (2002). Limnology: Inland Water Ecosystems. Prentice Hall.
6. Prasad, B., & Sharma, C. (2019). Sustainable Management of Aquatic Resources. CRC Press.
7. Datta, S. C., & Chattopadhyay, G. N. (2017). Ecology of Plankton. Springer.
8. Keshaviah, P. (Ed.). (2014). Water Resources, Policies, and Politics in India: Initiatives and Challenges. Routledge.

Web Resources

1. International Union for Conservation of Nature (IUCN) - Freshwater Conservation: <https://www.iucn.org/theme/freshwater>.
2. Central Pollution Control Board (CPCB), India: <http://www.cpcb.nic.in/>
3. National Institute of Oceanography (NIO), India: <https://www.nio.org/>
4. Ministry of Environment, Forest and Climate Change, Government of India: <http://moef.gov.in/>
5. Indian Council of Agricultural Research (ICAR) - Central Inland Fisheries Research Institute: <https://cifri.icar.gov.in/>
6. National Institute of Oceanography, India: <https://www.nio.org/>
7. National Mission for Clean Ganga, Government of India: <https://nmcg.nic.in/>
8. World Wide Fund for Nature (WWF) - India: <https://www.wwfindia.org/>
9. United Nations Environment Programme (UNEP) - India: <https://www.unep.org/explore-topics/resource-efficiency/what-we-do/resource-efficiency-and-chemicals/regions/asia-and-87>
10. https://mpeda.gov.in/?page_id=933
11. <https://www.cmfri.org.in/cmfri-neutraceuticals>

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Develop a comprehensive knowledge and understand different types of aquatic ecosystems.	R, U, An	PSO-1,2,3
CO-2	Categorize various aquatic fauna and analyse the way they are adapting to the different aquatic habitats.	U, An, E	PSO-1,2,3
CO-3	Evaluate various aquatic ecosystem issues and assess the major conservation strategies used to revitalize aquatic ecosystems.	U, An, E	PSO-1,2,3,7
CO-4	Analyze the bioprospecting potential of aquatic ecosystems, and evaluate various value-added products	An, E, C	PSO-1,3,5,7
CO-5	Understand various issues and apply innovations in Sustainable Blue Economy Management.	U, Ap, An	PSO-1,2,3,7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Aquatic Ecosystems and Sustainable Management

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practicum (P)
CO-1	Develop a comprehensive knowledge and understand different types of aquatic ecosystems.	PO-1,2,3 PSO-1,2,3	R, U, An	F, C	L	-
CO-2	Categorize various aquatic fauna and analyse the way they are adapting to the different aquatic habitats.	PO-1,2,3 PSO-1,2,3,4	U, An, E	F, C	L	-

CO-3	Evaluate various aquatic ecosystem issues and assess the major conservation strategies used to revitalize aquatic ecosystems.	PO-1,2,3 PSO-1,2,3,7	U, An, E	F, C	L	
CO-4	Analyze the bioprospecting potential of aquatic ecosystems, and evaluate various value-added products	PO-2,3,6 PSO-1,3,5,7	An, E, C	F, C, P	L	
CO-5	Understand various issues and apply innovations in Sustainable Blue Economy Management.	PO-2,3,6,7 PSO-1,2,3,7	U, Ap, An	F, C	L	

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

Mapping of COs with PSOs and POs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO 1	3	2	1	-	-	-		3	2	1	-	-	-	-	-
CO 2	2	3	2	1	-	-		2	3	2	-	-	-	-	-
CO 3	2	1	2	-	-	-	2	1	2	3	-	-	-	-	-
CO 4	1	-	3	-	2	-	2	-	2	2	-	3	2	-	-
CO 5	1	2	2	-	-	-	2		2	2		-	2	1	-

Correlation Levels:

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

Assessment Rubrics:**Assignment/Seminar topics**

1. Types of aquatic ecosystems.
2. Importance of bioindicators in aquatic systems with examples.
3. Aquatic adaptations of deep sea fishes.
4. Ramsar sites in Kerala.
5. Impact of Climate change on aquatic ecosystems.

Continuous Comprehensive Assessment

1. Assignments
2. Seminars
3. Test
5. Quiz/Debate

End Semester Evaluation

1. Multiple Choice Question
2. Very Short Answer Question
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		✓		✓