Programme	B. Sc. Aquaculture Honours					
Course Title	Fundamentals of Aquaculture					
Type of Course	**Major** core					
Semester	I					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2 hours
Pre-requisites	A pass in HSE/VHSC or Equivalent with biology					
Course Summary	This course introduces the principles and practices of aquaculture. Students will learn about fish biology, water quality management, various aquaculture systems, sustainability and environmental impacts, economic aspects, and practical skills in aquaculture management.					

Course Outcome

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the basic principles of aquaculture, including fish biology and water quality management.	(U)	(F)	Instructor-created exams , Quiz
CO2	Identify and describe various aquaculture systems and practices.	R	C	Instructor-created exams Seminar presentations
CO3	Apply aquaculture techniques for breeding, rearing, and harvesting aquatic organisms.	Ap	P	Practical Assignment Observation of practical skills Instructor-created exams
CO4	Analyse case studies to evaluate the sustainability and environmental impact of aquaculture practices.	An	M	In-class discussions, Instructor-created exams Assignments
CO5	Evaluate the economic aspects of aquaculture, including market trends and business planning.	E	C	Oral presentation Instructor-created exams \Assignment
CO6	Create a comprehensive aquaculture management plan that incorporates best practices	C	P	Project or Plan Submission Seminar presentations

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed syllabus

Programme	B. Sc. Aquaculture Honours					
Course Title	Foundations of Aquatic Biology					
Type of Course	**Major** Core					
Semester	II					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	3	-	2	75	2hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The Foundations of Aquatic Biology course offers an in-depth exploration of aquatic ecosystems, covering their properties, diverse life forms, ecological dynamics, and research methods, equipping students with the knowledge to study and conserve aquatic environments.					

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the history, scope, and importance of aquatic biology in aquaculture.	U	C	Written exams, quizzes
CO2	Grasp the characteristics and diversity of aquatic ecosystems and life forms.	U	C	Quizzes, lab reports
CO3	Apply knowledge of physical and chemical water properties to assess their influence on aquatic life.	Ap	P	Practical exams, lab reports
CO4	Analyze trophic dynamics, nutrient cycles, and ecological interactions within aquatic environments.	An	P	Case studies, project reports
CO5	Evaluate the impact of human activities and climate change on aquatic systems and explore conservation strategies.	E	C	Research projects, presentations
CO6	Develop skills in scientific research methods, data analysis, and experimental design specific to aquatic biology.	C	P	Lab practicals, field studies, seminar presentations

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	B. Sc. Aquaculture Honours					
Course Title	Aquaculture Genetics and Biotechnology					
Type of Course	**Major** Core					
Semester	III					
Academic Level	200-299					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	4		0	60	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology .Should have completed previous semesters					
Course Summary	This overview covers the fundamental distinctions between cell types and genetics, and extends into aquaculture biotechnology, focusing on genetic modifications, breeding, and biotechnological strategies for sustainable aquaculture improvement.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the structural and functional differences between prokaryotic and eukaryotic cells, including an overview of cell organelles and their significance in the diversity of life.	U	F	Written exams, quizzes
CO2	Understand the processes of cell division, specifically mitosis and meiosis, and grasp foundational genetic principles including Mendel’s laws, gene interactions, and inheritance patterns."	U	C	Written exams, quizzes, assignments
CO3	Apply knowledge of chromosomal aberrations, mutations, and genetic modifications to understand their implications in biotechnology and aquaculture.	Ap	P	Lab reports, practical exams
CO4	.Apply selective breeding, hybridization techniques, and the use of genetic markers and GMOs in aquaculture for improved production and sustainability.	Ap	P	Project work, presentations
CO5	Apply biotechnological tools in managing aquatic animal health, encompassing molecular diagnostics, vaccine development,	Ap	P	Case studies, lab practicals

	and the use of probiotics and prebiotics.			
CO6	Evaluate and create innovative solutions for challenges in aquaculture biotechnology, including genetic improvements, bioremediation, and enhancing the nutritional value of aquaculture products.	E, C		Research projects, seminar presentatio
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Fundamentals of cell Biology**		**10**
	1	Introduction to the fundamental differences between prokaryotic and eukaryotic cells, setting the stage for the complexity and diversity of life at the cellular level. An over view of different organelles of eukaryotic cell	2
	2	The Command Centre The Nucleus and Chromosomes.	3
	3	Powerhouse and Photosynthesis Factories: Mitochondria and Chloroplasts and other organells	3
	4	Cell division – Mitosis and meiosis	2
II	**Basic Genetics**		**10**
	5	Mendel's law of inheritance. Gene interactions	3
	6	Complete, incomplete and co-dominance, multiple alleles, linkage	2
	7	Chromosomal aberrations: Monosomy, trisomy.	2
	8	Mutations and mutagens. Translocations, inversions, duplications, deletions	3
III	**Aquaculture Biotechnology**		**20**
	9	Selective Breeding and Hybridization Techniques	2
	10	Genetic Markers and Their Applications	2
	11	Transgenic Fish and GMOs in Aquaculture:	2
	12	Recombinant DNA technology	2
	13	Biotechnological tools for aquaculture,	2
	14	Chromosome manipulation in fish and shell fishes- Triploidy, Polyploidy, Gynogenesis, Androgenesis	3
	15	Monosex production, super male and super female fish production techniques.	3
	16	Synthetic hormone production for induced breeding	2
	17	Cryopreservation	2
IV	**Biotechnology for Aquatic Animal health Management**		**8**
	18	Molecular diagnostics, immunological techniques, and their applications in disease detection	2
	19	Development and application of vaccines and immunostimulants for disease prevention.	2

Programme	B. Sc. Aquaculture Honours					
Course Title	Biology of fishes					
Type of Course	**Major** core					
Semester	III					
Academic Level	200-299					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	3	-	2	75	2
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	This course offers a comprehensive overview of ichthyology, encompassing fish biology, taxonomy, physiology, and practical aspects of aquaculture. It integrates theoretical knowledge with hands-on experiments and specimen collection, focusing on nutrition, growth, reproduction, endocrinology, and sustainable aquaculture practices.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Identify and classify different fish species and understand their morphological characteristics.	U	F	Quizzes Assignments Identification tests
CO2	Analyze and interpret fish feeding habits, growth patterns, and reproductive mechanisms	An	C	Case studies, Analysis reports, Practical demonstrations
CO3	Apply methods for assessing fish health, including examination of gill structures and alimentary canals.	Ap	p	Practical exams, Lab exercises, Fieldwork
CO4	Evaluate the impact of different environmental conditions on fish physiology and behaviour.	E	M	Research projects, Group discussions, Seminar presentation
CO5	Apply practical skills in collecting fish specimens and conducting experiments to explore aspects of fish biology."	Ap	p	Hands-on lab work, Field trips, Experiment reports
CO6	Analyse the roles of fish endocrinology and excretion in aquaculture to understand their implications for fish health and farm management	An	C	Theses, Synthesis papers, Conceptual mappings
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	B. Sc. Aquaculture Honours					
Course Title	Ornamental fish culture and Management					
Type of Course	**Major** Core					
Semester	IV					
Academic Level	200-299					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	3	-	2	75	2
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	This course delves into the ornamental fish industry, emphasizing the biology, breeding, culture, and management of ornamental fish. It addresses system design, water quality, nutrition, health, breeding methods, and marketing. The aim is to provide students with the skills and knowledge needed for successful ornamental fish management, focusing on sustainability and conservation.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Identify major ornamental fish species and their ecological requirements, and understand the significance of biodiversity."	R.U	F	Oral exams, Quizzes
CO2	Explain the setup and management of aquarium systems, emphasizing the selection of equipment and species compatibility.	U	C	Assignments, Quizzes
CO3	Apply techniques for maintaining water quality and health management practices in ornamental fish culture	Ap	p	Practical Sessions, Reports
CO4	Analyze breeding strategies and genetic selection principles to enhance ornamental fish production.	An	C	Case Studies Presentations
CO5	Evaluate market trends, regulatory impacts, and sustainability practices within the ornamental fish industry.	E	C	Group Project, Presentations
CO6	Create a conservation breeding program for endangered ornamental fish species that incorporates sustainable practices.	C	M	Project Report, Oral Exam
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P)				

Programme	B. Sc. Aquaculture Honours					
Course Title	Aquaculture Nutrition and Feed Technology					
Type of Course	**Major** Core					
Semester	IV					
Academic Level	200-299					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The Aquaculture Nutrition and Feed Technology course focuses on diet formulation, feed production, and sustainable practices in aquaculture, blending theory with practical application to enhance fish health and environmental sustainability.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the principles and significance of nutrition in aquaculture.	U	C	Quizzes, Lectures, Group Discussions
CO2	Analyze nutritional requirements and formulate diets for various aquaculture species.	An	p	Diet Formulation Assignments, Case Studies
CO3	Evaluate the impact of different feed ingredients and additives on fish health and growth.	E	C	Comparative Analysis Reports, Practical Demonstrations
CO4	Apply knowledge of feed manufacturing technology and quality control in feed production.	Ap	P	Factory Visits, Quality Assurance Simulations
CO5	Evaluate the sustainability and environmental impacts of aquafeed production practices."	E	C	Research Projects, Sustainability Assessments
CO6	Apply practical skills in implementing aquaculture feeding strategies."	Ap	P	Field Studies, Hands-On Workshops
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	B. Sc. Aquaculture Honours					
Course Title	Freshwater & Brackish water aquaculture					
Type of Course	**Major** core					
Semester	IV					
Academic Level	200-299					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	3	-	2	75	2
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course on "Brackish water and Freshwater Aquaculture" teaches essential aquaculture techniques, sustainability, and farm management through theoretical lessons and practical experiences, preparing students for careers in the aquaculture industry.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the fundamentals of aquaculture, including the basic principles of freshwater and brackish water aquaculture systems, species selection, and their significance	U	C	Written exams, quizzes
CO2	Apply knowledge of water quality management and system design in both freshwater and brackish water settings.	Ap	P	Lab reports, practical exams
CO3	Analyze and implement culture techniques for key aquaculture species, including carps, tilapia, catfish, *Macrobrachium rosenbergii*, and brackish water species	An	P	Fieldwork reports, practical exams
CO4	Evaluate and apply sustainable aquaculture practices with a focus on disease management, environmental impact mitigation, and the integration of innovative systems like biofloc technology and IMTA	E	C	Case studies, project reports
CO5	Understand the economic aspects of aquaculture, including production costs, market dynamics, and the economic viability of aquaculture systems.	U	C	Written exams, presentations
CO6	Apply practical skills in aquaculture	Ap	P	Lab practicals,

Programme	B. Sc. Aquaculture Honours					
Course Title	Mariculture					
Type of Course	**Major** Core					
Semester	V					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	4		0	60	2
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology. Should have completed previous semesters					
Course Summary	The course provides an in-depth exploration of Mariculture, focusing on the cultivation of finfish and shellfish, sustainable practices, and environmental management, preparing students to address and mitigate the ecological impacts associated with marine farming.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Describe the fundamentals, significance, and differences between mariculture, aquaculture, and traditional fishing.	Remember	Factual	Quizzes, Oral Examinations
CO2	Explain the types of mariculture systems and the technologies used, including their advantages and limitations.	Understand	Conceptual	Written Examinations, Assignments
CO3	Apply principles of biology and ecology to select and manage species for mariculture, incorporating system design and management practices.	Apply	Procedural	Practical Work, Lab Reports
CO4	Analyze the impact of mariculture on the environment and propose sustainable practices to mitigate negative effects.	Analyze	Conceptual	Case Study Analysis, Group Discussions
CO5	Evaluate the criteria for selecting species for mariculture based on economic, environmental, and biological factors.	Evaluate	Conceptual	Project Presentations, Peer Reviews
CO6	Design a mariculture project that integrates best practices for	Create	Procedural	Project Design, Final Project

	species selection, system design, and environmental sustainability.			Reports

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**Principles of Mariculture**		**10**
	1	Overview of Mariculture: Definition, History, and Importance	2
	2	Comparison between Mariculture, Aquaculture, and Traditional Fishing	3
	3	Basic Biological and Ecological Principles of Marine Farming	3
	4	Present status of mariculture	2
II	**Mariculture Systems and Technologies**		**10**
	5	Types of Mariculture Systems: Cages, Ponds, Recirculating Systems, and Offshore Structures	3
	6	Introduction to Mariculture Equipment and Technology	3
	7	Innovations and Sustainable Practices in Mariculture	2
	8	Criteria for Selecting Species for Mariculture: Economic, Environmental, and Biological Considerations	2
III	**Culture of Fin fishes**		**20**
	9	Overview of Finfish Species in Mariculture sea breams, rabbitfish, Groupers, pomfret, yellowtail, cobia, flatfishes, tuna, cod, puffers, silver pompono and porgy	3
	10	Biological and Ecological Needs of Cultured Finfish	2
	11	Open Ocean Cages and Pens: Design, Operation, and Management	2
	12	Land-based Recirculating Aquaculture Systems (RAS)	2
	13	Integrated Multi-Trophic Aquaculture (IMTA) for Sustainable Finfish Culture	2
	14	Broodstock Management and Genetic Improvement Programs	2
	15	Larval Rearing Techniques and Nursery Management	2
	16	Health Management in Finfish Culture	2
	17	Vaccination and Health Monitoring Practices	3
IV	**Culture of Shell Fishes**		**8**
	18	Overview of Shellfish Species in Mariculture. (mussels, edible oysters, pearl oysters, clams, cockles, abalones, sea cucumber, squid, cray fish)	2
	19	Suspension Culture: Rafts, Longlines, and Buoys	2
	20	Bottom Culture: Trenches and Trays	2
	21	Hatchery and Nursery Techniques for Shellfish	1
	22	Selective Breeding and Spat Collection	1
V	**Open ended Module**		**12**
	1	Assessing the Environmental Impact of Mariculture: Eutrophication, Habitat Destruction, and Escapes	
	2	Strategies for Minimizing Environmental Impact and Enhancing Sustainability	
	3	Case Studies: Success Stories and Challenges in Species Cultivation	

Programme	B. Sc. Aquaculture					
Course Title	Fishing Techniques and Practices					
Type of Course	**Major** Core					
Semester	V					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	3	-	2	75	2
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course delves into fishing methods, gear, marine environment understanding, and sustainability, complemented by practical training on gear use and sustainable practices.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the fundamental principles and historical development of fishing methods and gear, including the marine environment's role and the principles of responsible fisheries.	U	C	Written exams, quizzes
CO2	Explain the characteristics and functionalities of different types of fishing crafts in India, highlighting the distinctions between traditional, motorized, and mechanized crafts.	R	F	Oral presentations, short quizzes
CO3	Analyze the classification, design, and operational mechanisms of both modern and traditional fishing gears, focusing on active and passive gear types.	An	P	Case studies, written analysis
CO4	Evaluate materials and technologies used in fishing craft and gear construction, including an assessment of sustainability and efficiency in modern boat building and netting materials.	E	P	Project reports, presentations
CO5	Apply knowledge of fishing gears, devices, and materials in practical	Ap	p	Field trips, practical exams

	settings, including the identification of synthetic and natural fibers, and the use of fish detection devices.			
CO6	Create and implement sustainable fishing gear technologies through hands-on workshops and on-board fishing excursions, demonstrating innovation in net making and gear repair.	C	P	Practical workshops, reflective journals
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Introduction,**		**10**
	1	Principle and evolution of fishing methods and gear..	2
	2	Introduction to Marine environment	3
	3	Responsible fisheries,.	3
	4	CCRF, Safety at sea	2
II	**Fishing Crafts**		**10**
	5	Different types of fishing crafts in India- inland and marine ,traditional, motorized and mechanized.	3
	6	Trawlers	2
	7	Purse seiners	2
	8	Gill netters, long liners, trollers, deep sea vessels.	3
III	**Fishing Gears and Fish finding devices**		**15**
	9	Classification and description of modern fishing gears.	2
	10	Active Gears Design and operation of – trawls, purse seines, ring seines	2
	11	Design and operation of –beach / shore seine, boat seine, pole and line	2
	12	Passive Gears Design and operation of- gill nets, long lines, hooks, traps, stake net, dol net, chinese dip nets, cast nets	2
	13	Destructive fishing methods like electrical fishing, poisoning and use of dynamits	1
	14	Prohibited fishing practices	1
	15	Introductory information on echo-sounder, sonar, net sonde, global position systems, remote sensing, potential fishing zones	2
	16	Code of conduct of responsible fishing	2
	17	Turtle Exclusion Devices (TED) andBy-catch Reduction Devices (BRD).	1
IV	**Fishing Craft and Gear materials**		**10**
	18	Fishing craft materials – traditional and modern.	2
	19	Introduction to boat building materials - wood, steel, FRP, ferro-cement, aluminum etc	2
	20	Introduction to netting materials - natural and synthetic fishing gear materials	2

Programme	B. Sc. Aquaculture Honours					
Course Title	Fish Processing Technology					
Type of Course	**Major** Core					
Semester	V					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	This course on Fish Processing and Value Addition offers in-depth knowledge of preservation techniques and value addition in seafood, combining theoretical insights with practical experience to enhance industry standards and economic value.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the principles of fish preservation, including the importance of hygiene and sanitation in fish handling.	Understand (U)	Conceptual Knowledge (C)	Written exams, quizzes
CO2	Apply techniques for chilling, icing, drying, smoking, and freeze-drying fish, along with modern preservation methods.	Apply (Ap)	Procedural Knowledge (P)	Practical exams, lab reports
CO3	Analyze the processes involved in freezing and canning fish, focusing on the underlying principles and various stages.	Analyze (An)	Procedural Knowledge (P)	Case studies, practical exams
CO4	Create high-quality fish fillets, value-added products, and by-products to enhance product quality and market value.	Create (C)	Procedural Knowledge (P)	Project work, presentations
CO5	Evaluate the economic impact and sustainability of utilizing fish processing by-products and adding value to seafood products.	Evaluate (E)	Metacognitive Knowledge (M)	Seminar presentations, research papers

CO6	Apply hands-on skills in processing, analyzing, and creating value-added seafood products through practical modules and field visits.	Apply (Ap)	Procedural Knowledge (P)	Field reports, project documentation
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Introduction to fish processing**		**10**
	1	Principles of fish preservation.	2
	2	Importance of hygiene and sanitation in fish handling.	3
	3	Quality of water and ice in fish handling and processing.	3
	4	Chilling and Icing	2
II	**Drying, Smoking and Freeze-drying**		**10**
	5	Principles of smoking, drying and salting of fish.	3
	6	Different types of drying and factors affecting drying Packing and storage of dried products	3
	7	Modern methods of preservation by irradiation and modified atmospheric storage	2
	8	Accelerated freeze drying and packing of freeze dried products.	2
III	**Freezing and Canning**		**15**
	9	Fundamental principles involved in freezing of fish and fishery products.	2
	10	Various freezing methods	1
	11	Freezing of shrimps and fishes..	1
	12	Preparation of fish fillets	2
	13	Changes during the cold storage of fish and fishery products.	2
	14	Principles involved in canning of fish	2
	15	Different stages of canning of Tuna	2
	16	Retortable pouch processing	1
	17	Cut open test , commercial sterility and F value	2
IV	**Value Addition and By-Products**		**10**
	18	Value addition in sea food.	2
	19	Value added products , Advantages of value addition	2
	20	Battered and breaded products. Preparation of products viz. fish/prawn pickle, fish wafers, fish soup powder,	2
	21	By products and its economic significance	2
	22	Fish meal, fish protein concentrate, shark fin rays, fish maws, isinglass, fish liver oil, fish body oil, fish hydrolysates, chitin, chitosan, glucosamine hydrochloride, squalene, pearl essence, ambergris, gelatin, beche-de-mer, fish silage	2
V	**(Practical Module)**		**30**
	1	1.Determination of moisture content in fish and fishery products 2.General description – freezing	20

Programme	B. Sc. Aquaculture Honours					
Course Title	Aquaponics and integrated farming Systems					
Type of Course	**Major** Elective					
Semester	V					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	4			60	2hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	This course provides a comprehensive overview of aquaponics and integrated farming systems, exploring the symbiotic relationship between aquatic animals and plants, system designs, water quality management, and sustainable farming practices. It prepares students for innovative agriculture practices by covering various integrated systems, sustainability, market dynamics, and includes practical applications through case studies and farm visits.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the basic concepts and designs of aquaponics and integrated farming systems, including the symbiotic relationships between plants and aquatic animals.	(U)	(C)	Written exams, quizzes
CO2	Apply techniques for managing water quality, nutrient dynamics, and the selection of appropriate fish and plant species in aquaponics systems.	(Ap)	(P)	Practical exams, lab reports
CO3	Analyze the sustainability, benefits, and challenges of various integrated farming practices such as Duck-Fish, Fish-Rice, and Fish-Vegetable cultures.	(An)	(C)	Case studies analysis, presentations
CO4	Create and manage integrated farming systems, utilizing ecosystem management, pest and	(C)	(P)	Project work, design assignments

	disease control strategies, and resource optimization for productivity and sustainability.			
CO5	Evaluate the economic aspects, market dynamics, and the role of emerging technologies in aquaponics and integrated farming, and their contributions to global food security and sustainability.	(E)	(C)	Seminar presentations, research papers
CO6	Apply practical skills in aquaponics and integrated farming through engagement with case studies, farm visits, and project work, promoting innovation and entrepreneurial thinking.	(Ap)	(P)	Field reports, project documentation
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**An introduction to Aquaponics**		**10**
	1	Fundamentals of aquapoincs Aquaponics System components, and cycle.	2
	2	Understanding symbiotic relationships between plants and aquatic animals.	3
	3	Underlying principles and Process involved	3
	4	Learning about different types of aquaponics systems (media-filled beds, NFT, DWC) and their components	2
II			**10**
	5	Water Quality Management: Understanding key water quality parameters, testing, and maintenance.	3
	6	Fish in Aquaponics: Selection criteria, care, and management of fish suitable for aquaponics systems.	3
	7	Plants in Aquaponics: Selection of compatible plant species and their cultivation in aquaponics.	2
	8	Nutrient Dynamics: Study of nutrient cycles, supplementation, and management in aquaponics systems.	2
III	**Overview of Integrated Farming:**		**20**
	9	Integrated farming and Types of Integrated Farming Practices an overview	3
	10	Fish-Duck Culture	2
	11	Fish-Rice Culture	2
	12	Fish-Vegetable Culture	2

Programme	B. Sc. Aquaculture Honours					
Course Title	Climate change and Aquatic resources					
Type of Course	**Major** Elective					
Semester	V					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	4			60	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The "Climate Change and Aquatic Resources" course provides an in-depth exploration of the impacts of climate change on marine and freshwater ecosystems, emphasizing the challenges and opportunities it presents for sustainable aquaculture practices. Through a blend of theoretical knowledge and practical application, students will learn to assess vulnerabilities, devise adaptation strategies, and contribute to the resilience of aquatic resources in the face of global climate change.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the basic science of climate change, its global effects, and the importance of communication and public awareness.	(U)	(C)	Written exams, quizzes
CO2	Analyze the impact of climate change on marine and freshwater ecosystems, including ocean acidification and deoxygenation.	(An)	(C)	Case studies, project reports
CO3	Evaluate the vulnerability of aquaculture to climate change and identify sustainable adaptation and mitigation practices.	(E)	(P)	Research papers, presentations
CO4	Apply traditional knowledge and technological innovations to enhance climate resilience in aquaculture practices.	(Ap)	(P)	Practical exams, lab reports
CO5	Evaluate policies and governance frameworks to	(E)	(C)	Group discussions,

	enhance climate resilience in aquaculture at both international and national levels			policy analysis projects
CO6	Apply field-based learning to observe and assess the application of climate-smart aquaculture practices in real-world settings	Ap	(P)	Field trip reports, reflective journals
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Fundamentals of Climate Change**		**10**
	1	Introduction to Climate Change: Overview, causes, and global effects.	2
	2	Climate Change Science: Understanding greenhouse gases, carbon cycles, and climate modelling	3
	3	Impact of Climate Change on Global Weather Patterns: Changes in temperature, precipitation, and extreme weather events	3
	4	Climate Change Communication and Public Awareness	2
II	**Climate Change and Aquatic Ecosystem**		**10**
	5	Effects on Marine Ecosystems: Ocean acidification, sea temperature rise, and impacts on coral reefs.	3
	6	Effects on Freshwater Ecosystems: Changes in river flows, lake temperatures, and ice cover	3
	7	Biodiversity Loss and Species Migration: Consequences for aquatic food webs and species distribution	2
	8	Ocean Deoxygenation and Its Effects	2
III	**Climate Change Impacts on Aquaculture and Mitigation practices**		**20**
	9	Vulnerability of Aquaculture to Climate Change: Risk assessment and management. .	3
	10	Adaptation Strategies for Aquaculture: Breeding, feed management, and disease control	2
	11	Climate-Induced Changes in Aquatic Pathogens and Disease Dynamics	2
	12	Reducing carbon footprint in aquaculture operations.	2
	13	Integrated Multi-Trophic Aquaculture (IMTA), recirculating aquaculture systems (RAS).	2
	14	Ecosystem-based Aquaculture Management: Conservation and restoration of aquatic habitats	2
	15	Carbon Sequestration in Aquatic Environments: Blue carbon ecosystems	2
	16	Water Use Efficiency and Management: Techniques for reducing water footprint.	2
	17	Policy and Governance for Climate-Resilient Aquaculture: International	3

Programme		B. Sc. Aquaculture Honours				
Course Title		Blue Economy and Aquaculture				
Type of Course		**Major** Elective				
Semester		V				
Academic Level		300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total hours	Exam Duration
	4	4			60	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course provides an in-depth exploration of the Blue Economy, focusing on sustainable use of ocean resources and the economic opportunities it offers, alongside environmental sustainability and marine conservation.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the concept, principles, and key sectors of the Blue Economy.	(U)	(C)	Written exams, quizzes
CO2	Understand the significance of ecosystem services and natural capital in the context of the Blue Economy.	(U)	(C)	Written exams, group discussions
CO3	Analyze the linkage between Sustainable Development Goals (SDGs) and the Blue Economy.	(An)	(C)	Research papers, presentations
CO4	Evaluate sustainable practices in fisheries, aquaculture, and marine bioprospecting for the Blue Economy.	(E)	(P)	Case studies, practical exams
CO5	Evaluate the distinctions between the Green and Blue Economies, and analyze environmental sustainability challenges associated with the Blue	(E)	(C)	Written exams, debates

	Economy.			
CO6	Analyze innovative sectors within the Blue Economy, such as green shipping, marine renewable energy, and sustainable tourism.	(An)	(C)	Project work, field trips
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Introduction to Blue Economy**		**10**
	1	What is Blue economy	2
	2	Principles of blue economy	2
	3	Coastal and Ocean industries	3
	4	Blue economy Stake holders and innovators	3
II	**Ecosystem Services**		**10**
	5	Introduction to Ecosystem services	3
	6	Natural capital and the blue economy	3
	7	Valuing ecosystem services,	2
	8	The fundamental techniques used to value natural resources and ecosystem services	2
III	**Sustainable Development and Blue economy**		**20**
	9	Sustainable Development Goals (SDGs) and the Blue Economy: Understanding the linkage	3
	10	Marine Biodiversity: Importance for the blue economy.	2
	11	Sustainable Fisheries and Aquaculture: Practices and technologies.	2
	12	Marine Bioprospecting: Potential for new products and medicines	2
	13	Aquaculture's Role in the Blue Economy: How aquaculture contributes to sustainable ocean resource use.	2
	14	Blue economy prospects and opportunities	2
	15	Difference between Green and Blue Economy.	2
	16	Environmental Sustainability of the Blue Economy.	2
	17	Blue Economy and Marine Pollution Issues.	3
IV	**Exploring the Blue Economy**		**8**
	18	Green Shipping and Port Management:	2
	19	Marine Renewable Energy	2
	20	Sustainable Marine Tourism	2
	21	Ocean Health and Wildlife:	1
	22	Marine Conservation Strategies	1
V	**Open ended Module**		**12**
	1	Aquaculture tourism and blue economy	
	2	Marine waste management	
	3	International Maritime Law: UNCLOS and other agreements.	

Programme	B. Sc. Aquaculture Honours					
Course Title	Fish Biochemistry					
Type of Course	**Major** Elective					
Semester	V					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	4			60	2
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	This course delves into the biochemical constituents of aquatic life, covering the intricate biochemistry of proteins, lipids, and enzymes found in fish, crustaceans, and molluscs. It explores their structural, functional, and post-mortem changes, alongside the preparation and properties of marine polysaccharides, emphasizing the practical applications and impacts of these biochemical processes on seafood quality and nutrition.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the biochemical constituents of fish, crustaceans, and mollusks, including their proteins and lipids.	Understand	Conceptual	Written exams, quizzes
CO2	Analyze the structural and functional properties of seafood proteins and lipids, understanding their importance in nutrition and food processing.	Analyse	Conceptual	Practical exams, lab reports
CO3	Evaluate the impact of post-mortem biochemical changes and processing methods on the quality of seafood.	Evaluate	Conceptual	Case studies, project reports
CO4	Apply knowledge of enzymatic reactions, including kinetics and mechanisms, to assess seafood quality and shelf-life.	Apply	Procedural	Lab practicals, presentations

CO5	Investigate the roles of polysaccharides in seafood, focusing on the preparation and applications of chitin, chitosan, and glucosamine.	Analyze	Procedural	Research projects, lab exercises
CO6	Synthesize knowledge of antioxidants, oxidation indices, and enzyme classifications to develop strategies for preserving seafood quality.	Create	Procedural	Group projects, seminar presentations
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Biochemical composition of fish**		**10**
	1	Biochemical constituents of fish, crustaceans and mollusks.	2
	2	Biochemistry of fish proteins, Classification. Sarcoplasmic proteins, Myofibrillar proteins and Stroma proteins	3
	3	Structure of fish muscles and Post mortem biochemical changes, rigor mortis	3
	4	Non-protein nitrogenous compounds, K value	2
II	**Proteins**		**10**
	5	Functional properties of seafood proteins: Solubility, emulsification, viscosity, water holding, stability, gelation,	3
	6	Precipitation of proteins, Salting in and Salting out	3
	7	Denaturation and coagulation of proteins	2
	8	Changes in proteins during processing	2
III	**Seafood Lipids**		**20**
	9	Seafood lipids: Composition and nutritive value	3
	10	Triglycerides, phospholipids,	2
	11	Non-saponifiables including sterols and vitamins.	2
	12	Classification and naming of fatty acids	2
	13	MUFA, PUFA, HUFA , Omega 3 Fatty acids	2
	14	Auto-oxidation of fatty acids, rancidity	2
	15	Lipasas and phospholipases, ,	2
	16	Pro- and anti-oxidants,	2
	17	Oxidation indices, Peroxide value , TBA Value, FFA value	3
IV	**Enzymes**		**8**
	18	Structure and function of enzymes	2
	19	Kinetics of enzyme activity, KM value, Turnover number,	2
	20	Mechanism of Enzyme activity	2
	21	Classification of enzymes,	1
	22	Ribozymes, Abzymes, Synthetic enzymes	1

Programme	B. Sc. Aquaculture Honours					
Course Title	Aquaculture Engineering and Technology					
Type of Course	**Major** Core					
Semester	VI					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	4			60	2
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	This course on Aquaculture Engineering and Technology provides an in-depth exploration of the engineering principles behind aquaculture systems, including farm design, equipment, production systems, and the latest technologies for sustainable aquaculture practices. It combines theoretical knowledge with practical applications, including visits to aquaculture farms, to prepare students for advanced roles in the aquaculture industry, focusing on innovation, efficiency, and biosecurity.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the foundational principles of aquaculture engineering, including site selection criteria and surveying techniques essential for aquaculture system design.	(U)	(C)	Written exams, quizzes
CO2	Apply knowledge in the design and management of diverse aquaculture systems such as Recirculating Aquaculture Systems (RAS), cage, and pond cultures, with an emphasis on maintaining water quality and optimizing system components.	(Ap)	(P)	Practical exams, project work
CO3	Apply principles of farm design, focusing on the integration and optimization of equipment, aeration systems, and pumps to enhance aquaculture operations.	(Ap)	(P)	Design assignments, presentations
CO4	Analyze and implement advanced techniques in broodstock management, hatchery design, and operation, ensuring efficient use of hatchery equipment.	(An)	(P)	Case studies, lab reports

CO5	Create and integrate automation and biosecurity measures into aquaculture practices to improve operational efficiency and disease prevention.	(C)	(P)	Design projects, seminar presentations
CO6	Evaluate recent innovations in aquaculture technology through case studies and practical experiences, aiming to encourage continuous improvement and innovation in the field.	(E)	(M)	Field reports, group discussions

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**Farm Engineering.**		**10**
	1	Principles of Aquaculture Engineering:	2
	2	Criteria for the selection of site for aquaculture – freshwater, brackishwater and marine aquaculture	2
	3	Surveying –Chain survey, plane table survey, leveling	3
	4	Calculation of earthwork for the construction of ponds. Types of soil, soil sampling methods, prevention of erosion	3
II	**Farm Design and Equipment**		**10**
	5	Design of freshwater and brackish water farms. Project formulation and layout.. Various farm equipment..	3
	6	Different components of aquafarms – peripheral dikes, secondary dikes, feeder canals, sluice gate and monks	3
	7	Role of aeration in culture ponds. Paddle wheel aerators aspirators, compressors and blowers	2
	8	Pumps in aquaculture, different type of pumps	2
III	**Aquaculture Production Systems**		**20**
	9	Recirculating Aquaculture Systems (RAS): Design and operation of RAS.	3
	10	Water Treatment Technologies: Filtration, aeration, and disinfection methods.	2
	11	Cage Culture Engineering: Design and management of cage culture systems	2
	12	Pond Culture Engineering: Construction and management of pond systems	2
	13	Raceway Systems: Design, flow control, and management.	2
	14	Broodstock Management Technologies	2
	15	Components of shrimp hatcheries – various components and infrastructure facilities required.	2

Programme	B. Sc. Aquaculture Honours					
Course Title	Biostatistics and Bioinformatics					
Type of Course	**Major** core					
Semester	VI					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	5	-	2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	This course provides a comprehensive foundation in bioinformatics and biostatistics tailored for aquaculture, covering essential statistical concepts, bioinformatics tools, and their application in aquaculture research. Through hands-on practical exercises, students will learn to analyze genetic data, understand disease mechanisms, and apply sustainable practices to enhance aquaculture productivity and sustainability.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Undrstand fundamental statistical concepts including methods of data collection, sampling methods, and measures of central tendency such as arithmetic mean, median, and mode.	Understand (U)	Conceptual (C)	Quizzes, Written Exams
CO2	Apply descriptive statistical techniques to analyze aquaculture data, including the calculation of range, mean deviation, standard deviation, and understanding their application in aquaculture research.	Apply (Ap)	Procedural (P)	Practical Assignments, Lab Reports
CO3	Analyze aquaculture datasets for skewness, kurtosis, and perform regression and correlation analysis to determine	Analyze (An)	Procedural (P)	Case Studies, Analysis Reports

	relationships between variables.			
CO4	Understand the role of bioinformatics in aquaculture, familiarize with primary bioinformatics databases, and use tools for sequence alignment and phylogenetic analysis.	Understand (U)	Conceptual (C)	Quizzes, Database Navigation Exercises
CO5	Apply bioinformatics tools and techniques for genetic diversity studies, disease-associated gene identification, and analysis of quantitative traits in aquaculture species.	Apply (Ap)	Procedural (P)	Project Work, Practical Sessions
CO6	Apply practical skills in using bioinformatics and statistical software for data analysis and visualization, including sequence alignment, protein structure visualization, and statistical analysis of aquaculture data.	Apply (Ap)	Procedural (P)	Lab Exercises, Software Tool Usage Reports
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Basic Statistics**		**10**
	1	Methods of data collection and Sampling methods	2
	2	Tbulation and diagrammatic representation of data	3
	3	Arithmetic mean, median, mode	3
	4	Geometric mean and harmonic mean.	2
II	**Statistical Analysis**		**10**
	5	Range, mean deviation, - calculation and its application.	3
	6	Standard deviation and coefficient of deviation	2
	7	Skewness and kurtosis.	2
	8	Regression and Correlation	3
III	**Introduction to Bioinformatics**		**15**
	9	Overview of bioinformatics and its significance in aquaculture.	2
	10	Basic concepts of molecular biology and genetics.	2
	11	Introduction to primary databases (GenBank, EMBL, DDBJ).	2
	12	Overview of protein and genome databases.	2
	13	Principles of sequence alignment.	1
	14	Tools for sequence alignment (BLAST, ClustalW).	1

Programme	B. Sc. Aquaculture Honours					
Course Title	Fishery Microbiology and Quality control					
Type of Course	**Major** Core					
Semester	VI					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	This course offers an in-depth exploration of microbiology with a focus on aquatic environments and aquaculture systems, integrating historical perspectives, microbial structure and function, and practical applications in seafood safety and microbial management. Through a combination of theoretical knowledge and practical skills, students will learn to isolate, characterize, and manage microorganisms critical to aquatic health, food safety, and quality control.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Evaluate the historical contributions of Louis Pasteur, Koch, and Winogradsky to microbiology and understand the characteristics of various microorganisms.	E & U	C & F	Written exams, oral presentations
CO2	Apply microscopy techniques to study the ultrastructure of prokaryotic and eukaryotic cells, including virus classification and life cycles.	Ap	P	Lab reports, practical exams
CO3	Analyze the microflora of aquatic environments using isolation and cultivation techniques to understand bacterial and fungal growth.	An	C & P	Case studies, research projects
CO4	Create strategies for microbial management in aquaculture ponds and understand biogeochemical cycles.	C	P & C	Project design, strategy proposals
CO5	Develop and implement quality control protocols for seafood safety,	Ap & C	P & C	Simulations, role-play exercises,

	including spoilage prevention and HACCP principles.			practical demonstrations
CO6	Conduct practical techniques for microbial isolation, enumeration, and characterization, and assess seafood quality.	Ap	P	Lab practicals, sensory evaluation exercises
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Foundations of Microbiology and Microbial Structure**		**10**
	1	History and Development of Microbiology: Contributions of Louis Pasteur, Koch, and Winogradsky	2
	2	General characteristics of bacteria, fungi, viruses, algae, and protozoans.	3
	3	Microbial Structure Biology: Principles and applications of various microscopy techniques	3
	4	Ultrastructure and function of prokaryotic and eukaryotic cells, including bacteria, fungi, yeast, and viruses. Classification of viruses, and the life cycle of bacteriophages	2
II	**Aquatic and Aquaculture Microbiology**		**10**
	5	Aquatic Microbiology: Microflora of aquatic environments, isolation, and cultivation techniques.	3
	6	Nutrition and growth of bacteria and fungi, prokaryotic growth characteristics, and the impact of environmental factors.	3
	7	Aquaculture Microbiology: Microbial dynamics in culture ponds, nutrient regeneration,	2
	8	Biogeochemical cycles and the significance of autotrophic and heterotrophic microorganisms.	2
III	**Sea food safety and Quality control**		**15**
	9	Perishability of seafood, spoilage microflora of fish and shellfish,	2
	10	Intrinsic and extrinsic factors affecting spoilage	1
	11	Health risks associated with filter feeding bivalve shellfish and their depuration	1
	12	Different types of spoilage in fishery products – chemical, physical and biological spoilage	2
	13	Quality control – basic concepts, Salient features of sea food quality.	2
	14	Risk factors in sea food- biotoxins, physical, chemical and biological hazards.	2
	15	HACCP, SSOP, GMP.	2
	16	Methods of evaluating fish freshness and quality – organoleptic, sensory, physical, chemical, microbiological and instrumental methods	2
	17	Sampling systems followed in processing plants for testing the quality	1
IV	**Isolation and Characterization of Aquatic Microorganisms**		**10**
	18	Isolation enumeration of bacteria from water, sediment and fish	2
	19	Isolation and cultural characteristics of *Vibrio sp*	2

Programme	B. Sc. Aquaculture Honours					
Course Title	Aquatic Animal Health and Disease Management					
Type of Course	**Major** Elective					
Semester	VI					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	4			60	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	This course focuses on advanced aquaculture techniques, covering the comprehensive spectrum from breeding, nutrition, and health management to molecular diagnostics for aquatic animal health. It aims to equip students with in-depth knowledge of aquatic ecosystems, innovative aquaculture practices, sustainable and ethical management, along with business and quality control skills essential for the global seafood trade.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Evaluate the types and causes of various aquatic diseases, including protozoan, bacterial, and viral diseases, in fish and shrimp.	E	C & F	Written exams, oral presentations, critical review essays.
CO2	Understand the relationship between disease and environment in aquaculture, and apply this knowledge to mitigate environmental factors contributing to disease outbreaks.	U & Ap	C	Group discussions, written assignments, environmental analysis reports.
CO3	Apply diagnostic tools and techniques, such as microscopy, immune detection, and DNA/RNA techniques, for effective	Ap & An	P & C	Lab practicals, diagnostic test result analysis, presentation of

	disease identification in aquaculture.			findings.
CO4	Analyze the nutritional needs of aquatic organisms to prevent nutritional deficiencies and related diseases through effective management strategies.	An & E	C & P	Nutritional plan development, case study critiques, oral defenses.
CO5	Create vaccination and disease management strategies for aquatic organisms, incorporating the latest developments in vaccines and chemotherapeutics.	C & E	P & C	Project proposals, strategy design documents, peer-reviewed presentations.
CO6	Develop and implement sustainable aquaculture practices, including pond management and disease prevention, to enhance the health and productivity of aquatic organisms.	Ap & C	P & C	Project implementation reports, sustainability assessments, practical demonstrations.

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

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**Introduction to Aquatic Diseases and Protozoan Diseases**		**10**
	1	Overview of fish diseases including pathology and parasitology..	2
	2	Definitions and categories of diseases, the relationship between disease and environment	2
	3	Detailed study of protozoan diseases affecting finfish, such as Ichthyophthiriasis, Costiasis, whirling diseases, and trypanosomiasis.	3
	4	Examination of shrimp protozoan diseases including Microsporidiosis, Gregaria disease, and ecto-commensal protozoan	3
II	**Fungal Diseases and Nutritional Pathology**		**10**
	5	Detailed coverage of fungal disease Saprolegniosis and Brachiomycosis,	3
	6	Fungal diseases such as Ichthyophorus diseases, Lagenidium diseases, and Fusarium diseas	2

Programme	B. Sc. Aquaculture Honours					
Course Title	Sustainable Aquaculture Practices					
Type of Course	**Major** Elective					
Semester	VI					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	4			60	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	This course delves into the complexities of aquatic ecosystems, highlighting sustainability, the challenges posed by climate change, and the economic and biological constraints on aquatic resource management. Through a blend of theoretical knowledge and practical application, it equips students with the skills to innovate in aquaculture, implement sustainable practices, and navigate the intricacies of green technologies in the field					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the role and impacts of aquatic ecosystems on food, nutrition, and livelihood systems.	U	C	Written exams, discussions
CO2	Analyze the ecological impacts of exotic species introduction, salinization, and mangrove deforestation.	An	C & F	Case studies, research papers
CO3	Evaluate the economic and environmental challenges in aquatic resource management including water and land use conflicts.	E	C	Essays, presentations
CO4	Apply principles of sustainable aquaculture development and understand biological constraints in aquaculture.	Ap	P & C	Project proposals, lab practicals

CO5	Create strategies for implementing advanced sustainable aquaculture practices and renewable energy applications.	C	P & C	Design projects, strategy development exercises
CO6	Analyze green technologies in aquaculture for water recycling, energy efficiency, and smart aquaculture technologies.	An	P & C	Analytical reports, technology assessment presentations

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

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**"Aquatic Ecosystems: Sustainability, Threats, and Climate Change Impacts"**		**10**
	1	Role of aquatic resources in food and nutrition; Aquatic resource and livelihood systems.	2
	2	Exotic species introduction, escapement, contamination of indigenous gene pool,	2
	3	Salinization of soil and water, over exploitation of wild stocks, mangrove deforestation	3
	4	Impact of climate change	3
II	**Economic Challenges in Aquatic Resource Management**		**10**
	5	Water and Land Use Conflicts	3
	6	Aquaculture vs. Traditional Fishing: Navigating Interests	2
	7	Community Resistance to Aquatic Resource Projects	3
	8	International Trade and Environmental Policies	2
III	**Biological Constraints and Sustainable Practices in Aquaculture**		**20**
	9	Availability of Juveniles in Aquaculture	3
	10	Nutritional Requirements in Aquaculture	2
	11	Disease Management and Pathogen Control	2
	12	Principles of Sustainable Aquaculture Development	2
	13	Open vs. Closed Aquaculture Systems	2
	14	Water System Design Principles	2
	15	Coastal Aquaculture Guidelines	2
	16	FAO Code of Conduct for Responsible Fisheries	2
	17	Guidelines for Sustainable Aquaculture	3
IV	**Strategies for Sustainable Aquaculture**		**8**
	18	Foundations of Sustainability in Aquaculture	2
	19	Advanced Sustainable Aquaculture Practices- Rotational Aquaculture and	2

Programme	B. Sc. Aquaculture Honours					
Course Title	Aquatic Ecology and Conservation in Aquaculture					
Type of Course	**Major** Elective					
Semester	VI					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	4			60	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed Previous semesters					
Course Summary	The course offers an in-depth exploration of aquatic ecosystems, focusing on biodiversity, ecological dynamics, conservation practices, and the application of modern technologies in fisheries management. It aims to equip students with the knowledge and skills necessary to address contemporary challenges in marine and freshwater environments, emphasizing sustainable practices and the protection of aquatic biodiversity.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the components, structure, and functions of aquatic ecosystems.	U	C	Written exams, quizzes
CO2	Analyze ecological concepts such as succession, homeostasis, natality, and mortality within ecosystems.	An	C	Case studies, project reports
CO3	Apply concepts of habitat, ecological niche, and carrying capacity to real-world scenarios.	Ap	C	Practical exams, fieldwork reports
CO4	Evaluate biodiversity and the impact of human activities on marine and freshwater environments.	E	C	Seminar presentations, research projects
CO5	Create strategies for the conservation of aquatic biodiversity and fisheries management.	C	P	Group projects, policy drafting exercises

CO6	Utilize modern computer tools for ecosystem modeling and understand the ecosystem approach to fisheries management.	Ap	P	Lab practicals, softwar

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**"Foundations of Aquatic Ecosystems**		**10**
	1	Aquatic ecosystem– components, structure and functions..	2
	2	Ecological concepts – succession, homeostasis, natality and mortality	3
	3	Concepts of habitat and ecological niche; carrying capacity	3
	4	Ecological classification of marine and freshwater	2
II	**Conservation and Biodiversity**		**10**
	5	Biodiversity and diversity indices.	3
	6	IUCN categorization and endangered fishes.	3
	7	Conservation of freshwater resources and fish	2
	8	Ecological importance of mangrove vegetation	2
III	**Marine Environments and Conservation Strategies**		**20**
	9	The division of the marine environment – benthic, pelagic, bathyal, littoral capacity.	3
	10	Ocean waters as a biological environment	2
	11	Distribution and population of plants and animals.	2
	12	Littoral Zones: Fauna of intertidal zones, their distribution and adaptations	2
	13	Effects of pollution on marine life	2
	14	Impact of climate change/global warming in marine fisheries.	2
	15	Management of reserves- in situ and ex situ conservation	2
	16	Aquatic Protected Areas. Marine sanctuaries	2
	17	Modern computer tools in ecosystem modeling and trophic interactions. ECOPATH and ECOSIM	3
IV	**Advanced Fisheries Management:**		**8**
	18	Ecosystem approach to Fisheries management	2
	19	Use of technology in fisheries conservation using TED,BRD etc.	2
	20	Use of selective fishing gears, mesh size regulations, capture of juveniles	2
	21	Deep sea fishing policy of India.	1
	22	KMFR Act	1
V	**Open Ended Module Regulatory Measures and International Agreements"**		**12**
	1	International fishery regulations, treaties and instruments.	
	2	Input control measures such as access control, size, type, number and power of boats, duration of fishing	
	3	Output control measures such as Total Allowable Catch. Catch Quotas, Licensing	

Programme	B. Sc. Aquaculture Honours					
Course Title	Aquaculture farm Management					
Type of Course	**Major Elective**					
Semester	VI					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	4			60	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The Aquaculture farm Management course is designed to equip students with comprehensive knowledge and practical skills necessary for the successful operation and management of aquaculture facilities. It covers a wide range of topics, from water quality and feed management to sustainable practices and business planning, preparing students for a career in the evolving aquaculture industry.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the scope and significance of the aquaculture industry and its various farming types.	U	C	Written exams, quizzes
CO2	Apply knowledge of water quality management and filtration systems in aquafarming.	Ap	P	Practical exams, lab reports
CO3	Evaluate and implement effective feed types and disease management strategies for optimal productivity.	E	P	Case studies, project reports
CO4	Analyze and utilize advanced aquaculture equipment and technology for farm efficiency.	An	P	Presentations, lab practicals
CO5	Create sustainable aquafarming practices,	C	C	Research projects, seminar presentations

	understanding environmental impacts and adhering to regulations.			
CO6	Develop a comprehensive business model for aquaculture ventures, including market analysis and financial planning.	C	P	Group projects, business plan submissio
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Aquaculture Fundamentals: Industry Overview and Water Management Techniques**		**10**
	1	Overview of aquaculture industry	2
	2	Types of aquafarms: freshwater, marine, and brackish water	3
	3	Parameters of water quality	3
	4	Systems for water filtration and circulation	2
II	**Optimizing Aquafarm Productivity: Nutrition, Health, and Technological Innovations**		**10**
	5	Feed types and feeding strategies	3
	6	Disease prevention and management	3
	7	Advances in aquaculture equipment	2
	8	Role of technology in modern aquafarms	2
III	**Comprehensive Aquaculture Management: From Hatchery to Harvest and Beyond**		**20**
	9	Principles of hatchery design and operation	3
	10	Broodstock management and spawning techniques	2
	11	Larval rearing conditions and methodologies	2
	12	Best practices for sustainable aquaculture	2
	13	Mitigating environmental impacts	2
	14	National and international regulations	2
	15	Certification and standards for sustainable aquaculture	2
	16	Business plan development	2
	17	Market analysis and marketing strategies	3
IV	**Advanced Aquaculture Systems**		**8**
	18	Concepts and benefits of IMTA systems	2
	19	Designing IMTA systems for sustainability and productivity	2
	20	Case studies of successful IMTA implementations	2
	21	Latest innovations in aquaculture technology	1
	22	The role of automation and remote monitoring in improving aquafarm efficiency	1
V	**Open ended Module Entrepreneurship and Business Management in Aquaculture**		**12**

Programme	B. Sc. Aquaculture Honours					
Course Title	Capture Fisheries					
Type of Course	**Major** core					
Semester	VII					
Academic Level	400-499					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	4			60	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course covers the economics, diversity, and management of capture fisheries, emphasizing the significance of marine fisheries in India, global fish production trends, and the conservation of pelagic and demersal species, alongside the management of India's crustacean and molluscan fisheries					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Gain a foundational understanding of the marine fisheries sector and its significance in the Indian economy and food security.	U	C	Written exams, quizzes
CO2	Analyze global and Indian inland and estuarine fisheries resources, including trends, production, and issues in fisheries development.	An	C	Project reports, case studies
CO3	Understand the impact of climate change on marine fisheries and adapt fisheries management practices accordingly.	Ap	C	Presentations, research projects
CO4	Identify the major fishing zones of the world and India, with a focus on pelagic and	U	C	Quizzes, written exams

	demersal fish species and their conservation.			
CO5	Evaluate the regulatory frameworks governing marine fisheries in India, including policies and acts, for sustainable fisheries management.	E	P	Seminar presentations, case studies
CO6	Apply knowledge of crustacean and molluscan fisheries management, emphasizing sustainable practices and conservation.	Ap	P	Practical exams, lab reports
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Introduction to Capture fisheries**		**10**
	1	Marine fisheries sector, its significance in the Indian economy, and its role in food security	2
	2	Major inland waters of the world and India, their fish fauna; global inland fish production trends; major inland fish producing countries and ecosystems.	3
	3	Estuarine fisheries resources of India, Fisheries of major estuarine systems in India and Kerala. Fishing methods, recent statistics of catches, problems encountered in fisheries development of major estuaries	3
	4	Examination of the regulatory framework governing marine fisheries in India, including the Marine Fishing Regulation Acts (MFRA) of various states.	2
II	**Contemporary Issues and Trends in Global Marine Fisheries**		**10**
	5	Global marine fish production trends	3
	6	FAO status, Deep sea fishing policy of India	3
	7	Impact of climate change	2
	8	Major fishing zones of world and India	2
III	**Pelagic Fisheries: Diversity, Production, and Conservation**		**20**
	9	Introduction to pelagic fishery resources,	3
	10	White baits, Anchovies,	2
	11	Shads and other clupeids,	2
	12	Tuna, Seer fish	2
	13	Carangids, Ribbonfish,	2
	14	Barracudas, Bombay ducks	2
	15	Pomfrets, and mullet	2

Programme	B. Sc. Aquaculture Honours					
Course Title	Instrumentation					
Type of Course	**Major** core					
Semester	VII					
Academic Level	400-499					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	This course on Instrumentation delves into the comprehensive understanding and application of modern instrumentation, including spectrophotometry, chromatography, electrophoresis, and microscopy, tailored to the needs of the aquaculture industry. It emphasizes hands-on experience with instrument calibration, data analysis, and the integration of various analytical methods for enhancing productivity, sustainability, and innovation in seafood production and aquafarm management					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Gain comprehensive understanding of advanced analytical techniques and their applications in aquafarm management.	U	C	Written exams, quizzes
CO2	Apply instrument calibration, validation principles, and ensure laboratory safety and maintenance.	Ap	P	Practical exams, lab reports
CO3	Master quantitative analysis techniques through spectrophotometry, including operation and analysis.	Ap	P	Lab practicals, project reports
CO4	Analyze and interpret data from chromatography and electrophoresis for substance identification and quantification.	An	P	Practical exams, research projects
CO5	Utilize advanced microscopy techniques for detailed examination and analysis of aquaculture samples.	Ap	P	Lab practicals, presentations
CO6	Conduct field visits to reputed laboratories to observe real-world applications of analytical techniques in aquaculture.	Ap	F	Field reports, group projects

Programme	B. Sc. Aquaculture Honours					
Course Title	Live feed Culture					
Type of Course	**Major** core					
Semester	VII					
Academic Level	400-499					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	This course on live feed in aquaculture dives deep into the science and techniques behind the cultivation, enrichment, and preservation of live feeds essential for aquaculture operations. Covering topics from natural food sources to advanced culture systems, students will learn to optimize nutrition and enhance the sustainability and productivity of aquaculture practices.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the importance of natural food and its enrichment and preservation in aquaculture.	U	C	Written exams, quizzes
CO2	Apply techniques for the enrichment and preservation of live feeds, including Artemia and microalgae.	Ap	P	Lab reports, practical exams
CO3	Analyze the nutritional quality of commonly used fish food organisms and the role of periphyton in aquaculture.	An	C	Case studies, project reports
CO4	Master the production and use of Artemia, including cyst hatching, morphology, and nutritional quality.	Ap	P	Practical exams, lab practicals
CO5	Cultivate microalgae and zooplankton, understanding culture conditions, harvesting techniques, and nutritional value.	Ap	P	Hands-on workshops, presentations
CO6	Evaluate the efficiency of live feed production systems and develop strategies for optimizing aquaculture	E	C	Research projects, group projects

Programme	B. Sc. Aquaculture Honours					
Course Title	Fisheries Economics and Extension					
Type of Course	**Major** core					
Semester	VII					
Academic Level	400-499					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	4			60	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	___	The Fisheries Economics and Extension "course offers a deep dive into the economic principles and financial analyses crucial to the sustainable management and development of fisheries and aquaculture sectors. Through exploring topics such as market dynamics, international trade, and the socio-economic aspects of fisheries extension and cooperative development, students will gain the skills and knowledge necessary to address the complex challenges facing today's marine resource management.				

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the fundamental concepts of economics including demand, supply, and market structures within the fisheries and aquaculture sectors.	U	C	Written exams, quizzes
CO2	Apply economic principles to analyze fisheries management issues, focusing on elasticity of demand and the law of diminishing marginal utility.	Ap	C	Case studies, practical exams
CO3	Evaluate financial strategies and perform economic analyses in fisheries and aquaculture, including break-even analysis and	E	P	Project reports, presentations

	cost concepts.			
CO4	Develop comprehensive farm planning and budgeting strategies, and assess the feasibility and risks associated with fisheries projects.	C	P	Lab reports, group projects
CO5	Demonstrate an understanding of the role and impact of subsidies, international trade, and market dynamics on the fisheries sector.	An	C	Seminar presentations, written exams
CO6	Implement and evaluate fisheries extension programs, understanding the importance of cooperative development and institutional support in enhancing the socio-economic conditions of fishermen.	Ap	P	
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Introduction to Economics**		**10**
	1	Economics-definition, scope, Individual demand,	2
	2	Basic concept of economics -goods, services, wants, utility	3
	3	Demand and Supply	3
	4	Market demand, Value based Pricing and Cost Based pricing.	2
II	**Economic Principles in Fisheries Management**		**10**
	5	Elasticity of demand, Law of diminishing marginal utility..	3
	6	Supply and demand in fish markets	3
	7	Price determination and market structures	2
	8	International trade in fisheries	2
III	**Financial and Economic Analysis in Fisheries and Aquaculture**		**20**
	9	Break Even Analysis in fisheries	3
	10	Cost Concepts- Variable Cost, Fixed Cost, Total Cost,	2

Programme	B. Sc. Aquaculture Honours					
Course Title	Seed Production and Hatchery Management					
Type of Course	**Major** core					
Semester	VII					
Academic Level	400-499					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	4			60	2hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The Seed Production and Hatchery Management course provides an in-depth exploration of the science and techniques behind successful hatchery management and seed production for a range of aquatic species, including fish and crustaceans. It covers induced breeding, hatchery layout design, live feed culture, and the application of modern technologies in aquaculture to ensure the sustainable growth and health of broodstock and larvae.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Master the principles of induced breeding, hatchery, nursery, and pond management for various fish and crustaceans.	Ap	P	Practical exams, project reports
CO2	Understand the reproductive biology and lifecycle of crustaceans, applying hatchery production techniques effectively.	U	C	Written exams, lab reports
CO3	Develop competencies in marine seed production, including techniques for crabs, lobsters, molluscs, and various marine fishes.	Ap	P	Case studies, practical exams
CO4	Implement live feed culture techniques and understand the role of artificial diets in larviculture.	Ap	P	Lab practicals, seminar presentations
CO5	Evaluate and apply strategies for monitoring and maintaining optimal water quality in hatchery environments.	An	C	Research projects, presentations
CO6	Analyze breeding strategies to ensure	An	P	Group projects, field trip reports

	healthy and genetically diverse seed stock, incorporating field insights from hatchery visits.			

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**Hatchery, and Seed Production Technologies**		**10**
	1	Induced breeding in fishes Management of hatchery, nursery and rearing ponds.	2
	2	Seed production technology of carps, tilapia and catfish.	3
	3	Management of hatchery, nursery and rearing ponds	2
	4	Hatchery layout and designing. Recirculating hatchery systems	3
II	**Crustacean Reproduction and Hatchery Techniques**		**10**
	5	Reproductive biology and life cycle in crustaceans.	3
	6	Induced breeding in prawns and shrimps	3
	7	Hatchery production techniques of shrimp.	2
	8	Hatchery production techniques of *Macrobrachium rosenbergii*.	2
III	**Marine Seed Production: Techniques and Technologies**		**20**
	9	Natural breeding and seed resources of cultivable crabs, lobsters and molluscs.	3
	10	Seed production technique of mud crab	2
	11	Hatchery technology for lobsters	2
	12	Methods for spat collection	2
	13	Induced maturation, spawning and hatchery rearing of mussels, edible oysters and pearl oysters	2
	14	Marine and brakishwater fish seed production in India..	2
	15	Marine fish hatchery-general considerations	2
	16	Seed production techniques of Sea Bass.	2
	17	Seed production techniques Cobia and Groupers	3
IV	**Live Feeds and Artificial Diets**		**8**
	18	Live feed culture techniques..	2
	19	Mass production of algae for hatcheries.	2
	20	Artemia production techniques	2
	21	Culture of zooplanktons for larviculture	1
	22	Artificial feeds in larviculture	1
V	**Open ended module Water Quality, Breeding Strategies, and Field Insights**		**12**
	1	Techniques for monitoring and maintaining optimal water parameters to support the growth and health of broodstock and larvae.	
	2	Selection, conditioning, and breeding strategies to ensure healthy and genetically diverse seed stock	
	3	Visit to Hatcheries	

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed

Programme	B. Sc. Aquaculture Honours					
Course Title	Sea weed Cultivation and Utilization					
Type of Course	**Major** core					
Semester	VIII					
Academic Level	400-499					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3		2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The "Seaweed Cultivation and Utilization" course covers the fundamentals of seaweed farming and its diverse applications, emphasizing sustainable practices and commercial viability..					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Master the fundamentals of seaweed biology, ecology, and the roles seaweeds play in marine ecosystems.	U	C	Written exams, quizzes
CO2	Acquire practical skills in seaweed cultivation, from site selection to harvesting, and address common cultivation challenges.	Ap	P	Practical exams, lab reports
CO3	Evaluate the use of seaweeds in various industries such as food, agriculture, cosmetics, and biofuels.	An	C	Case studies, project reports
CO4	Understand the regulatory frameworks, certification standards, and sustainability practices within the seaweed industry.	U	F	Quizzes, written exams
CO5	Apply innovative technologies and strategies for seaweed biorefinery, genetic engineering, and climate change mitigation.	Ap	P	Research projects, seminar presentations
CO6	Analyze the economic viability, market trends, and ethical	An	C	Group projects, presentations

	considerations in seaweed aquaculture to develop sustainable business models.			

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**Introduction to Seaweed Biology and Ecology**		**10**
	1	Fundamentals of Seaweed Biology Overview of seaweed classification, morphology, and life cycles.	2
	2	Ecological Roles of Seaweeds Seaweeds in marine ecosystems: biodiversity, habitat provision, and carbon sequestration.	3
	3	Seaweed Distribution and Habitat Global and local distribution patterns, habitat preferences, and environmental factors affecting growth	3
	4	Seaweed Biodiversity and Conservation Threats to seaweed habitats, conservation strategies, and sustainable management practices	2
II	**Seaweed Cultivation Techniques**		**10**
	5	Basics of Seaweed Farming Site selection, farm setup, and species selection for cultivation.	3
	6	Cultivation Methods Onshore, offshore, and integrated multitrophic aquaculture (IMTA) systems	3
	7	Harvesting Techniques Methods for sustainable harvesting, post-harvest handling, and processing	2
	8	Challenges and Solutions in Seaweed Cultivation Addressing common challenges such as disease, pests, and environmental impacts	2
III	**Seaweed for Industrial and Commercial Use**		**15**
	9	Food and Nutraceuticals Utilization of seaweeds in food industries and health supplements.	2
	10	Bioactive Compounds from Seaweeds Extraction and applications of bioactive compounds in pharmaceuticals	2
	11	Seaweeds in Agriculture Seaweed-based fertilizers and soil conditioners	2
	12	Cosmetics and Personal Care Products Application of seaweed extracts in cosmetics.	1
	13	Biofuels and Bioplastics Production of biofuels and bioplastics from seaweed biomass	1
	14	Integrated Uses of Seaweeds Waste treatment, carbon sequestration, and habitat restoration projects	1
	15	Seaweeds in Animal Feed Inclusion of seaweeds in aquaculture and livestock feed	2
	16	Innovative Products and Emerging Technologies	2

Programme		B. Sc. Aquaculture Honours				
Course Title		Deep Sea fisheries				
Type of Course		**Major** core				
Semester		VIII				
Academic Level		400-499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	4			60	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course explores deep-sea fisheries, addressing their biodiversity, challenges, and environmental impacts, and highlights sustainability practices, technological advancements, and management strategies, with a special focus on India's deep-sea fishing sector					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the significance, biodiversity, and challenges of deep-sea fisheries.	U	C	Written exams, quizzes
CO2	Analyze the environmental impacts of deep-sea overfishing and the necessity for global management strategies.	An	C	Project reports, case studies
CO3	Apply knowledge of advanced technologies and methods for sustainable deep-sea fishing.	Ap	P	Lab practicals, presentations
CO4	Evaluate conservation strategies for protecting deep-sea biodiversity and implementing responsible fishing practices.	E	C	Research projects, group discussions
CO5	Create innovative solutions to address challenges and opportunities in deep-sea fisheries.	C	P	Seminar presentations, project reports
CO6	Understand and assess India's deep-sea fishing policies and management strategies.	U	F	Case studies, written exams
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)				

Programme		B. Sc. Aquaculture Honours				
Course Title		Fish Population Dynamics				
Type of Course		**Major** Core				
Semester		VIII				
Academic Level		400-499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	4			60	2 Hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course on "Fish Population Dynamics" provides an in-depth exploration of the mechanisms that drive changes in fish populations, including growth, mortality, and recruitment strategies, alongside the application of mathematical models and software for fish stock assessment. It equips students with the analytical tools and ecological understanding necessary to assess, manage, and conserve fishery resources, addressing challenges like overfishing, habitat loss, and climate change impacts on aquatic ecosystems					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the basic concepts of stock, recruitment, growth rate, and mortality rate in fisheries.	U	C	Written exams, quizzes
CO2	Analyze the importance and application of Maximum Sustainable Yield (MSY) and its challenges in fisheries management.	An	C	Case studies, project reports
CO3	Apply principles of fish population dynamics to assess growth, mortality, and recruitment strategies using analytical and prediction models.	Ap	P	Practical exams, lab reports
CO4	Evaluate the effects of ecological factors like climate change and habitat usage on fish population dynamics.	E	C	Research projects, presentations
CO5	Utilize software applications and tools, including R program, for fisheries assessment and management.	Ap	P	Lab practicals, software simulations
CO6	Create sustainable fisheries management	C	P	Group projects, seminar presentations

	strategies considering technological, enhancement, and socio-economic aspects.			

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**Stock Assessment and Management Principles"**		**10**
	1	Basic concepts: stock, recruitment, growth rate, and mortality rate...	2
	2	Importance of Stratified Random Sampling in Fisheries	3
	3	Maximum Sustainable Yield (MSY)- Definition and calculation of MSY	2
	4	Challenges and limitations in applying MSY to fisheries management	3
II	**Fish Population Dynamics: Growth, Mortality, and Recruitment Strategies"**		**10**
	5	Growth parameters - Length of infinity, Growth coefficient, VBGF equation, , Mortality parameters; Types of mortality; Estimation of total, natural and fishing mortality rates, Exploitation ratio, Exploitation rate.	3
	6	Principles of growth - Growth parameter estimation Gulland and Holt Plot, Ford – Walford plot & Chapman's method	3
	7	Mortality parameters; Types of mortality; Estimation of total, natural and fishing mortality rates, Exploitation ratio, Exploitation rate	2
	8	Recruitment and gear selectivity: Timing and size of recruitment. Factors influencing recruitment; Principle and estimation of gear selectivity trawl net and gill net selectivity	2
III	**"Fisheries Assessment: Models, Methods, and Software Applications"**		**20**
	9	Analytical models - Cohort dynamics and life history,	3
	10	Virtual population analysis	2
	11	Prediction models (Thompson and Bell model	2
	12	Yield per recruit model and Relative Yield per Recruit model)	2
	13	Surplus production models	2
	14	Holistic models: Schaefer's model, Fox model. Swept area method	2
	15	Software's - Software for fish stock assessment	2
	16	Computer based software's, FISAT, Monte Carlo simulations.	2
	17	R program: basics- Application of R program in fisheries	3
IV	**Ecological Foundations of Fish Population Dynamics"**		**8**
	18	Impact of life history strategies on population dynamics and fisheries management.	2
	19	Reproductive Biology and Its Impact on Population Dynamics	2
	20	Effects of Climate Change on Fish Populations	2
	21	Habitat Usage and Migration Patterns on Fish Populations	1
	22	Predator-Prey Interactions in Aquatic Ecosystems	1
V	**Open ended module Sustainable Fisheries: Technology, Enhancement, and Socio-economic Strategies**		**12**
	1	Fishing Technology and Bycatch Issues	
	2	Stock Enhancement and Rebuilding Strategies	
	3	Social and Economic Aspects of Fisheries Management	

Programme	B. Sc. Aquaculture Honours					
Course Title	Research Methodology					
Type of Course	**Major**					
Semester	VIII					
Academic Level	400-499					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	4			60	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology. Should have completed previous semesters					
Course Summary	The course on research methodology delves into the essentials of designing and executing scientific research in the aquaculture field, covering everything from formulating hypotheses to ethical considerations and statistical analysis. It aims to equip students with the skills needed to critically assess research problems, develop robust study designs, and effectively communicate their findings, preparing them for advanced research and professional practice in aquaculture management.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the distinctions between pure, applied, and action research, including research ethics.	U	C	Written exams, quizzes
CO2	Identify and select research problems, conduct a literature review, and develop a research hypothesis.	Ap	P	Project reports, literature reviews
CO3	Design a research study applying appropriate research designs and statistical analysis techniques.	Ap	P	Lab reports, data analysis assignments
CO4	Master the preparation of research proposals and understand the process of submission to funding agencies.	Ap	P	Seminar presentations, project proposals
CO5	Acquire skills in academic writing, including structuring research papers, thesis, and understanding citation styles.	Ap	C	Research papers, thesis writing

CO6	Utilize digital libraries and internet resources effectively for literature collection and research.	Ap	P	Practical exams, online research tasks

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**Foundations of Research:**		**10**
	1	Types of Research: Pure, Applied and Action Research. Research Ethics	2
	2	Kinds of Research: Diagnostic, Descriptive, Exploratory, Explanatory.	3
	3	Research Ethics, Animal ethics; Human ethics.	3
	4	Biosafety in research	2
II	**Formulating and Proposing Research:**		**10**
	5	Identification and selection of research problems,	3
	6	Literature search and Review of Literature.	3
	7	Formulation of Hypothesis. Hypothesis Testing and estimation	2
	8	Preparation of research proposal and submission of research project proposals to funding agencies	2
III	**Research Design and Statistical Analysis in Scientific Research"**		**20**
	9	Need for research design.	3
	10	Features of good Research designs	2
	11	Types of research design Descriptive design, case control, cohort, cross sectional, longitudinal	2
	12	Basic principles of experimental design	2
	13	CRD and Quasi-Experimental designs	2
	14	Collection of Data: Primary Data, Secondary data, Data Collection methods	2
	15	Sampling Technique	2
	16	Data Analysis, , tabulations, classifications, Interpretations	2
	17	Statistics in Research:	3
IV	**Academic Writing and Research Methodology**		**8**
	18	Research paper, reviews, synopsis,	2
	19	Structure of Thesis	2
	20	Components of a research articles, role of author, guide, co-authors.	2
	21	Conference papers and project reports	1
	22	Citation styles: Footnotes, abbreviations	1
V	**Open ended Module Literature Collection**		**12**
	1	Collection of literature- News articles – Newsletters – Magazines – Books - Journals virtual sources – other sources. Short communications –review articles	
	2	Digital library and search of articles - Keywords and search - Internet – Google Scholar, PubMed ,Inflibnet ,Medline, Agricola ,Science direct	
	3	Open access Journals -	

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the

Programme	B. Sc. Aquaculture Honours					
Course Title	Endocrinology of Fish					
Type of Course	**Major** Elective					
Semester	VIII					
Academic Level	400-499					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	4			60	2 hours
Pre-requisites	A pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	This course provides a comprehensive overview of fish endocrinology, focusing on hormonal systems and their roles in regulating physiological processes crucial for aquaculture. Students will gain insights into hormonal functions, adaptations, and manipulations for aquaculture practices.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand and describe the basic and complex hormonal systems in fish, their chemical structures, and physiological functions.	Understand (U)	Conceptual Knowledge (C)	Written exams, Quizzes
CO2	Apply knowledge of hormonal mechanisms and pathways to assess and improve fish health and growth in aquaculture.	Apply (Ap)	Procedural Knowledge (P)	Practical exams, Lab reports
CO3	Analyze the effects of environmental changes and endocrine disruptors on fish hormonal systems and propose mitigation strategies.	Analyze (An)	Conceptual Knowledge (C)	Case studies, Project reports
CO4	Evaluate and critique current research and technologies in fish endocrinology, assessing their practical applications and limitations.	Evaluate (E)	Conceptual Knowledge (C)	Research projects, Seminar presentations

CO5	Create innovative approaches to manipulate hormonal levels for enhanced breeding and stress management in aquaculture settings.	Create (C)	Procedural Knowledge (P)	Lab practicals, Group projects
CO6	Develop a comprehensive understanding of future trends in fish endocrinology research, focusing on sustainability and ethical considerations.	Understand (U)	Metacognitive Knowledge (M)	Presentations, Research projects
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Fundamentals of Endocrinology in Fish**		**10**
	1	Introduction to Endocrinology – Basic concepts and significance in aquaculture..	2
	2	Hormonal Classification – Types of hormones and their chemical structures	3
	3	Mechanisms of Hormone Action – Receptors, signaling pathways, and feedback loops	3
	4	Comparative Endocrinology – Differences and similarities in hormonal systems across various fish species	2
II	**Hormonal Regulation in Fish**		**10**
	5	Growth Hormones – Roles and regulation of growth in fish.	3
	6	Reproductive Hormones – Mechanisms controlling reproductive cycles and behaviors	3
	7	Thyroid Hormones – Influence on metabolism and development.	2
	8	Cortisol and its effects on fish health and disease resistance	2
III	**Advanced Topics in Fish Endocrinology**		**20**
	9	Hormonal adaptations to environmental stressors.	3
	10	Photoperiod and seasonal effects on hormone regulation.	2
	11	Endocrine disruptors and their impact on fish health.	2
	12	Techniques in manipulating hormonal levels for enhanced breeding.	2
	13	Case studies on hormonal treatment successes and failures.	2
	14	Future trends in hormonal research in aquaculture	2
	15	Genetic and epigenetic influences on hormone functions.	2
	16	Neuroendocrine control in fish.	2
	17	Practical sessions involving hormone assays and interpretation	3
IV	**Practical Applications of Endocrinology in Aquaculture**		**8**
	18	Hormone therapies in fish farming – applications and considerations	2
	19	Diet and hormones – Nutritional strategies to modulate hormonal responses.	2
	20	Handling and transport – Minimizing stress through hormonal	2

Programme	B. Sc. Aquaculture Honours					
Course Title	Fish Immunology					
Type of Course	**Major** Elective					
Semester	VIII					
Academic Level	400-499					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	4			60	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course on "Fish Immunology "delves into the intricate immune mechanisms of fish and shellfish, exploring the basics of immunity, the impact of environmental factors, and the practical applications of immunological knowledge in aquaculture. It equips students with an understanding of immune responses, vaccination strategies, and immunological techniques, preparing them for advanced studies and careers in fish health and disease management.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the basic structure and function of immune systems in vertebrates, focusing on aquatic organisms.	U	C	Written exams, quizzes
CO2	Analyze the influence of environmental factors on the immune responses of fish and invertebrates.	An	C	Case studies, project reports
CO3	Apply knowledge of immunoglobulins in fish to practical scenarios, including their production and applications.	Ap	P	Practical exams, lab reports

CO4	Evaluate different types of immunity and immune responses in fish, understanding cellular and humoral immunity mechanisms.	E	C	Seminar presentations, research projects
CO5	Design vaccination strategies and immunization protocols for disease prevention in aquaculture settings.	C	P	Group projects, presentations
CO6	Utilize immunological techniques such as immunohistochemistry, ELISA, and flow cytometry for fish disease research and management.	Ap	P	Lab practicals, research projects
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Immune Systems in Aquatic Organisms: Basics and Environmental Effects**		**10**
	1	Overview of the immune system in vertebrates	2
	2	Basic principles of immune system in fishes and shell fish Organs and cells involved in immunity	3
	3	Environmental Influences on Fish Immunity	3
	4	Invertebrate immune response	2
II	**Immunoglobulins in Fish: Structure, Functions, and Applications**		**10**
	5	Structure and types of immunoglobulin, Functions of immunoglobulin, ,	3
	6	Monoclonal Antibodies,	3
	7	Production and Applications of Immunoglobulin	2
	8	Immuno-stimulant and immunomodulation	2
III	**Immunity Types, Responses, and Mechanisms in Fish Immunology**		**20**
	9	Types of immunity Passive immunity, Active immunity, Herd Immunity, Innate immunity	3
	10	Types of Immune Response	2
	11	Cell mediated Immunity	2
	12	T-cells, T-cell receptors, T-cell maturation, activation, differentiation.	2
	13	Humeral immunity	2
	14	B-cells Antigens and Antibodies	2
	15	Aantimicrobial and antitumor substances	2
	16	Immune responses to infection, inflammation.	2
	17	Cytokines &Antagonists	3
IV	**Systems, Responses, and Vaccination**		**8**

Programme	B. Sc. Aquaculture Honours					
Course Title	Organic Aquaculture					
Type of Course	**Major** (Elective)					
Semester	VIII					
Academic Level	400-499					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	4			60	2hours
Pre-requisites	A pass in HSE/VHSC or Equivalent with Biology. Should have completed previous semesters					
Course Summary	The "Organic Aquaculture" course provides an in-depth exploration of the principles, practices, and challenges of organic aquaculture, including regulatory frameworks, sustainability, and environmental stewardship. It equips students with the knowledge and skills to implement ethical and profitable organic aquaculture operations, emphasizing disease management, feed formulation, and marketing strategies within a global context.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Grasp the definition, principles, history, and global trends of organic aquaculture.	U	C	Written exams, quizzes
CO2	Understand and differentiate between organic and conventional aquaculture practices, including regulatory frameworks.	U	C	Quizzes, written exams
CO3	Apply principles of organic broodstock management, hatchery operations, and sustainable practices in aquaculture.	Ap	P	Practical exams, lab reports
CO4	Analyze and implement organic feed formulation, disease prevention, and water quality management strategies.	An	P	Case studies, project reports
CO5	Develop biosecurity plans, minimize environmental impacts, and integrate aquaculture with	C	P	Seminar presentations, research projects

	ecosystem health.			
CO6	Evaluate the economic feasibility, profitability, and effective marketing strategies for organic aquaculture products.	E	C	Group projects, presentations
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Introduction to Organic Aquaculture**		**10**
	1	Definition and principles of organic aquaculture	2
	2	History and global development of organic aquaculture	3
	3	Regulatory framework for organic aquaculture certification (domestic and international)	3
	4	Comparison of organic vs. conventional aquaculture practices	2
II	**Hatchery operation**		**10**
	5	Suitable species for organic aquaculture (finfish, shellfish, seaweed)	3
	6	Organic broodstock management and selection	3
	7	Hatchery and nursery operations in organic aquaculture	2
	8	Sustainable stocking densities and carrying capacities	2
III	**Feeding and Disease prevention**		**20**
	9	Feed formulation and sourcing for organic aquaculture	3
	10	Organic nutrient sources and fertilization strategies	2
	11	Maintaining water quality and soil health in organic aquaculture system	2
	12	Disease prevention strategies in organic aquaculture	2
	13	Non-chemical parasite control methods	2
	14	Importance of maintaining fish health and resilience	2
	15	Water quality parameters crucial for organic aquaculture	2
	16	Monitoring and maintaining optimal water quality conditions	2
	17	Aeration and biofiltration techniques in organic systems	3
IV	**Sustainable management strategies**		**8**
	18	Biosecurity plan development for organic aquaculture operations	2
	19	Minimizing environmental impact of organic aquaculture	2
	20	Integrating organic aquaculture with ecosystem health	2
	21	Economic feasibility and profitability of organic aquaculture	1
	22	Marketing strategies for organic aquaculture products	1
V	**Open ended module**		**12**
	1	Regulatory Framework Permitted Inputs and Practices: Water Quality and Disease Management practices required for Certification Habitat Management and Sustainability:	
	2	Traceability and Labeling:	
	3	Case studies and future of Organic aquaculture	

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed

Programme	B. Sc. Aquaculture Honours					
Course Title	Fisheries Oceanography					
Type of Course	**Major** Elective					
Semester	VIII					
Academic Level	400-499					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	4			60	2 hours
Pre-requisites	A pass in HSC/VHSC or equivalent with biology.Should have completed previous semesters					
Course Summary	This course on Fisheries Oceanography" delves into the intricate relationships between marine organisms and their environments, emphasizing the importance of physical, chemical, and biological processes in the ocean. It equips students with the knowledge and skills to apply advanced oceanographic techniques and ecological principles towards the conservation and sustainable management of marine resources.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the geographical, chemical, and physical properties of world oceans, including the marine environment.	U	C	Written exams, quizzes
CO2	Analyze the physico-chemical features and biological divisions of the marine environment affecting fisheries.	An	C	Project reports, case studies
CO3	Apply knowledge of marine ecology, trophic dynamics, and oceanographic processes to sustainable fisheries management.	Ap	P	Lab practicals, presentations
CO4	Evaluate the impact of climate phenomena like ENSO on marine ecosystems and their implications for fisheries.	E	C	Research projects, group discussions
CO5	Design conservation strategies based on marine biodiversity to	C	P	Seminar presentations, project reports

	support sustainable fisheries and ocean health.			
CO6	Utilize modern oceanographic tools and technologies for data collection and fish stock assessment.	Ap	P	Practical exams, field trip

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**World Oceans: Geography, Chemistry, and Physical Properties"**		**10**
	1	Salient features of world oceansa	2
	2	Oceanographic features of Arabian Sea, Bay of Bengal and Andaman Se	3
	3	Elemental composition of seawater..	3
	4	Chemical and physical properties of sea water- temperature, salinity, density, light, pressure, colour	2
II	**Marine Environment: Physical Processes and Chemical Features"**		**10**
	5	Physico-chemical features of Marine environment-, waves,	3
	6	Tides, currents and waves	3
	7	Monsoon cycles	2
	8	Upwelling and Mud banks	2
III	**Marine Ecology and Oceanography:**		**20**
	9	General characteristics of the marine environment.	3
	10	Zonation of sea.	2
	11	Biological divisions of the sea.	2
	12	Intertidal environment Adaptations of intertidal organisms.	2
	13	Intertidal rocky, sandy, and muddy shore associated fauna and their adaptations	2
	14	Deep Ocean Topographic features Deep sea adaptations.	2
	15	Population of the oceans - phytoplankton, zooplankton, benthos, and nekton	2
	16	Marine food chains and food webs	2
	17	Basics of marine ecology and trophic dynamics	3
IV	**Climate & Oceanography: Shaping Sustainable Fisheries"**		**8**
	18	El Nino Southern Oscillation (ENSO). -	2
	19	Upwelling and fisheries	2
	20	Climate change and fisheries.	2
	21	Oceanography In relation to fisheries.	1
	22	Marine Biodiversity and Conservation Strategies in Fisheries	1
V	**Open ended module**		**12**
	1	Oceanographic sampling and data collection methods Remote sensing and satellite oceanography	
	2	Acoustic methods for fish stock assessment	
	3	Emerging technologies in oceanographic research Field trips to coastal and marine research facilities	

Programme	B. Sc. Aquaculture Honours					
Course Title	Aquatic Pollution and Toxicology					
Type of Course	**Major** (Elective)					
Semester	VIII					
Academic Level	400-499					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	4	4			60	2 hours
Pre-requisites	A pass in HSC/VHSC or equivalent with biology/ should have completed previous semesters					
Course Summary	This course on "Water Pollution: Causes, Consequences, and Treatment" delves into the critical issues surrounding aquatic pollution, exploring the types, sources, impacts, and the latest methods for monitoring, testing, and treating contaminated water. It aims to equip students with a deep understanding of environmental toxins, advanced wastewater treatment technologies, and the principles of ecotoxicology, preparing them for effective management and conservation efforts in aquatic environments					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Identify and categorize the types, sources, and impacts of water pollution.	U	F	Written exams, quizzes
CO2	Analyze water quality parameters and understand their implications for aquatic health and safety.	An	C	Lab reports, practical exams
CO3	Evaluate the effectiveness of different wastewater treatment methods (primary, secondary, tertiary).	E	P	Project reports, presentations
CO4	Comprehend the mechanisms of toxicity, entry, and impact of toxicants in aquatic environments.	U	C	Quizzes, case studies
CO5	Apply modern toxicity testing methods (in vitro, in vivo, microbiological) to assess environmental health.	Ap	P	Lab practicals, research projects
CO6	Develop strategies for managing ecosystem health amidst challenges like bioaccumulation and	C	C	Seminar presentations, group project

	pollution.			

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**Water Pollution: Causes, Consequences, and Treatment**		**10**
	1	The Nature of Water Pollution(Types ,Sources and Impact)	3
	2	Understanding Water Quality Parameters (BOD,COD etc)	2
	3	Investigating Water Pollution - Case Studies	3
	4	Wastewater treatment: Primary, Secondary and tertiary	2
II	**Understanding Environmental Toxins**		**10**
	5	Introduction to Toxicity and Toxicants	3
	6	Entry of Toxicants into the Environment	3
	7	Cycles and Residence Time of Toxicants	2
	8	Toxicity of Specific Contaminant Groups	2
III	**Unveiling Toxicity: A Comprehensive Exploration of Testing Methods**		**20**
	9	Introduction to Toxicity Testing	3
	10	Principles of Toxicity Testing	2
	11	In Vitro Toxicity Testing	2
	12	In Vivo Toxicity Testing	2
	13	Monitoring Approaches for Environmental Toxicity	2
	14	Microbiological Toxicity Testing	2
	15	Bio-sensors and Biomarkers	2
	16	Molecular Markers of Toxicity	2
	17	Emerging Technologies in toxicity testing	3
IV	**Core Principles of Ecotoxicology**		**8**
	18	Toxicants and Communities	2
	19	Multilevel Interactions and Toxic Effects	2
	20	Bioaccumulation and Biomagnification	2
	21	Sensitivity and Resilience of Ecosystems	1
	22	Managing Ecosystem Health	1
V	**Open Ended module**		**12**
	1	Emerging Toxicants and Environmental Changes Microplastics and Persistent Organic Pollutants Environmental Regulations and Policy	
	2	Toxicology and Human Health	
	3	Case Studies in Ecotoxicology	

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed module

Programme	B. Sc. Aquaculture Honours					
Course Title	Fisheries Business Management					
Type of Course	**Major** Elective					
Semester	VIII					
Academic Level	400-499					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	4			60	2hours
Pre-requisites	A pass in HSE?VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course delves into the essentials of fish business management, spanning strategic planning, organizational dynamics, and leadership in the seafood industry, enriched with case studies on aquaculture and seafood exports to highlight practical applications in global fisheries management.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Master the fundamental concepts of management processes and functions, and understand the distinct roles of managers in business management and administration.	U	C	Written exams, quizzes
CO2	Analyze the dynamics of fish capture, culture, domestic and export seafood businesses, incorporating strategic planning and forecasting.	An	C	Project reports, case studies
CO3	Design an organizational structure suited to the seafood industry, understanding formal and informal organizations and departmentalization strategies.	Ap	P	Presentations, organizational charts
CO4	Apply principles of human resource management in the seafood industry, focusing on staffing, selection processes, and promoting a culture of safety and compliance.	Ap	P	Practical exams, HR development plans
CO5	Evaluate leadership theories and human factors in business management, aligning individual and	E	C	Seminar presentations, leadership analysis

	organizational objectives for enhanced managerial effectiveness.			
CO6	Implement controlling systems and processes within fisheries business management, utilizing budgeting and technological tools for effective international management.	Ap	P	Case studies, management simulation exercises

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**"Fundamentals of Fish Business Management and Operations"**		**10**
	1	Management process, Functions of management,	2
	2	Role of a manager in business Management and administration	3
	3	Types of fish businesses- Fish capture and culture business,	3
	4	Domestic and export seafood business	2
II	**Strategic Planning and Forecasting in Fisheries Management"**		**10**
	5	Planning: Nature & Purpose	3
	6	Objectives and Managing by Objectives	3
	7	Forecasting in Fish Production and Marketing	2
	8	Case studies from seafood processing and export business and aquaculture business	2
III	**"Organizational Structure and Human Resources in Seafood Industry Management"**		**20**
	9	Nature and Purpose of Formal and Informal Organizations Departmentalization Strategies	3
	10	Organizational Chart: Understanding Structure and Process	2
	11	Line and Staff Authority: Benefits and Limitations	2
	12	Decentralization and Delegation of Authority	2
	13	Staffing and Selection Process: Techniques	2
	14	Human Resource Development and Managerial Effectiveness	2
	15	Role of HR in Promoting a Culture of Safety and Compliance	2
	16	Methods for Assessing and Enhancing Employee Performance	2
	17	Case Studies: Organizing in Seafood Production, including insights from seafood processing, export business, and aquaculture operations	3
IV	**"Leadership and Human Factors in Business Management"**		**8**
	18	Understanding the scope and importance of directing in business management.	2
	19	Exploring the role of human factors in the workplace, including creativity and innovation	2
	20	Techniques for aligning individual and organizational objectives.	2
	21	Overview of leadership and its significance in directing.	1
	22	Maslow's Hierarchy of Needs and its application in the workplace.	1
V	**Open ended module Controlling in Fisheries Business Management"**		**12**

Programme		B. Sc. Aquaculture Honours				
Course Title		Fish as Food: Nutrition and Beyond"				
Type of Course		**MDC**				
Semester		I				
Academic Level		100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	3	3		0	45	1 ½ hours
Pre-requisites		A Pass in HSE/VHSE or Equivalent with biology				
Course Summary		The course delves into fish nutrition's health benefits and environmental sustainability, highlighting dietary roles, global consumption trends, and sustainable practices in aquaculture.				

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the nutritional value of fish in a balanced diet, focusing on omega-3 fatty acids, vitamins, and minerals.	U	C	Written exams, quizzes
CO2	Evaluate the health benefits and risks associated with fish consumption, including the impact of mercury and PCBs.	E	C	Case studies, project reports
CO3	Analyze global trends in fish consumption, food security, and the role of fish in traditional diets.	An	C	Research projects, presentations
CO4	Apply knowledge of fish quality and safety in culinary practices to enhance nutrient retention and develop sustainable seafood menus.	Ap	P	Practical exams, lab reports, culinary workshops
CO5	Create strategies for sustainable fish consumption and nutritional security, leveraging innovations in aquaculture.	C	P	Group projects, seminar presentations
CO6	Assess the role of policy, governance, certification, and labeling in promoting sustainable fisheries and nutritional interventions.	An	F	Written exams, quizzes, panel discussions

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	B. Sc. Aquaculture Honours					
Course Title	Marine biodiversity and conservation					
Type of Course	**MDC**					
Semester	II					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	3	3		0	45	1 ½ hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course offers an in-depth look at marine ecosystems and conservation efforts, focusing on biodiversity threats and strategies for environmental protection and restoration.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Gain a comprehensive understanding of marine ecosystems, including their physical, chemical properties, and marine life forms.	U	C	Written exams, quizzes
CO2	Identify and analyze the major threats to marine biodiversity, including overfishing, pollution, habitat destruction, and climate change.	An	C	Case studies, project reports
CO3	Understand and apply principles of marine conservation, including the establishment and management of Marine Protected Areas (MPAs) and species-specific efforts.	Ap	P	Practical exams, lab reports
CO4	Evaluate the effectiveness of various marine conservation strategies, including habitat restoration, conservation biotechnology, and community-based efforts.	E	C	Research projects, presentations
CO5	Analyze the role of policy, governance, and international agreements in marine conservation, assessing their	An	F	Written exams, seminar presentations

	impacts through case studies.			
CO6	Design and implement a marine conservation project, employing appropriate research methods, data analysis, and communication of findings.	C	P	Group projects, lab practicals, reporting
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Introduction to Marine Ecosystems**		**8**
	1	Overview of Marine Ecosystems	2
	2	Physical and Chemical Properties of Marine Environments	2
	3	Introduction to Marine Life Forms	2
	4	Ecological Roles and Food Web	2
II	**Threats to Marine Biodiversity**		**8**
	5	Overfishing and Fisheries Management	2
	6	Pollution and Its Impact on Marine Life	2
	7	Habitat Destruction and Alteration	2
	8	Climate Change Effects on Marine Ecosystems	2
III	**Marine Conservation Strategies**		**15**
	9	Principles of Marine Conservation	2
	10	Marine Protected Areas (MPAs)	2
	11	Species-Specific Conservation Efforts	2
	12	Habitat Restoration Techniques	2
	13	Conservation Biotechnology in Marine Biology	2
	14	Community-based Conservation Efforts	2
	15	International Conservation Agreements and Policies	1
	16	Conservation Education and Public Awareness	1
	17	Challenges and Future Directions in Marine Conservation	1
IV	**Policy and Governance in Marine Conservation**		**6**
	18	Overview of Marine Governance	2
	19	National Legislation and Policies	1
	20	International Frameworks and Agreements	1
	21	Role of NGOs and Civil Society	1
	22	Case Studies in Marine Policy Successes and Failures	1
V	**Open ended Module Research and Practical Application in Marine Conservation**		**8**
	1	• Introduction to Research Methods in Marine Biology • Designing a Marine Conservation Project • Data Collection and Analysis • Project Implementation • Reporting and Communication of Findings	

Programme	B. Sc. Aquaculture Honours					
Course Title	Academic writing for life science students					
Type of Course	**SEC**					
Semester	V					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total hours	Exam duration
	3	3		0	45	1.5 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course teaches students how to write effectively and ethically in the life sciences, focusing on clarity, critical literature analysis, and preparing for academic publishing.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Master the principles of clear and effective academic writing tailored for the life sciences.	U	C	Quizzes, written exams
CO2	Understand and apply various scientific writing styles, focusing on passive vs. active voice and vocabulary precision.	Ap	C	Written exams, assignments
CO3	Develop skills in structuring scientific documents, including the use of the IMRaD format and logical argumentation.	Ap	P	Lab reports, project reports
CO4	Conduct comprehensive literature reviews, manage references effectively, and uphold academic integrity by avoiding plagiarism.	An	P	Research projects, presentations
CO5	Utilize advanced research and writing techniques for both qualitative and quantitative studies, tailored to specific audiences.	An	P	Case studies, seminar presentations
CO6	Navigate the academic publishing process, from literature search to understanding the ethics of writing and publication.	C	M	Group projects, peer review exercises

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	B. Sc. Aquaculture Honours					
Course Title	Aquatic Specimen Preservation: Techniques and Practices for Museum Collections					
Type of Course	**SEC**					
Semester	VI					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	3	3		0		1 ½ hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course provides in-depth training in preserving aquatic specimens, combining traditional and advanced techniques with a focus on ethical practices and conservation. It prepares students for roles in museum curation and aquatic research.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the fundamentals and importance of aquatic specimen preservation.	U	C	Written exams, quizzes
CO2	Apply basic principles of taxonomy and classification in the context of specimen preservation.	Ap	C	Practical exams, lab reports
CO3	Design educational and engaging museum displays incorporating modern technology.	C	P	Project reports, presentations
CO4	Master various chemical and physical preservation techniques for aquatic specimens.	Ap	P	Lab practicals, lab reports
CO5	Utilize advanced preservation techniques, including non-invasive imaging and digital preservation.	An	P	Research projects, group projects
CO6	Develop skills in specimen preparation, cataloging, and exhibition, adhering to ethical considerations.	C	P	Seminar presentations, museum visits

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	B. Sc. Aquaculture Honours					
Course Title	Ecotourism					
Type of Course	**VAC**					
Semester	III					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	3	3		0	45	1 ½ hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course on ecotourism in aquaculture focuses on imparting knowledge and skills in sustainable tourism practices, encompassing ecological, social, and economic aspects to promote conservation and community engagement.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Students will recall key concepts and principles of ecotourism, including environmental, social, and economic impacts.	Remember (R)	Factual Knowledge (F)	Written exams, Quizzes
CO2	Students will understand the integration of aquaculture in farm tourism and its significance to ecotourism.	Understand (U)	Conceptual Knowledge (C)	Case studies, Quizzes
CO3	Students will apply best practices for sustainable aquatourism, including waste management and pollution control.	Apply (Ap)	Procedural Knowledge (P)	Practical exams, Lab reports
CO4	Students will analyze the effectiveness of different ecotourism strategies to enhance community engagement and environmental conservation.	Analyze (An)	Conceptual Knowledge (C)	Research projects, Group projects
CO5	Students will evaluate the challenges and opportunities in marine tourism, using tools such as eco-certification and crisis management	Evaluate (E)	Procedural Knowledge (P)	Seminar presentations, Project reports

	strategies.			
CO6	Students will create innovative designs for eco-friendly tourist facilities that incorporate advanced technologies and community-led initiatives.	Create (C)	Metacognitive Knowledge (M)	Design projects, Presentations
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Introduction to Ecotourism**		**8**
	1	Foundations of Ecotourism	2
	2	Environmental Impacts	2
	3	Socio-economic Impacts	2
	4	Ethics and Best Practices	2
II	**Farm Tourism in Aquaculture**		**8**
	5	Introduction to farm tourism, its importance in aquaculture, and how it integrates with ecotourism.	2
	6	Management of Aquaculture Farms for Tourism	2
	7	Developing educational programs and tours that inform visitors about aquaculture processes and environmental stewardship	2
	8	Examination of successful farm tourism examples within the aquaculture industry.	2
III	**Aqua tourism**		**15**
	9	Exploration of aquatourism, including activities like snorkeling, scuba diving, and educational tours in aquatic settings	2
	10	Aquatic Biodiversity and Conservation	2
	11	Best practices for sustainable aquatourism, impact assessments, and methods to minimize the ecological footprint of tourism activities.	2
	12	Cultural and Community Engagement in Aquatourism	2
	13	Innovative conservation practices used in aquatourism to protect aquatic environments, such as coral reef restoration projects and artificial reefs.	2
	14	Eco-certification and Regulation Compliance	2
	15	Pollution Impacts by Aquatourism	1
	16	Managing Waste and Plastics in Aquatourism Environments	1
	17	Crisis Management and Resilience Building	1
IV	**Marine Tourism**		**6**
	18	Introduction to Marine Tourism	2
	19	Marine Protected Areas and Tourism	1
	20	Technologies in Marine Tourism	1
	21	Safety and Risk Management	1
	22	Marketing and Management	1
V	**Open ended Module Innovative Strategies and Community Engagement in Ecotourism**		**8**
		Innovative Design for Eco-Friendly Tourist Facilities Technology Integration in Ecotourism	

Programme	B. Sc. Aquaculture Honours					
Course Title	Environmental Impact Assessment					
Type of Course	**VAC**					
Semester	IV					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam duration
	3	3		0	45	1 ½ hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	he course "Fundamentals of Environmental Impact Assessment (EIA)" provides students with comprehensive knowledge and practical skills to understand, apply, and evaluate environmental impact assessment processes, focusing on aquatic ecosystems, mitigation strategies, and stakeholder engagement for sustainable development.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Recall EIA process components, methodologies, and techniques.	Remember (R)	Factual Knowledge (F)	Written exams, Quizzes
CO2	Understand EIA application in evaluating environmental impacts on aquatic ecosystems.	Understand (U)	Conceptual Knowledge (C)	Case studies, Quizzes
CO3	Apply EIA principles and methods to assess and mitigate impacts on aquatic ecosystems.	Apply (Ap)	Procedural Knowledge (P)	Practical exams, Lab reports
CO4	Analyze SEAs' significance in evaluating long-term environmental effects on aquatic environments.	Analyze (An)	Conceptual Knowledge (C)	Research projects, Group projects
CO5	Evaluate mitigation strategies' effectiveness in minimizing impacts on aquatic ecosystems.	Evaluate (E)	Procedural Knowledge (P)	Seminar presentations, Project reports
CO6	Create innovative mitigation strategies,	Create (C)	Metacognitive Knowledge (M)	Design projects, Presentation

	incorporating stakeholder engagement for sustainable development.			

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**Fundamentals of Environmental Impact Assessment (EIA)**		**8**
	1	Introduction to EIA	2
	2	EIA Process and Methodology	2
	3	Components of EIA	2
	4	Cumulative and strategic Environmental Assessment(SEA)	2
II	**Aquatic Ecosystems and Impacts**		**8**
	5	Understanding Aquatic Ecosystems	2
	6	Impact Assessment in Aquatic Environments	2
	7	Mitigation and Management Strategies	2
	8	Case Studies of Aquatic EIA	2
III	**Advanced Topics in Aquatic EIA**		**15**
	9	Deep-Sea Ecosystems	2
	10	Impacts of Offshore Development	2
	11	Coral Reef Assessment	2
	12	Cumulative Impact Models	2
	13	Assessing Water Pollution	2
	14	Fisheries Impact Assessment	2
	15	Public Participation in Marine EIA	1
	16	Socio-economic Considerations	1
	17	The role of public participation in the EIA process, particularly in sensitive aquatic environments	1
IV	**EIA Reporting and Post-EIA Activities**		**6**
	18	Preparing an EIA Report	2
	19	EIA Presentation Techniques	1
	20	Monitoring and Compliance	1
	21	EIA Audit and Evaluation	1
	22	Adaptive Management in EIA	1
V	**Open ended module Advanced Strategies in Environmental Impact Assessment"**		**8**
		Innovative Tools for EIA Scenario Planning and Future Forecasting Integrating Climate Change into EIA Stakeholder Engagement Strategi Unit 5: Creative Mitigation Strategies	

Programme	B. Sc. Aquaculture Honours					
Course Title	Introduction to Aquaculture					
Type of Course	**Minor Group1**					
Semester	I					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology					
Course Summary	This introductory course provides a broad overview of aquaculture, focusing on its principles, systems, management practices, and the sustainability challenges it faces. It is designed for students from various scientific backgrounds seeking foundational knowledge in aquaculture.					

Course outcome

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the history and fundamental principles of aquaculture, including water quality, seed stock, and feed management.	Understand (U)	Conceptual Knowledge (C)	Written exams, Quizzes
CO2	Apply knowledge of various aquaculture systems and species-specific cultivation techniques for freshwater, marine, and ornamental species.	Apply (Ap)	Procedural Knowledge (P)	Practical exams, Lab reports
CO3	Analyze nutritional requirements, feeding strategies, and health management practices to optimize aquaculture productivity and sustainability.	Analyze (An)	Procedural Knowledge (P)	Case studies, Project reports
CO4	Evaluate the environmental impacts of aquaculture practices and develop strategies to mitigate these impacts through sustainable practices.	Evaluate (E)	Conceptual Knowledge (C)	Research projects, Seminar presentations
CO5	Create and implement a mini aquaculture system project, demonstrating proficiency in practical aquaculture skills such as water quality management and disease prevention.	Create (C)	Procedural Knowledge (P)	Lab practicals, Group projects

CO6	Reflect on the role of aquaculture in societal and economic contexts, fostering a commitment to ethical practices and community engagement.	Evaluate (E)	Metacognitive Knowledge (M)	Presentations, Group discussions
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit	Content	Hrs
I	**Introduction to Aquaculture**		**10**
	1	Definition and History of Aquaculture – Global and local perspectives. .	2
	2	Importance of Aquaculture – Contribution to food security and economic development	3
	3	Basic Principles of Aquaculture – Water quality, seed stock, and feed management	3
	4	Major Aquaculture Systems – Extensive, intensive, and super-intensive systems.	2
II	**Aquaculture Species and Cultivation Techniques**		**10**
	5	Freshwater Aquaculture – Key species and cultivation methods.	3
	6	Marine Aquaculture – Focus on marine fish, crustaceans, and shellfish	3
	7	Ornamental Fish Culture – Techniques and species popularity	2
	8	Algae and Aquatic Plant Cultivation – Uses in food, biofuel, and pharmaceuticals	2
III	**Nutrition, Health, and Disease Management**		**15**
	9	Nutritional requirements for various species.	2
	10	Feed types and feeding strategies	2
	11	Common diseases and parasites in aquaculture.	1
	12	Prevention and treatment of diseases.	2
	13	Biosecurity measures in aquaculture facilities.	2
	14	Vaccination and health management.	2
	15	Role of genetics in disease resistance.	1
	16	Stress management and its impact on health.	1
	17	Case studies on managing outbreaks in aquaculture settings.	2
IV	**Sustainability and Environmental Impact**		**10**
	18	Environmental Impacts of Aquaculture – Pollution and habitat destruction.	2
	19	Sustainable Practices – Strategies to mitigate environmental impacts	2
	20	Regulation and Policy – National and international frameworks.	2
	21	Innovations in Aquaculture – Recirculating systems, integrated multitrophic aquaculture	2
	22	Social Aspects – Community engagement and social responsibility.	2
V	**Practical Module**		**30**
		• Hands-on training in aquaculture facility operations.	

Programme	B. Sc. Aquaculture Honours					
Course Title	Aquaculture Disease Management					
Type of Course	**Minor Group1**					
Semester	II					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	Aquaculture Disease Management introduces principles and practices for preventing, diagnosing, and controlling diseases in aquaculture, covering disease biology, epidemiology, diagnostics, treatment, and prevention strategies with a focus on practical applications and case studies.					

Course outcome

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the principles of aquaculture health management.	Understand (U)	Conceptual Knowledge (C)	Written exams, quizzes, case studies
CO2	Identify common pathogens in aquaculture systems and their transmission routes.	Remember (R)	Factual Knowledge (F)	Written exams, quizzes, lab practicals
CO3	Analyze the impact of diseases on aquaculture production.	Analyze (An)	Conceptual Knowledge (C)	Written exams, case studies, research projects
CO4	Apply diagnostic techniques and surveillance methods in aquaculture disease management.	Apply (Ap)	Procedural Knowledge (P)	Practical exams, lab reports, field visits
CO5	Evaluate different treatment and control measures for aquaculture diseases.	Evaluate (E)	Conceptual Knowledge (C)	Written exams, presentations, research projects
CO6	Demonstrate practical skills in disease monitoring, diagnosis, and management in aquaculture settings.	Apply (Ap)	Procedural Knowledge (P)	Lab practicals, practical exams, field visits
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit	Content	Hrs
I	**Introduction to Aquaculture Diseases**		**10**

Programme	B. Sc. Aquaculture Honours					
Course Title	Aquaculture Production Systems					
Type of Course	**Minor Group1**					
Semester	III					
Academic Level	200-299					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	Aquaculture Production Systems covers diverse techniques like pond culture, cage culture, RAS, and IMTA, emphasizing principles, management, environmental factors, and practical					

Course outcome

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the principles of aquaculture production systems.	Understand (U)	Conceptual Knowledge (C)	Written exams, quizzes, case studies
CO2	Identify key environmental factors influencing aquaculture and apply sustainable practices.	Apply (Ap)	Conceptual Knowledge (C), Procedural Knowledge (P)	Practical exams, field reports, case studies
CO3	Analyze the management strategies and techniques employed in pond and cage culture systems.	Analyze (An)	Procedural Knowledge (P)	Lab reports, case studies, project reports
CO4	Evaluate the design, operation, and management of recirculating aquaculture systems (RAS).	Evaluate (E)	Procedural Knowledge (P), Conceptual Knowledge (C)	Research projects, presentations, practical exams
CO5	Assess the concepts, benefits, and challenges of integrated multi-trophic aquaculture (IMTA).	Evaluate (E)	Conceptual Knowledge (C), Analytical Knowledge (An)	Presentations, research projects, case studies
CO6	Demonstrate practical skills in various aquaculture production techniques and technologies.	Apply (Ap)	Procedural Knowledge (P)	Lab practicals, field visits, final practical examination
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	B. Sc. Aquaculture					
Course Title	Introduction to Seafood Quality Control					
Type of Course	**Minor Group2**					
Semester	1					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3		2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology.					
Course Summary	This course provides comprehensive training in seafood quality control, covering essential aspects such as quality assessment techniques, preservation methods, safety regulations, and practical skills in ensuring seafood quality and safety standards.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the basics of seafood quality, including key factors and types of spoilage.	U	F	Quizzes, written assignments, and class participation.
CO2	Apply sensory evaluation, chemical analysis, and microbiological testing techniques in quality assessment.	Ap	P	Practical lab sessions, hands-on training, and lab reports.
CO3	Analyze various seafood preservation and processing methods and their impact on quality.	An	C	Written exams, case study analyses, and group discussions.
CO4	Evaluate safety and regulatory compliance measures, including HACCP and food safety systems.	E	C	Written assignments, compliance exercises, and regulatory case study evaluations.
CO5	Create a quality control plan for seafood processing, incorporating modern technologies.	C	P	Project work, practical demonstrations, and presentations.
CO6	Develop practical skills in packaging, storage techniques, and real-	C	P	Practical exercises, industry visits, and workshops.

Programme	B. Sc. Aquaculture					
Course Title	Fundamentals of Seafood Trade					
Type of Course	**Minor Group2**					
Semester	II					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3		2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology. Should have completed previous semesters					
Course Summary	This course provides an in-depth understanding of seafood trade and inspection, focusing on global and Indian trade dynamics, regulations, quality control, logistics, and practical skills for managing export and import processes					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the global seafood industry, including key players, markets, and economic impacts.	U	F	Quizzes, written assignments, and class participation.
CO2	Explain the international and national seafood trade regulations, including certification schemes.	U	C	Written exams, presentations, and group discussions.
CO3	Describe the export and import processes specific to the Indian seafood industry.	U	F	Written exams, assignments, and case study analyses.
CO4	Apply knowledge of trade logistics, including cold chain management and packaging standards.	Ap	P	Practical exercises, lab sessions, and field visit reports.
CO5	Analyze the challenges and opportunities in the Indian seafood export industry.	An	C	Written assignments, case studies, and group discussions.
CO6	Develop practical skills in preparing trade	C	P	Practical sessions, project work, and

	documentation, ensuring compliance, and managing risks.			presentations.

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit		Hrs
I	**Introduction to Seafood Trade**		**10**
	1	An introduction to the global seafood industry, key players, and major markets	2
	2	The economic impact of seafood trade on global and local economies.	3
	3	Understanding the seafood supply chain from harvest to market.	3
	4	Overview of international trade policies and agreements affecting seafood trade.	2
II	**Seafood Trade Regulations**		**10**
	5	Key international regulations governing seafood trade (WTO, Codex Alimentarius)	3
	6	Seafood trade regulations specific to various countries.	3
	7	Certification schemes and standards (MSC, ASC, etc.) in the seafood industry.	2
	8	Procedures and documentation required for exporting and importing seafood.	2
III	**Export and Import of Seafood Trade in India**		**15**
	9	Introduction to the Indian seafood industry and its significance in global trade.	2
	10	Key seafood products exported from India.	2
	11	Major international markets for Indian seafood.	2
	12	Key seafood products imported into India and their sources.	1
	13	Indian regulatory bodies overseeing seafood trade (MPEDA, FSSAI).	1
	14	Essential documentation and procedures for exporting seafood from India.	1
	15	Regulations and procedures for importing seafood into India	2
	16	Quality standards and certifications required for exporting Indian seafood.	2
	17	Challenges faced by the Indian seafood export industry and potential opportunities.	2
IV	**Market Access and Trade Logistics**		**10**
	18	Market Access Requirements	2
	19	Logistics involved in the global seafood supply chain.	2
	20	Importance and management of the cold chain in seafood trade.	2
	21	Packaging and labeling standards for international trade.	2
	22	Identifying and overcoming trade barriers in the seafood industry.	2
V	**Practical Module**		**30**
	1	Export Documentation Preparation Import Documentation Preparation Trade Compliance and Regulations Market Access Requirements	

Programme	B. Sc. Aquaculture					
Course Title	Seafood quality management systems					
Type of Course	**Minor Group2**					
Semester	III					
Academic Level	200-299					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3		2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology. Should have completed previous semesters					
Course Summary	This course offers an in-depth exploration of seafood quality management systems, focusing on regulatory standards, quality control techniques, and practical implementations within the seafood industry to ensure product safety and compliance.					

CO	CO Statement	Cognitive Level*	Knowledge Category	Evaluation Tools used
CO1	Understand the key attributes and factors affecting seafood quality.	U	F	Quizzes, written assignments, and class participation.
CO2	Explain the principles and implementation of various quality management systems in seafood processing.	U	C	Written exams, presentations, and group discussions.
CO3	Describe the regulatory frameworks and standards governing seafood quality management.	U	F	Written exams, assignments, and case study analyses.
CO4	Apply quality management techniques, including HACCP, GMPs, and SSOPs, in seafood processing.	Ap	P	Practical exercises, lab sessions, and field visit reports.
CO5	Analyze the challenges and best	An	C	Written assignments, case studies, and

	practices in maintaining seafood quality and compliance.			group discussions.
CO6	Develop practical skills in implementing and auditing quality management systems.	C	P	Practical sessions, project work, and presentations.
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Module	Unit		Hrs
I	**Introduction to Seafood Quality Management Systems**		**10**
	1	Overview of Seafood Quality Management	2
	2	Key physical, chemical, and sensory attributes affecting seafood quality.	3
	3	Biological, environmental, and processing factors impacting seafood quality.	3
	4	Basics of QMS and their role in maintaining seafood quality.	2
II	**Regulatory Frameworks and Standards**		**10**
	5	HACCP (Hazard Analysis Critical Control Point)	3
	6	ISO 22000: Food Safety Management Systems	3
	7	FSSAI Guidelines	2
	8	EU Regulations and USFDA Standards	2
III	**Quality Management Techniques and Systems**		**15**
	9	Principles of TQM and its application in the seafood industry	2
	10	Implementation of GMPs to ensure seafood safety and quality.	2
	11	Importance and development of SSOPs in seafood processing.	2
	12	Techniques for quality control and assurance in seafood processing.	1
	13	Methods and importance of inspection and auditing in maintaining seafood quality.	1
	14	Ensuring traceability of seafood products through the supply chain.	1
	15	Identifying and managing risks in seafood quality management.	2
	16	Best practices for documentation and record keeping in quality management systems.	2
	17	Strategies for continuous improvement in seafood quality management.	2
IV	**Certification and Compliance**		**10**
	18	Certification Schemes	2
	19	Compliance with National and International Standards	2
	20	Third-Party Audits and Inspections	2
	21	Ethical and Sustainable Practices	2
	22	Analysis of real-world case studies on seafood quality management and compliance	2
V	**Practical Module**		**30**
	1	Practical exercises on developing and implementing HACCP plans in seafood processing	

Programme	B. Sc. Aquaculture Honours					
Course Title	Ornamental Fish Breeding Techniques					
Type of Course	**Vocational Minor (Group1)**					
Semester	I					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology					
Course Summary	The Ornamental Fish Breeding Techniques course offers a comprehensive study of breeding methods, management strategies, and practical applications essential for successful ornamental fish production					

Course outcome

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the overview of the ornamental fish industry.	U	Conceptual Knowledge (C)	Written exams, quizzes, presentations
CO2	Recognize the importance of breeding techniques in the ornamental fish trade.	U	Conceptual Knowledge (C)	Written exams, quizzes, presentations
CO3	Demonstrate the ability to select and manage broodstock for ornamental fish breeding.	Ap	Procedural Knowledge (P)	Practical exams, lab reports, case studies
CO4	Apply facility design principles for setting up ornamental fish breeding operations.	Ap	Procedural Knowledge (P)	Practical exams, lab reports, case studies
CO5	Implement spawning induction techniques and larval rearing strategies.	Ap	Procedural Knowledge (P)	Practical exams, lab reports, case studies
CO6	Evaluate disease management protocols and marketing strategies in ornamental fish breeding.	An	Procedural Knowledge (P)	Practical exams, lab reports, case studies

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	B. Sc. Aquaculture Honours					
Course Title	Aquarium Systems and Management					
Type of Course	**Vocational Minor**					
Semester	II					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The suggested readings provide comprehensive insights into aquarium systems and management, covering topics such as freshwater and saltwater aquarium setups, aquatic plant care, reef ecosystems, and coral reef management.					

Course outcome

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the structure and dynamics of the aquarium industry.	U	Conceptual Knowledge (C)	Written exams, quizzes, presentations
CO2	Apply principles of aquarium design to create functional and aesthetically pleasing aquariums.	Ap	Procedural Knowledge (P)	Practical exams, project reports, presentations
CO3	Demonstrate the ability to select appropriate equipment and install aquarium systems effectively.	Ap	Procedural Knowledge (P)	Practical exams, lab reports, presentations
CO4	Analyze and implement aquascaping techniques to enhance the visual appeal of aquariums.	An	Procedural Knowledge (P)	Lab reports, case studies, presentations
CO5	Identify key water parameters and their significance in maintaining water quality in aquariums.	U	Factual Knowledge (F)	Written exams, quizzes, practical exams
CO6	Apply various filtration systems and techniques to maintain optimal water quality in aquariums.	Ap	Procedural Knowledge (P)	Practical exams, lab reports, project reports

Programme	B. Sc. Aquaculture Honours					
Course Title	Health Management in Ornamental Fish					
Type of Course	**Vocational Minor(Group1)**					
Semester	III					
Academic Level	200-299					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	"Health Management in Ornamental Fish provides a comprehensive understanding of disease prevention, diagnosis, and treatment, alongside essential practices in water quality management and biosecurity measures crucial for ensuring the well-being of ornamental fish populations in aquariums and aquaculture facilities."					

Course outcome

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the principles of health management in ornamental fish.	U	Conceptual Knowledge (C)	Written exams, quizzes, case studies
CO2	Recognize the importance of disease prevention in ornamental fish and its impact on populations.	U	Conceptual Knowledge (C)	Written exams, quizzes, case studies
CO3	Identify the basic anatomy and physiology of ornamental fish.	U	Conceptual Knowledge (C)	Written exams, practical exams, lab reports
CO4	Explain the principles and importance of biosecurity measures in ornamental fish facilities.	U	Conceptual Knowledge (C)	Written exams, quizzes, case studies
CO5	Apply diagnostic techniques for identifying common fish diseases	Ap	Procedural Knowledge (P)	Practical exams, lab practicals, field

	and water quality analysis.			observations
CO6	Develop and implement prevention strategies, quarantine procedures, and integrated pest management approaches in ornamental fish facilities.	Ap	Procedural Knowledge (P)	Case studies, group projects, practical exercise

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit	Content	Hrs
I	**Introduction to Health Management in Ornamental Fish**		**10**
	1	Overview of health management principles	2
	2	Importance of disease prevention in ornamental fish	3
	3	Basic anatomy and physiology of ornamental fish	3
	4	Introduction to biosecurity measures	2
II	**Common Diseases in Ornamental Fish**		**10**
	5	Identification and classification of common fish diseases	3
	6	Symptoms, causes, and transmission routes of diseases	3
	7	Case studies and examples of disease outbreaks	2
	8	Impact of diseases on ornamental fish populations	2
III	**Disease Diagnosis and Treatment**		**15**
	9	Diagnostic Techniques in Ornamental Fish Health Management	2
	10	Water Quality Analysis and Its Role in Disease Diagnosis	2
	11	Understanding Fish Pathogens: Bacteria, Viruses, and Parasite	1
	12	Treatment Options: Medications and Antibiotics	2
	13	Alternative Therapies in Ornamental Fish Health Management	2
	14	Diagnosis and management of bacterial diseases	2
	15	Diagnosis and management of viral diseases	1
	16	Alternative Therapies in Ornamental Fish Health Management	1
	17	Surgical Interventions in Fish Health Management	2
IV	**Prevention Strategies and Biosecurity Measures**		**10**
	18	Biosecurity protocols for ornamental fish facilities	2
	19	Quarantine procedures for new fish arrivals	2
	20	Environmental management for disease prevention	2
	21	Integrated pest management approaches	2
	22	Risk Assessment and Mitigation Strategies	2
V	**Practical module**		**30**

Programme	B. Sc. Aquaculture Honours					
Course Title	Business Aspects of Ornamental Fish Trade					
Type of Course	**Vocational Minor (Group1)**					
Semester	VIII					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	Business Aspects of Ornamental Fish Trade" provides a comprehensive overview of the global ornamental fish industry, covering market trends, regulatory frameworks, ethical considerations, and business management strategies essential for success in the trade.					

Course outcome

CO	Understand the structure and dynamics of the global ornamental fish industry.	Understand (U)	Conceptual Knowledge (C)	Written exams, case studies
CO1	Analyze market trends and conduct demand analysis in the ornamental fish trade.	Analyze (An)	Procedural Knowledge (P)	Quizzes, research projects
CO2	Explain the legal and regulatory frameworks governing the ornamental fish trade.	Understand (U)	Conceptual Knowledge (C)	Written exams, presentations
CO3	Evaluate ethical considerations and sustainability practices in the ornamental fish industry.	Evaluate (E)	Conceptual Knowledge (C)	Case studies, project reports
CO4	Develop effective branding and product differentiation strategies.	Create (C)	Procedural Knowledge (P)	Group projects, presentations
CO5	Apply pricing strategies and market positioning techniques in the ornamental fish trade.	Apply (Ap)	Procedural Knowledge (P)	Practical exams, seminar presentations
CO6				
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	B. Sc. Aquaculture Honours					
Course Title	Fundamentals of Fish Processing					
Type of Course	**Vocational Minor (Group2)**					
Semester	I					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2 hours
Pre-requisites	A Pass HSC/VHSC or Equivalent with biology					
Course Summary	The course "Fundamentals of Fish Processing" covers essential aspects of processing techniques, including preservation methods, quality control, and safety standards, crucial for efficient and sustainable fish production					

Course outcome

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the principles and significance of fish processing in aquaculture.	Understand	Conceptual Knowledge	Written exams, Assignments
CO2	Apply proper fish handling and preservation techniques to maintain product quality.	Apply	Procedural Knowledge	Practical exams, Lab reports
CO3	Demonstrate proficiency in various fish processing techniques and value-added products.	Apply	Procedural Knowledge	Practical exams, Case studies
CO4	Evaluate the quality control measures and packaging standards in fish processing.	Evaluate	Conceptual Knowledge	Presentations, Project reports
CO5	Gain practical experience in fish processing operations through hands-on activities.	Apply	Procedural Knowledge	Lab practicals, Field visits
CO6	Analyze the importance of regulatory standards and safety measures in fish processing.	Analyze	Conceptual Knowledge	Research projects, G

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Programme	B. Sc. Aquaculture Honours					
Course Title	Seafood Safety and Quality Control					
Type of Course	**Vocational Minor (Group2)**					
Semester	II					
Academic Level	100-199					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	Seafood Safety and Quality Control" provides students with comprehensive knowledge and practical skills in ensuring the safety, quality, and regulatory compliance of seafood products through a thorough examination of industry standards, regulatory frameworks, and quality assurance practices.					

Course outcome

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the regulatory framework and standards governing seafood safety and quality.	Understand	Conceptual	Assignments, Examinations
CO2	Identify and assess various hazards in seafood and implement Hazard Analysis and Critical Control Points (HACCP).	Apply	Procedural	Case Studies, Practical Exams
CO3	Demonstrate proficiency in conducting sensory, chemical, and microbiological analysis of seafood products.	Apply	Procedural	Lab Reports, Practical Exams
CO4	Manage and mitigate contaminants in seafood processing, including toxins, heavy metals, and microbial contamination.	Apply	Procedural	Research Projects, Presentations
CO5	Implement safety protocols, risk management strategies, and crisis communication in seafood processing.	Apply	Procedural	Seminar Presentations, Group Projects
CO6	Apply quality control measures, sanitation practices, and traceability systems to ensure seafood safety and compliance.	Apply	Procedural	Practical Examinations, Field Visits

Programme	B. Sc. Aquaculture Honours					
Course Title	Value-Added Fish Products Development					
Type of Course	**Vocational Minor(Group2)**					
Semester	III					
Academic Level	200-299					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course "Value-Added Fish Products Development" explores processing techniques, market analysis, and practical applications to enhance the value and market competitiveness of fish products through innovative processing methods and consumer-oriented strategies.					

Course outcome

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the concept of value addition in the fish processing industry	Understand (U)	Conceptual Knowledge (C)	Written exams, quizzes, case studies
CO2	Apply techniques for developing new value-added fish products	Apply (Ap)	Procedural Knowledge (P)	Practical exams, lab reports, project reports
CO3	Analyze the market trends and consumer preferences in the fish product market	Analyze (An)	Conceptual Knowledge (C)	Case studies, research projects, presentations
CO4	Evaluate strategies for branding, packaging, and product differentiation	Evaluate (E)	Conceptual Knowledge (C)	Group projects, seminar presentations, case studies
CO5	Demonstrate proficiency in processing and developing various value-added fish products	Apply (Ap)	Procedural Knowledge (P)	Practical exams, lab practicals, field visits
CO6	Integrate knowledge of fish processing techniques with market demands	Create (C)	Conceptual Knowledge (C)	Project reports, group projects, presentation
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Programme	B. Sc. Aquaculture Honours					
Course Title	Advanced Packaging and Preservation Techniques					
Type of Course	**Vocational Minor(Group2)**					
Semester	VIII					
Academic Level	300-399					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	Exam Duration
	4	3	-	2	75	2 hours
Pre-requisites	A Pass in HSE/VHSE or Equivalent with biology Should have completed previous semesters					
Course Summary	The course "Advanced Packaging and Preservation Techniques" provides an in-depth exploration of modern packaging and preservation technologies, focusing on their applications in enhancing the shelf life, safety, and sustainability of aquaculture products.					

Course outcome

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understanding the fundamentals of packaging technologies and their role in food preservation.	U	Conceptual Knowledge	Written exams, quizzes
CO2	Ability to identify and evaluate different packaging materials and methods based on their suitability and effectiveness.	An	Procedural Knowledge	Lab reports, case studies
CO3	Applying design principles to develop packaging solutions that meet specific requirements and address sustainability concerns.	Ap	Procedural Knowledge	Project reports, presentations
CO4	Analyzing advanced packaging technologies and their applications in food preservation and quality enhancement.	An	Conceptual Knowledge	Research projects, group projects
CO5	Evaluating regulatory standards, safety considerations, and consumer preferences in packaging and food preservation.	E	Factual Knowledge	Seminar presentations, case studies
CO6	Demonstrating practical skills in assessing the effectiveness and performance of various packaging and preservation techniques.	Ap	Procedural Knowledge	Lab practicals, field trips, practical exams
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive				