ABOUT THE COURSE

Vocational education, a dream of Mahatma Gandhi, was realized by the central government in the year 1983 to address the problem of massive unemployment among the youth in our country. Among the different vocational courses introduced, Fisheries courses have great relevance. Being a country with a vast coastline of about 8000 km, fishing and allied industries play an important role in providing employment to a vast majority of the population, as well as sustaining the economy with the foreign exchange earned from the export of various fisheries products. Among the maritime states of India, Kerala holds a remarkable position in fisheries sector. That is why the importance of fisheries in the economic development of Kerala was emphasized by Dr. APJ Abdul Kalam.

The course 'Marine Fisheries & Sea food Processing' (MFSP) is a two year vocational course introduced in Kerala VHSE curriculum as an updated, modified, multi skilled course. Since Kerala is having a large coast line and an active fishing community relying on the marine fisheries, the course will enable the students to acquire various skills needed for the industry. It offers scope in studying new technologies, and helps to improve the fishing industry, which directly or indirectly helps to improve the standard of living of fisher folk and also generates employment opportunities.

Since the sea food processing industry is deeply connected with marine fish resources, the introduction of multi skilled modular based 'Marine Fisheries & Sea food Processing' course with four modules namely Fishing Technology, Fish Processing Technology, Fish Quality Control & Inspection systems and Fishery value added & byproducts has great importance in vocational education.

JOB ROLES (CAREER PATH)

GOVT/SEMI GOVT SECTOR/PRIVATE SECTOR

- Entry cadres in Fisheries Dept. Govt. of Kerala
- Laboratory Technical Assistant in VHSE
- Field assistants in Fisheries Institutions like Matsyafed
- Quality control supervisors in Fish processing plants
- Production assistants in Fish meal plants, Chitosan plants
- Microbiology lab assistants in fish processing plants
- Supervisors in value added fishery products manufacturing units

SELF EMPLOYMENT

- Fish drying unit
- Fish pickle unit
- Fish meal production
- Chitin/chitosan production
- Fish cutlet unit
- Fish trading
- Preprocessing units

SUBJECT APPROACH

Man has constantly been trying to explore the universe for providing himself with food, clothing and housing. These days the problems of food have become very drastic and it is being felt that supplementing agriculture could develop the main weapon in war on hunger. Fisheries is one of the important allied activities of agriculture sector. It is regarded as a powerful income and employment generator as it stimulates the growth of a number of subsidiary industries. This is also a foreign exchange earner besides providing balanced protein food to all classes of people. India possesses ideal conditions for improvement of fisheries. In spite of various advantages of fish as a valuable source of food, its availability is rather restricted in India on account of limited fishing industry. Till recently fishing and allied activities were restricted with certain sector of population. Boats, nets and tackles are what were devised centuries ago and are made by hands while other countries have marched much ahead with modern techniques. Organization of fishing industry on modern line will go a long way in solving the food problem in the country and improving the life of the fishermen who constitute a significant part of India's population.

One of the important objectives of fisheries development has been improvement of economic condition of fishermen who are the prime producers. One of the best ways to uplift the fisher folk is to eradicate illiteracy and to give awareness about new techniques developed in fishing and allied industries. Today fisheries have been incorporated in our education system as a subject at various levels. Our approach is to teach fisheries as a vocational subject to transfer the scientific and technical knowhow to learners, which will empower them to transfer the knowledge to fisheries sector and modernize it. A diverse range of methods have been evolved to exploit marine fishery resources and to preserve a wide range of fish species in different parts of the world. Significant development has taken place in the fisheries sector and degree of sophistication in the operation and handling in the last decades.

Advances in the fishing technology, post harvest technology, Quality control and monitoring systems have increased the precision and efficiency of fish preservation and handling. In the course of MFSP, it is attempted to give an overview of the important fish resources, fishing methods, preservation methods, preparation of fishery products, quality assurance and environmental impact of processing industry. It is hoped that this will be useful source of information for the students of fisheries science and may inspire them to share their knowledge for the overall development of fisheries sector and fisher folk.

LEARNING STRATEGIES

Every function in the child's cultural development appears twice: first, on the social level and, later on, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological). The studies conducted by UNESCO and SCERT on the various defects of teacher centered interaction revealed that the knowledge construction within the student will sustain only through interpsychological and intrapsychological processes. Thus the learning activities in education process have conceived the new idea of student centered, skill centered and activity oriented educational approach. According to this approach, the learning activities should pave way for the construction of knowledge. While selecting the learning activities we should take into account the nature, mental ability and skill of students. This approach should explore the activities like problem solving and self studying. It is important that the new educational approach should create opportunities for individual learning, co-learning and group learning. For this we can adopt different strategies and techniques:-

Discovery learning

Here the learning takes place in problem solving situations where the learner draws on his own experience and prior knowledge and is a method of instruction through which students interact with their environment by exploring and manipulating objects, wrestling with questions and controversies, or performing experiments. The teacher has to create an atmosphere that encourages the learner to discover ideas and facts of his own. For example; the teacher can assign the students to identify and classify marine fishes. This gives an opportunity for the learner to observe fishes in the local market and collect information from different sources like internet and journals. Their observation can be consolidated and presented.

Co-operative learning

Co-operative learning is an educational approach which aims to organize classroom activities into academic and social learning experiences. In this method, the learners learn by helping each other. The negotiations among peers take place here. For example, if the

teacher wants to make an awareness among the students about different fishing methods, the students can be divided into different groups and a group discussion on the topic can be conducted. The ideas evolved from the discussion can be consolidated and presented in the class by one person from each group.

Collaborative learning

Collaborative learning is a situation in which two or more people learn or attempt to learn something together. Unlike individual learning, people engaged in collaborative learning capitalize on one another's resources and skills (asking one another for information, evaluating one another's ideas, monitoring one another's work, etc.). More specifically, collaborative learning is based on the model that knowledge can be created within a population where members actively interact by sharing experiences.

Socio - cultural related learning

This method of learning pertains to social and cultural aspects of the society. For example, to study the problems faced by fishermen in keeping the fish in fresh condition, conduct an informal interview with the fishermen to understand the problems, find out solutions and prepare a report.

Role of learner

The needs of the learner should reflect in the learning process. Active participation, making use of resources, applying thoughts, make interpretations, draw inferences, dedication for acquiring expertise or skill are expected from a learner.

A congenial atmosphere inside and outside the class room where transaction takes place should be ensured by the learner as well as by the teacher.

Role of teacher

The teacher's role is redefined nowadays from an actual teacher to one who learns the learners, knows his strength and weakness, arranges the resources, needs as and when required, creates learning situations, learns with the learner, assists or scaffolds the learner throughout the learning process, evaluates the learner and equips him further to live in the society.

Role of supporting system

The school resource group, parent teacher association, Government and nongovernmental organisations are the main supporting systems. A live institution-industrial linkage is also essential in imparting vocational education.

Evaluation

In educational process the evaluation should be systematic, continuous and comprehensive. A good scheme of evaluation can be drawn in such a way that it can measure the skill or expertise acquired by the learner. The aptitude, attitude and approach of the learner should also be assessed for better evaluation.

ICT possibilities

Vocational education is practical oriented, even though time will be a limiting factor for learning processes. Hence the curricular objectives can be achieved by making use of new technologies like ICT enabled education. Making use of multimedia, CDs are helpful in transaction processes inside the classroom as the learner understands more from what he sees than hear.

Learning Situations

Fish processing plants, Fish drying units, Fish meal plants, Chitin / chitosan plants and Pre processing centres are the most suitable areas for skill development. Students can make use of the hands on experience and knowledge of industrial experts, which are more effective than the classroom situation for the learning process.

Resources

The state of Kerala is endowed with a long coastline of 590 km providing good marine fish resources, fishing harbours, landing centres and an established fish processing industry. Other than the school level infrastructure and human resources, vocational education requires more practical experience from the industry.

OJT / field visit

More than the class room activities OJT / Field visits provide the needed practical exposure for the students in an applied field like fishing technology and fish processing. In Kerala all the V.H.S.E schools which offer Marine Fisheries & Sea food Processing courses are having industrial linkages and they are situated near by coastal areas. The students can utilize the facilities of institutions like CIFNET, NIFPHATT, CIFT, MATSYAFED etc. and various projects of fisheries department.

Inclusiveness

Vocational education is a group activity and the learners are a heterogeneous mixture of gifted learners, average learners, slow learners and differently abled learners. Our class rooms ensure the participation of these groups and reap benefit.

SYLLABUS

Module I: FISHING TECHNOLOGY

Unit 1.1: **Marine fishery resources of India**

Marine environment, Commercially important fishery resources

Unit 1.2: **Fishing crafts and gear**

Fishing craft, Fishing gear and its operation, Fish finding devices and FAD's

Unit 1.3: **Deep sea fishing**

Scope and opportunities of deep sea fishing, deep sea resources

Unit 1.4: Navigation and seamanship

Navigational equipments and aids, Life saving appliances

Unit 1.5: Conservation of fishery resources

Responsible fishing, Marine legislation.

Module II: FISH PROCESSING TECHNOLOGY

Unit 2.1: Nutritive values of fish

Proximate composition of fish- fish protein, fish lipids, vitamins & minerals, NPN compounds, importance of fish as food material

Unit 2.2: Fish spoilage

Post mortem changes in fish, sensory evaluation

Unit 2.3: Fish handling

Onboard and onshore fish handling, icing/chilling, cold chain

Unit 2.4: Fish preservation methods

Basic aspects of fish preservation, traditional processing methods

Unit 2.5: Fish drying

Principle of fish drying, solar/mechanical driers, common defects found in dried fish

Unit 2.6: Freezing technology

Principle of freezing, different types of freezers; freezing of fish, prawn, cephalopods & crabs; common defects found in freezing

LEARNING OUTCOMES

After the completion of first two modules of the course the learner:

1.1.1 Classifies marine ecosystem

1.1.2 Describes mud bank

1.1.3 Identifies major fishing zones of India, maritime states, coastal districts of Kerala.

1.1.4 Describes and label the Morphology of typical prawn and fish

1.1.5 Differentiates Teleost and elasmobranch

1.1.6 Identifies commercially important fishes, and describes their distribution, fishing season, breeding season and fishing methods

1.1.7 Records catch trend and export data

1.2.1 Identifies different traditional, mechanized & motorized fishing crafts

1.2.2 Identifies fishing gears and explains its operation

1.2.3 Identifies & familiarizes with fish finding devices and fish aggregating devices and discusses PFZ & INCOIS

1.3.1 Identifies the scope and opportunities of deep sea fishing

1.4.1 Identifies & familiarizes with marine compass, radar, GPS, VHF, AIS, radar reflector, heliograph, Flag , signal lights

1.4.2 Demonstrates the use of life saving appliances

1.5.1 Discusses the code of conduct of responsible fisheries

1.5.2 Discusses KMFRA, trawl ban, EEZ, CRZ

2.1.1 Explains Proximate composition of fish muscle and importance of fish as food material.

2.1.2 Lists fish protein

2.1.3 Classifies fish based on its fat content as fatty fish, semi fatty and lean fish.

2.1.4 Identifies vitamins & minerals present in fish and its deficiency diseases

2.1.5 Lists NPN compounds like TMAO, ammonia, urea, free amino acids

2.1.6 Describes the importance of fish in human diet and explain the role of PUFA , list the deficiency diseases

2.2.1 Explains the post mortem changes.

2.2.2 Differentiates spoiled and fresh fish.

2.3.1 Employs hygienic handling of fish onboard and onshore.

2.3.2 Categorizes different types of ice.

2.3.3 Describes cold chain.

2.4.1 Discusses various fish preservation techniques.

2.5.1 Describes the principle involved in drying and factors affecting the process of drying.

2.5.2 Operates different solar driers and mechanical driers like tunnel drier, rotary drum drier.

2.5.3 Observes various defects of dried products and employ preventive measures

2.6.1 Describes the principle of freezing, slow & quick freezing, Factors affecting freezing

2.6.2 Operates different types of freezers like horizontal plate freezer, tunnel freezer, IQF

2.6.3 Employs freezing of fish, prawn, cephalopods and crabs.

2.6.4 Identifies freezing defects like Dehydration, drip loss, freeze burn, blue discoloration in crab and employs preventive measures

SCHEME OF WORK

The course is divided into the following four modules. Each module is of six months duration.

Module I: FISHING TECHNOLOGY

Month	Unit No.	Name of Units	Periods
June	1.1	**Marine fishery resources**	
		Marine environment	70
		Commercially important fishery resources	80
July August	1.2	**Fishing crafts and gears** Fishing crafts Fishing gears and its operation	 30 45
August	1.3	**Deep sea fishing** Scope of deep sea fishing	 15
September	1.4	**Navigation & seamanship**	
		Navigational equipments and aids	15
		Life saving appliances	15
October	1.5	**Conservation of fishery resources**	
		Responsible fishing	15
		Marine legislation	15

Module II: FISH PROCESSING TECHNOLOGY

Month	Unit No.	Name of Units	Periods
November	2.1	**Nutritive values of fish**	
		Proximate composition of fish	30
		Fish protein	
		Fish lipids	
		Vitamins & minerals	
		NPN compounds	
		Importance of fish as a food material	
November	2.2	**Fish spoilage**	20
		Post mortem changes in fish	
December		Sensory evaluation	30
December	2.3	**Fish handling**	
		Onboard & onshore fish handling	20
January		Icing / chilling	
		Cold chain	
January	2.4	**Fish preservation methods**	
		Various fish preservation methods	20
January	2.5	**Fish drying**	
		Principle of fish drying,	10
		Factors affecting rate of fish drying	
		Solar / mechanical driers	50
		Defects in dried fish	20
February	2.6	**Freezing technology**	
		Principle of freezing	
		Factors affecting rate of freezing	10
		Types of freezers	40
		Freezing of fish, prawn, cephalopods and crabs	50
		Common defects in freezing	40

COURSE STRUCTURE

This course consists of 4 modules such as:-

Sl .No	Name of Module	Total periods
Module 1	*Fishing Technology*	*340*
Module 2	*Fish processing Technology*	*340*
Module 3	*Fish quality control & Inspection Systems*	*340*
Module 4	*Fishery value added & byproducts*	*340*

CLASS ROOM ACTIVITIES

- General discussions
- Seminars
- Group discussions
- Debate
- Interaction with industrial experts
- Power point presentation
- IT enabled audio visual aids
- Exhibitions - charts, diagrams
- Assignments
- Projects

PRACTICAL ACTIVITIES

- Lab works
- Field visits
- Model preparations
- Survey
- Case study
- PTC / OJT

ON THE JOB TRAINING

OJT is an essential part of vocational education to impart technical skills in the specific areas. It gives a good platform for students to learn the working condition and work culture. OJT helps the learner to identify the skill needs of the industry. It is the place where the students acquire and polish their vocational skill. The students get familiarized with the administrative background of the institution where they undergo training. This will contribute the managerial skill in future. A total one month OJT can be scheduled as per the modules in related industries.

OJT centres include private organizations, Govt. /Semi govt. organizations:

- ABAD Fisheries, Vizhinjam, Thiruvananthapuram
- SIFFS, Karamana, Thiruvananthapuram
- KING MARINE PRODUCTS, Uliyakovil, Kollam
- SAN MARINE Exports, Sakthikulangara, Kollam
- CAPITHAN Exports, Sakthikulangara, Kollam
- IAP, Sakthikulangara, Kollam
- NETTOS Exports, Sakthikulangara, Kollam
- SIFFS, Sakthikulangara, Kollam
- Dry Fish Compex, Dept. of Fisheries, Sakthikulangara, Kollam
- Nalapakam, Dept. of Fisheries, Sakthikulangara, Kollam
- MATSYAFED Chitosan Plant, Neendakara
- CHARLY'S Fisheries, Neendakara, Kollam
- KING Fisheries, Neendakara, Kollam
- VERONICA Exports, Neendakara, Kollam
- NIFPHATT, Ernakulam
- CIFNET, Ernakulam
- CIFT, Wellington Island, Ernakulam
- MATSYAFED Ice & Freezing Plant, Kochangadi, Ernakulam
- MATSYAFED Net Factory, Nr. High Court, Ernakulam
- UNIROYAL Marine Exports, Vengalam, Kozhikode
- National Mariners, Puthiyappa, Kozhikode
- SIFFS, Eranjipalam, Kozhikode
- MATSYAFED Fish Meal Plant, Azheecode, Kodungalloor, Thrisur
- MATSYAFED Fish Meal Plant, West Hill, Kozhicode

Certification of skills in each module

- Skill Certificate in FISHING TECHNOLOGY
- Skill Certificate in FISH PROCESSING TECHNOLOGY
- Skill Certificate in FISH QUALITY CONTROL & INSPECTION SYSTEMS
- Skill Certificate in FISHERY VALUE ADDED & BYPRODUCTS

OVERVIEW OF MODULE - 1 FISHING TECHNOLOGY

The fisheries sector of our country is presently on the path of transformation from traditional practices to mechanization. The fish

processing factories and seafood export of the country accounting for a significant contribution to our foreign exchange earnings depends greatly on the marine fisheries sector. The advent of modern equipments and techniques in these sectors demands for the creation of skilled manpower. The deep sea fishery resources still remain under exploited in our waters and the present module aims to provide an overview of the potential of deep sea fisheries to the learners. The module emphasizes on the potential fish stocks, different craft and gears used for its exploitation, fish finding devices, navigational equipments and life saving appliances.

List of Expected Skills

- Classification of marine ecosystem and major fishing zones
- Identification of commercially important fish resources of India
- Identification of fishing craft & gear
- Operation of fishing gears
- Identification of fish finding devices, navigational equipments and life saving appliances
- Marine legislation
- Units under which module I is given below:

MODULE 1

Fishing Technology: 340Periods

Unit No.	Name of Units	Periods
1.1	Marine fishery resources of India	150(105 P, 45 T)
1.2	Fishing crafts and gear	100(70 P, 30 T)
1.3	Deep sea fishing	30(21 P, 9 T)
1.4	Navigation and seamanship	30(21 P, 9 T)
1.5	Conservation of fishery resources	30(21 P, 9 T)
	Total Periods	**340(238 P, 102T)**
*P – Practical, T - Theory		

30% periods - theory sessions and 70% periods - practical activities

Module 1 : FISHING TECHNOLOGY	Unit 1.1 Marine fishery resources of India (150 periods)		
Ideas/Concepts/Skill	**Learning Outcomes**	**Suggested Activities**	**Assessment**
Define Marine environment	• Classifies marine ecosystem- Continental shelf, continental slope and abyssal plain, Nerritic zone, Oceanic province • Describes mud bank, its occurrence ecology and Important fishery • Identifies major fishing zones of India, maritime states, coastal districts of Kerala	• General discussion • Chart preparation • Group discussion • Multimedia/field visit • Drawing diagrams and maps	• Discussion points • Prepared charts • Discussion points • Notes preparation/ • Report of field visit • Prepared diagrams and maps
Commercially important fishery resources	• Identifies the Morphology of typical prawn and fish • Differentiates Teleost and elasmobranch'	• Drawing diagrams and label the parts • Practical activity with specimen and Group discussion	• Prepared diagrams • Discussion points
	• Identifies commercially important fishes and describes distribution, fishing season, breeding season and fishing methods of Oil sardine, Mackerel, Anchovy, Tuna, Ribbon fish, Seer fish, Flat fishes, Silver belly, Carangids, Pomfrets, Elasmobranchs, Shrimps (tiger, naran, karikadi, kazhanthan, poovalan), lobsters, crabs, cephalopods, mussel, oyster • Analyses catch trend and export data	• Visit to landing centre and specimen collection • General discussion • Diagrams of specimens • Chart/ graph preparation • Seminar	• Report of field visit • Notes preparation • Prepared diagrams • Prepared charts/graphs Seminar report

Module 1 : FISHING TECHNOLOGY	1.2 Fishing Crafts and Gears (100 Periods)		
Ideas/Concepts/Skill	**Learning Outcomes**	**Suggested Activities**	**Assessment**
Fishing craft	• Identifies different traditional crafts like, catamaram, dugout canoe, plank built canoe and motorized fishing crafts like fibre boat, plywood boat and mechanized crafts like trawler, purse siener, troller, long liner	• General discussion • Field visit • Model display • Group discussion	• Notes preparation • Field visit report • Diagrams • Discussion points
Fishing gear and its operation	• Identifies fishing gears like gill net, trammel net, purse seine, boat seine, shore seine, trawl net, long line, trolling, hand line, fish traps and explain its fishing operations.	• Group discussion • Field visit • Interacting with fishermen • Models & multimedia	• Discussion points • Field visit report • Ability of interaction • Diagrams, notes preparation
Fish finding devices, FAD's	• Identifies and familiarizes with fish finding devices like sonar and fish aggregating devices/artificial reefs and discusses PFZ and INCOIS.	• General discussion • Field visit • Internet/ Multimedia	• Discussion points • Report of field visit Prepared notes
1.3 : Deep sea fishing (30 Periods)			
Deep sea fishing	• Identifies the scope and opportunities of deep sea fishing, identifies deep sea fishes such as Yellow fin tuna, Seer fish, Oceanic squids, Deep sea prawns like (Heterocarpus Sp.) and explains fishing methods like long line, trawling, hand line, jigging, fish attracting devices, fish baits.	• General discussion· • Multimedia· • Specimen collection	• Discussion points • Prepared notes • Diagrams

Module 1 : FISHING TECHNOLOGY	1.4 Navigation and seamanship (30 Periods)		
Ideas/Concepts/Skill	**Learning Outcomes**	**Suggested Activities**	**Assessment**
Navigational equipments and aids	• Identifies and familiarizes with marine compass, radar, GPS, VHF, AIS, radar reflector, heliograph, Flag and signal lights	• General discussion • Field visit to CIFNET/FSI	• Discussion points • Report on field visit
Life saving appliances	• Demonstrates the use of life saving appliances like Life buoy, life jacket, life raft, life boat, and search & rescue beacon.	• General discussion • Group discussion • Visit to CIFNET/FSI	• Discussion points • Field visit report
Responsible fishing	• Discusses the necessity of protecting the marine resources, the negative impact of destructive fishing methods and its legal issues, fishing gear mesh size regulations, perils of juvenile fishing and importance of square mesh, fish sanctuaries, closed season, closed fishing area.	• General discussion • Seminar • Assignment	• Prepared notes • Seminar points • Assignment report
Marine legislation	• Discusses about KMFRA, trawl ban, EEZ, CRZ	• General discussion • Case study • Interaction with fishermen • Internet	• Note preparation • Report on the study • Ability of interaction • Notes

PRACTICALS ACTIVITIES OF MODULE - I

Unit - 1

- Classifying the marine environment with the help of chart/ projector.
- Field visit to "CHAKARA" to observe mud bank formation and fishery there.
- Visit to fishing harbor, Collection and identification of specimens, recording.
- Recording Morphology of typical fish and prawn with the help of specimen.
- Identification of different crafts and gears through model preparation & field visit to fishing harbor/boat building yard.
- Collection and identification of deep sea fishes and prawns.
- Identification of gears used for deep sea fishing.
- Field visit and audio visual presentation of navigational equipments and aids.
- Demonstration of life saving appliances.

List of References:-

- Hand book on Fisheries & Aquaculture - ICAR publication
- Fishing Craft and Gear Technology - ICAR publication -Letha Shenoy

List of Tools:-

- Charts
- Models of fishing crafts and gears
- Life saving appliances
- Multimedia equipments like CDs, laptops and projectors
- Internet facility

OVERVIEW OF MODULE - 2

The captured fish across the world is inadequate to meet the total demand of population. So hygienic handling and preservation of captured fish is very important to utilize these resources to the maximum. In our country we have an organized sector of seafood processing and exporting which earns foreign money. In addition to these we have an organized internal as well as international fresh fish market. The important fish preservation techniques namely freezing technology, advanced mechanical drying and other preservation techniques such as canning, AFD etc. are included in this module. This module is aimed at providing skilled man power to the industry and encouraging possibilities of self employment.

List of Expected Skills

- Differentiate spoiled and fresh fish
- Fresh fish handling - Icing/chilling
- Categorise various methods of fish preservation
- Cold chain - fish transportation
- Skill in freezing and drying

Units under which module II is given below:

MODULE 2

FISH PROCESSING TECHNOLOGY

Unit No.	Name of units	Periods
2.1	Nutritive value of fish	30(21P, 9T)
2.2	Fish spoilage	50(35P, 15T)
2.3	Fish handling	20(14P, 6T)
2.4	Fish preservation methods	20(14P, 6T)
2.5	Fish drying	80(56P, 24T)
2.6	Freezing technology	140(98P, 42T)
	TOTAL PERIODS	**340(238P, 102T)**

30% periods - theory sessions and 70% periods - practical activities

Module 2 : FISH PROCESSING TECHNOLOGY **Unit 2.1 Nutritive values of fish (30 Periods)**

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
Proximate composition of fish	• Explains Proximate composition of fish muscle such as moisture, protein, fat, vitamins & minerals, NPN compounds, essential amino acids.	• General discussion • Group discussion • Seminar • Charts	• Questionnaire • Discussion points • Report of seminar • Prepared charts
Fish protein	• Differentiates fish protein into sarcoplasmic, fibrillar and stroma protein.	• General discussion	• Quiz • Open book exam
Fish lipids	• Classifies fish based on its fat content as fatty fish, semi fatty and lean fish.	• Collection and categorization of fish • Group discussion	• Collected specimens • Discussion points
Vitamins & minerals	• Lists vitamins & minerals present in fish	• Library reference • Group discussion	• Referred notes • Discussion points
NPN compounds	• Lists NPN compounds like TMAO, ammonia, urea, free amino acids	• Library reference • Group discussions	• Referred notes • Discussion points
	• Describes the importance of fish in human diet and explains the importance of essential amino acids and PUFA, lists the deficiency diseases like Kwashiorkor, Rickets, Night blindness	• General discussion • Seminar • Library reference • Internet • Media	• Prepared notes • Seminar points • Referred notes • Quiz • Questionnaire

Module 2 : FISH PROCESSING TECHNOLOGY		Unit 2.2 Fish spoilage (50 periods)	
Ideas/Concepts/Skill	**Learning Outcomes**	**Suggested Activities**	**Assessment**
Post mortem changes in fish	• Explains the post mortem changes like rigor mortis, glycolysis, autolysis, belly burst, microbial spoilage, nucleotide breakdown, formation of ammonia, TMA, histamine, indole, rancidity in fish.	• General discussion • Group discussion • Notes preparation	• Discussion points • Prepared notes
Sensory evaluation	• Differentiates spoiled and fresh fish.	• Observation of specimens • Sensory evaluation	• Sensory evaluation score
Unit 2.3 Fish handling (20 periods)			
Onboard & onshore fish handling	• Employs hygienic handling of fish onboard and onshore, chlorination & washing practices.	• Field visit to landing centre • Interaction with fishermen • Group discussion	• Report of field visit • Ability of interaction • Prepared notes
Icing/chilling	• Categorizes different types of ice such as block ice, flake ice, tube ice, gel ice, dry ice and employ icing practices.	• Visit to ice plant/ landing centre • General discussion	• Report on field visit • Prepared notes
Cold chain	• Describes chilled fish transport, fresh fish transport and live fish transport; identify Insulated box, Insulated cabin, Chilled storage, and Insulated/Refrigerated vehicles.	• General discussion • Field visit and interaction with industrial experts. • Seminar/Internet • Chart preparation	• Questionnaire • Report on field visit • Seminar notes • Flow chart of cold chain

Module 2 : FISH PROCESSING TECHNOLOGY	Unit 2.4 Fish preservation methods		
Ideas/Concepts/Skill	**Learning Outcomes**	**Suggested Activities**	**Assessment**
Basic aspects of fish preservation	• Discusses various fish preservation techniques like Salting, drying, smoking, freezing, canning, irradiation, freeze drying	• General discussion • Seminar	• Quiz • Seminar points
Unit 2.5 Fish drying (80 periods)			
Principle of fish drying	• Describes the principle involved in drying and factors affecting the process of drying viz. Temperature, air velocity, humidity, product thickness.	• General discussion • Group discussion	• Prepared notes • Discussion points/ Quiz
Solar/ mechanical driers	• Operates solar hot air drier and mechanical driers like tunnel drier, rotary drum drier.	• Field visit to drying plant • OJT/ PTC	• Report of field visit • Performance in OJT/PTC
Common defects found in dried fish	• Observes various defects such as rancidity, dun, pink/red spoilage, insects attack, case hardening, protein denaturation and employ preventive measures	• General discussion • Identification of spoiled specimens & suggest remedial measures	• Record of information • Observed defects & notes

Module 2 : FISH PROCESSING TECHNOLOGY **Unit 2.6 Freezing Technology**

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
Principle of freezing	• Describes the principle of freezing, Evaluates difference in quality of fish in slow & quick freezing • Factors affecting freezing	• General discussion • Group discussion	• Prepared notes • Discussion points
Different types of freezers	• Operates different types of freezers like horizontal plate freezer, tunnel freezer, IQF	• Freezing plant visit • OJT	• Report on field visit • OJT report
Freezing of fish, prawn, cephalopods, crabs	• Employs freezing of fish, prawn, cephalopods, crabs • Preprocessing steps; • Processing steps in individual freezing and block freezing; Different product styles.	• General discussion • Demonstration of freezing • Chart preparation • Industrial visit • OJT	• Prepared notes • Practical skill • Prepared charts • Field visit report • Record of information in practical log
Freezing defects	• Identifies freezing defects like Dehydration, drip loss, freeze burn, black spot formation, blue discoloration in crab and employ preventive measures	• General discussion/ Demonstration • Industrial visit • OJT	• Skill in identifying freezing defect • Field visit report • OJT report

PRACTICAL ACTIVITIES OF MODULE-2

- Chart preparation on proximate composition of fish
- Collection and classification of fishes into fatty fishes, semi fatty fishes and lean fishes
- Chart preparation of different types of protein
- Identification of belly burst
- Differentiating spoiled fish and fresh fish
- Sensory evaluation through scoring method
- Icing/chilling practice, calculation of quantity of ice required for chilling
- Chart preparation of steps in cold chain
- Preparation of curing mixture and drying of fish, prawn
- Preparation of dried prawn pulp
- Structure and operation of different driers
- Identification of defects in dried products and its preventive measures
- Pre processing of fish/prawn/cephalopods for freezing
- Preparation of different product styles of fish, prawn, cephalopods, crab
- Yield calculation of different product styles
- Preparation of block frozen fish, prawn, cephalopods, crabs
- Identification of freezing defects

List of references:-

- Quality Assurance in Fish Processing - Gopakumar
- Post mortem changes in fish - P K Khuntia
- Fish Processing Technology - Dr. T K Govindan
- Web site of CIFT

List of Tools:-

- Charts
- Specimens
- Freezer

Practical Assessment

The practical skill must be evaluated after completing all experiments in each module and the evaluation must cover all required indicators such as technical skill and practical knowledge of the different topics covered.

DETAILED UNIT ANALYSIS

UNIT NUMBER: 1 MARINE FISHERY RESOURCES OF INDIA

UNIT Overview: Marine fishery resource of India plays a vital role in the economy of our country. Apart from earning millions of currency as foreign exchange, it plays a major role in feeding large population of the country with low cost high quality protein rich diet. Since India is having large coastal line of 8129 Km. marine fisheries provides job to millions of people living along the coastal belt of the country.

Module 1 : FISHING TECHNOLOGY **Unit 1.1 Marine fishery resources of India (150 periods)**

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
Define Marine environment	• Classifies marine ecosystem- Continental shelf, continental slope and abyssal plain, Nerritic zone, Oceanic province • Describes mud bank, its occurrence, ecology and Important fishery • Identify major fishing zones of India, maritime states, coastal districts of Kerala	• General discussion • Chart preparation • Group discussion • Multimedia/field visit • Drawing diagrams and maps	• Discussion points • Prepared charts • Discussion points • Notes preparation • Report of field visit • Prepared diagrams and maps
Commercially important fishery resources	• Identifies the Morphology of typical prawn and fish • Differentiates Teleost and elasmobranch	• Drawing diagrams and label the parts • Practical activity with specimen and Group discussion	• Prepared diagrams • Discussion points
	• Identifies commercially important fishes and describes distribution, fishing season, breeding season and fishing methods of Oil sardine, Mackerel, Anchovy, Tuna, Ribbon fish, Seer fish, Flat fishes, Silver belly, Carangids, Pomfrets, Elasmobranchs, Shrimps (tiger, naran, karikadi, kazhanthan, poovalan), lobsters, crabs, cephalopods, mussel, oyster • Analyses catch trend and export data	• Visit to landing centre and specimen collection • General discussion • Diagrams of specimens • Chart/ graph preparation • Seminar	• Report of field visit • Notes preparation • Prepared diagrams • Prepared charts/graphs Seminar report

Concept: MARINE ENVIRONMENT

Suggested activities: General discussion

The teacher introduces the concept of marine ecosystem. After that teacher displays a chart with the help of projector to show the different ecological zones of marine environment such as

Topography of ocean floor

- Continental shelf
- Continental slope
- Abyssal plain

Division of water column

- Nerritic region
- Oceanic province

Teacher explains the importance of each zone regarding the fishery resources available there. After this teacher consolidates these points and students prepare a neat chart showing different zones of marine environment and prepare notes in their activity log.

MUD BANK: A general discussion on the formation of mud bank and its importance in the fishery of Kerala during monsoon.

Points for discussion:

- Formation of mud bank
- Important fishery of mud bank

Major fishing zones of India: Teacher introduces the point through general discussion in the class. Then displays the map of India and mark different zones like SW, NW, NE and SE, and maritime states included in these zones. Teacher can consolidate the points and students prepare notes, charts showing different fishing zones with maritime states in the activity log book.

Consolidation points

- Fishing zones
- Maritime states

Concept: COMMERCIALLY IMPORTANT FISHERY RESOURCES

Suggested activities: *General discussion/Group discussion/Chart preparation*

Morphology of fish and prawns: conduct a general discussion in the class about fish, prawns and its external features. Students recollect concept of fish studied in the earlier biology class. Then the teacher displays the chart showing external features of a typical prawn and

a fish. Teacher consolidates the points and students prepare the notes and figures of typical prawns and fish in their activity log book

Consolidation points

- External features of prawn and fish
- Differentiate Teleost and Elasmobranch

Commercially important fishes of India: Teacher starts a general discussion on commercially important fish resources of India and asks the students to divide into groups and conducts group discussion and directs each group to list important fishes, prawns, lobsters, crabs, mollusc varieties they have seen. Teacher consolidates the points.

Consolidation points

- Identification of fish varieties
- Distribution of fishes
- Fishing season
- Breeding season
- Capture methods and
- Catch trends

Students prepare notes and charts of important fishery resources of India.

CE Possibilities

a. Process assessment

- Group discussion
- Chart preparation

b. Portfolio assessment

- Report, Charts
- Discussion points / participation

c. Unit assessment

- Quiz
- Unit test
- Questionnaire
- Open book exam
- Preparation of question and writing answers.

Practical Assessment

The practical skill must be evaluated after completing all experiments in each module and the evaluation must cover all required indicators such as technical skill and practical knowledge of the different topics covered.

SAMPLE TERMINAL EVALUATION QUESTIONS

1. More than 80% of marine landings come from the _____ zone of ocean.

- Oceanic province
- Nerritic zone
- Continental slope
- Abyssal plain

2. Complete the sequence

- SW ZONE : _____
- _____: Tamil Nadu

3. OIL SARDINE—*Fragilaria oceanica*

Analyze the relationship between the above and comment on it.

4. *Sardinella longiceps*

Given above is a major fishery resource along West coast of India.

- Write the common name of this species
- Its distribution
- Fishing season
- Capture method

1. Match the column A with the column B and C.

A	B	C
Gill slits	Cephalothorax	Sardine
Walking legs	Terminal mouth	Shark
Operculum	Ventral mouth	Prawn
	Pelvic fin	Cuttle fish
		squid

2. Oil sardine

Mackerel

Anchovy

Given above are important pelagic resources of Kerala.

- Write a brief note on distribution and fishing season
- Capture methods
- Give the scientific names

Existing standard list for the course 'Fish Processing Technology' (FPT)

Sl. No	Type	Item	Specn.	Qty	Subject
1	Tools	Chemical balance (Common balance)		1	FPT
2	Tools	Physical balance		1	FPT
3	Tools	Auto clave		1	FPT
4	Tools	Incubator	24x24x30 3 shelved	1	FPT
5	Tools	Hot Air oven	24X24X24X		FPT
6	Tools	Colony counters		1	FPT
7	Tools	Distilled water unit	3 to 4	1ltr	FPT
8	Tools	Microscope		2nos	FPT
9	Tools	Refrigerator	300ltr.(double door)		FPT
10	Tools	Hot plate		1	FPT
11	Tools	Water bath		1	FPT
12	Tools	Muffle furnace		1	FPT
13	Tools	Over head projector		1	FPT
14	Tools	L..P.G.stove		1	FPT
15	Tools	Desiccator		1	FPT
16	Tools	Mixer/Grinder		1	FPT
17	Tools	Kjeldhas distillation unit		1	FPT
18	Tools	Sochelt apparatus		1	FPT
19	Tools	Kitchen balance		1	FPT
20	Tools	Petridishes with cover 100mm		150nos	FPT
21	Tools	Test tubes	18X150mm	100	FPT
22	Tools	Test tubes	12X100mm	100	FPT
23	Tools	Pipettes	1ml Capacity graduated	150	FPT
24	Tools	Pipettes	5ml Capacity graduated	25	FPT
25	Tools	Pipettes	10ml Capacity graduated	5	FPT
26	Tools	Pipettes	20mlCapacity graduated	25	FPT
27	Tools	Burette	50ml Capacity	26 nos	FPT
28	Tools	Conical Flasks	100ml	50	FPT
29	Tools	Conical Flasks	250ml	25	FPT
30	Tools	Conical Flasks	500ml	5	FPT
31	Tools	Measuring cylinder	10ml	2	FPT
32	Tools	Measuring cylinder	100ml	5	FPT
33	Tools	Measuring cylinder	250ml	5	FPT
34	Tools	Measuring cylinder	500ml	1	FPT
35	Tools	Beakers	100ml	10	FPT

Sl. No	Type	Item	Specification	Qty	Subject
36	Tools	Beakers	250ml	5	FPT
37	Tools	Beakers	500ml	3	FPT
38	Tools	standard flask	100ml	1	FPT
39	Tools	standard flask	1000ml	1	FPT
40	Tools	Funnels	50 mm dia.	5	FPT
41	Tools	Thermometer	Up to 100C	2	FPT
42	Tools	Thermometer	360 C	2	FPT
43	Tools	Watch glass	8mm dia	5	FPT
44	Tools	Mortars & Pezzle		5	FPT
45	Tools	Bunser Burner		5	FPT
46	Tools	Sprit lamps		2	FPT
47	Tools	Glass rods		2	FPT
48	Tools	Microscopic Slides & slidecovers		1 cover each	FPT
49	Tools	Reagent bottle glass stoppered		10	FPT
50	Tools	Sample boxes(Steel)small		15	FPT
51	Tools	Silica dish		1	FPT
52	Tools	Scooper		1	FPT
53	Tools	Lighter		1	FPT
54	Tools	Vim powder		500 g	FPT
55	Tools	Se rubber		4 nos	FPT

Sl. No	Type	Item	Specn.	Qty	Subject
1	Consumables	Brown paper			FPT
2	Consumables	Cotton			FPT
3	Consumables	Cotton			FPT
4	Consumables	Rubber band			FPT
5	Consumables	Dettol			FPT
6	Consumables	Soap			FPT
7	Consumables	Lab towels(small)			FPT
8	Consumables	Platinum/Nicroe wire			FPT
9	Consumables	Filter paper			FPT
10	Consumables	PH paper			FPT
1	Non consumables	Loop holder		10	FPT
2	Non consumables	Plastic Bucket		3	FPT
3	Non consumables	Plastic stainer		10	FPT
4	Non Consumables	Plastic Basin		10	FPT
5	Non Consumables	Pipette stands		5	FPT
6	Non Consumables	Burette Stands		26	FPT

Sl. No	Type	Item	Specn.	Qty	Subject
7	Non Consumables	Aluminium Baskets (for test tubes)	6"X 6" X 6"	6 nos	FPT
8	Non Consumables	Pipette barrel	88	3 nos	FPT
9	Non Consumables	Petri dish barrel		3 nos	FPT
10	Non Consumables	Wash bottle		10	FPT
11	Non Consumables	Tripod stand		2	FPT
12	Non Consumables	Wire gauze		2	FPT
13	Non Consumables	Spatula		5	FPT
14	Non Consumables	Test tube stands		20	FPT
15	Non Consumables	Plastic cans		2	FPT
16	Non Consumables	Knives	5 ltr	30	FPT
17	Non Consumables	Chopping board		26	FPT
18	Non Consumables	Frying pans (big size)		2	FPT
19	Non Consumables	Vessels for Cleaning	Large	2 2	FPT
	Non Consumables	fish(steel)	Medium		FPT
20	Non Consumables	Cans with lid		10	FPT
21	Non Consumables	Specimen jars with screw lid		60	FPT
22	Non Consumables	Working table (SS top[with ful drainage acility)		2 nos	FPT
					FPT
23	Non Consumables	Map of Kerala and India		1 each	FPT
24	Consumables	MPEDA chart Showing			FPT
11	Consumables	Commercially important fish,		500 g	FPT
12	Consumables	shell fish and molluscs		1 Litre	FPT
13	Consumables	Potassium dihydrogen ortho		500 g	FPT
14	Consumables	phosphate		250 g	FPT
15	Consumables	Glacial Acetic acid		500 g	FPT
16	Consumables	Sodium thio sulphate		500 g	FPT
17	Consumables	Potassium Iodide		5 bottles	FPT
18	Consumables	Starch		2 ltr	FPT
19	Consumables	Sodium hydroxide		1 ltr	FPT
	Consumables	Surgical/Rectified spirit		500 g	FPT
		Formalin		500 g	FPT
20	Consumables	Chlorine solution (Sodium		100 g	FPT
		hypochlorite)	450 ml	500 g	FPT
21	Consumables	Sodium chloride		500 g	FPT
22	Consumables	Citric acid		500 ml	FPT
23	Consumables	Methyl red indicator		500 ml	FPT
24	Consumables	TPC agar		250 g	FPT
25	Consumables	Nutrient agar		250 g	FPT
26	Consumables	Conc. HCL		100 ml	FPT
27	Consumables	Conc. H2SO4		100 g	FPT
28	Consumables	K2SO4		500 ml	FPT

Sl. No	Type	Iitem	specn.	Qty	Subject
				500 g	FPT
28	Consumables	Cu SO4		500 g	FPT
29	Consumables	Bromocresol green		500 ml	FPT
30	Consumables	Boric Acid		500 ml	FPT
31	Consumables	Stl. NH4 SO4 Solution		250 g	FPT
32	Consumables	Petroleum ether		250 g	FPT
33	Consumables	Mono Sodium Glutamate		100 ml	FPT
34	Consumables	Vinegar		100 g	FPT
35	Consumables	Raw material Fish Shrimp		500 ml	FPT
36		Other ingredients like onion , potato, chilly powder, oil , spices , turmeric powder , wheat flour, bread powder etc.....along with vegetables.		500 50 g 1 litre	FPT FPT FPT FPT FPT FPT
37		Collections of fish species for identification and preservation.	450 ml	20 Kg 5Kg	

Additional requirement for the course 'Marine Fisheries and Sea food Processing' (MFSP)

Sl. No	Type	Item	Specn.	Qty	Subject
1	Non Consumables	Models of fishing crafts:- Catamaran, Dug out canoe Plank built canoe, Fibre boat Plywood boat, Trawler, Purse siener, Troller		1 each	MFSP
2	Non Consumables	Long liner Models of fishing gears:- Gill net, Trammel net, Purse seine, Boat seine, Shore seine Trawl net, Long line, Troll net Hand line, Fish traps, Jigs Fish baits,			MFSP
3	Non Consumables	Navigational equipments:- GPS, Heliograph, VHF, AIS, RADAR,			MFSP
4	Non Consumables	Life saving appliances:- Life buoy, Life jacket, Life raft Life boat, Search and rescue beacon			MFSP