A.D.M. COLLEGE FOR WOMEN (AUTONOMOUS)

(Accredited With 'A' Grade By NAAC 3rd Cycle)

(Affiliated to Bharathidasan University, Tiruchirappalli)

NAGAPATTINAM – 611 001

Bachelor of Vocational Degree Programme (B.Voc)

MARINE FOOD PROCESSING AND PRESERVATION TECHNOLOGY

(for the candidates admitted from the academic year 2021 -2022 onwards)

B.Voc. MARINE FOOD PROCESSING AND PRESERVATION TECHNOLOGY

SYLLABUS

2021-2024

Bachelor of Vocational Degree Programme (B.Voc)
MARINE FOOD PROCESSING AND PRESERVATION TECHNOLOGY
(2021-2024 Batch)
OBE ELEMENTS

Programme Educational Objectives (PEO):

PEO 1:	To study planktons, the drifting life forms inhabiting water bodies that nourish the higher tropic levels in the ocean ecosystem and also act as indicator species.
PEO 2:	To gain knowledge of Fishery Science with regards to Population Dynamics.
PEO 3:	To consider the application of statistical tools to study fishery science.
PEO 4:	To learn about aquaculture of fin fish as well as crustaceans and molluscs.
PEO 5:	To attain a clear perception of the present status of sea farming in India.

Programme Outcomes (PO):

On completion of the course the learner will be able

PO 1:	Living and non-living things in the sea - Marine flora and fauna - Basic characteristics of different sea species - The ocean zones
PO 2:	Memorise the names of some sea creatures - Distinguish between sea animals and plants - Understand the relationship between species
PO 3:	Fishing craft in small-scale fisheries are generally small. They fish the area of the sea close to the shore.
PO 4:	The gear they use often determines the fishing methods used. As the craft are small, there is very limited space onboard, which makes proper handling and preservation of the catch difficult.
PO 5:	Fishing communities confront severe problems in handling, distributing and marketing fish.

Programme Specific Outcomes (PSO):

On completion of the course the learner will be able

PSO 1:	Students with vocational training can find work in several state and central government organizations, non-profit groups, and academic institutions and in private sectors as well.
PSO 2:	This program prepares students for specific types of occupations and frequently for direct entry into the market.
PSO 3:	After completion of this program students will have enough competences, to get benefit from market opportunities.
PSO 4:	This program would enable students to update their knowledge and professional skills for entering the work force executing income generating activities or occupying better positions.
PSO 5:	At each exit level of this program, students will be able to apply knowledge of general education subjects and skill development subjects to the conceptualization of food processing technologies.

Bachelor of Vocational Degree Programme (B.Voc)
Marine Food Processing and Preservation Technology
(for the candidates admitted from the academic year --2021- 2022 Batch

STRUCTURE OF THE PROGRAMME

Part	Title of the part	No. of Courses	Hours	Credit
I	LC- Language Course	4	12	12
II	ELC – English Language Course	4	12	12
III	CC- Core Course	18	92	92
	AC –Allied Course	4	24	24
	MBE - Major Based Elective	-	-	-
IV	NME - Non- Major Elective	2	4	4
	SBE - Skill Based Elective	-	-	
	SSD – Soft Skill Development	1	2	2
V	ES - Environmental Studies	1	2	2
	VE - Value Education	1	2	2
	Mini Project	1	6	6-
	Internship	1	12	12
	Project	1	12	12
	Total	**38**	**180**	**180**

* **Extra Credit Courses**:

- Semester I - NIL
- Semester II-- NIL

Bachelor of Vocational Degree Programme (B.Voc)
MARINE FOOD PROCESSING AND PRESERVATION TECHNOLOGY
(for the candidates admitted from the academic year -- 2021- 2022 Batch
SCHEME OF THE PROGRAMME

Sem.	Part	Course Code	Course	Ins. Hrs	Credit	Exam Hours	Marks		Total Marks
							CIA	SE	
I	I	VLTA	LC- Language Course	3	3	3	25	75	100
	II	VLEA	ELC – English Language Course	3	3	3	25	75	100
	III	ZVA	CC- Core Course I Fundamentals of Marine Edible Animals	4	4	3	25	75	100
		ZVBY	CC- Core Practical Anatomy of Marine Edible Animals	6	6	3	40	60	100
		ZVCY	CC- Core Practical II Harvest and Post-Harvest Handling of Fishes	6	6	3	40	60	100
		ZVA1Y	AC –Allied Course Instrumentation and Computer Application in Fisheries	6	6	3	40	60	100
	IV	VE	Value Education	2	2	3	25	75	100
			Total	**30**	**30**	**21**	**-**	**-**	**700**
II	I	VLTB	LC- Language Course	3	3	3	25	75	100
	II	VLEB	ELC – English Language Course	3	3	3	25	75	100
	III	ZVD	CC - Core Course II Biochemical and Microbial Changes in Fish	4	4	3	25	75	100
		ZVEY	CC- Core Practical Chilling Technology	6	6	3	40	60	100
		ZVFY	CC- Core Practical IV Fish Canning Technology	6	6	3	40	60	100
		ZVA2Y	AC -Allied Course II General Food Chemistry	6	6	3	40	60	100
	IV	ES	Environmental Studies	2	2	3	25	75	100
			Total	**30**	**30**	**21**	**-**	**-**	**700**

III	I	VLTC	LC- Language Course	3	3	3	25	75	100
	II	VLEC	ELC – English Language Course	3	3	3	25	75	100
	III	ZVG	CC - Core Course III Food Safety in Seafood Industry	4	4	3	25	75	100
		ZVHY	CC – Core Practical V Fish Nutrition and Feed Technology	6	6	3	40	60	100
		ZVIY	CC – Core Practical VI Fish Microbiology and Quality Assurance	6	6	3	40	60	100
		ZVA3Y	AC -Allied Course III Fish Processing Technology	6	6	3	40	60	100
	IV		NME -Non Major Elective I	2	2	3	25	75	100
			Total	**30**	**30**	**21**	**-**	**-**	**700**
IV	I	VLTD	LC- Language Course	3	3	3	25	75	100
	II	VLED	ELC – English Language Course	3	3	3	25	75	100
	III	ZVJ	CC –Core Course IV Packing and Labelling of Fish and Fishery Products	4	4	3	25	75	100
		ZVKY	CC –Core Practical VII Cured and Dried Fishery Products	6	6	3	40	60	100
		ZVLY	CC –Core Practical VIII Fish Products and By Products Technology	6	6	3	40	60	100
		ZVA4Y	AC - Allied Course IV Storage and Transportation of Fishery Products	6	6	3	40	60	100
	IV		NME - Non Major Elective II	2	2	3	25	75	100
	V		SBE – Skill- Based Elective I	-	-	-	-	-	-
			Total	**30**	**30**	**21**	**-**	**-**	**700**

V	III	ZVM	CC – Core Course V Entrepreneurship Development	3	3	3	25	75	100
		ZVN	CC- Core Course VI Fisheries Economics	3	3	3	25	75	100
		ZVO	CC – Core Course VII Quality Control of Fish and Fishery Products	4	4	3	25	75	100
		ZVPY	CC- Core Practical IX Fisheries Extension Education	6	6	3	40	60	100
		ZVQY	CC- Core Practical X Marine Biotechnology	6	6	3	40	60	100
		ZVRP	Mini Project	6	6	3	40	60	100
		SSD	Soft Skills Development	2	2	3	25	75	100
			Total	**30**	**30**	**21**			**700**
VI	III	ZVS	CC- Core Course– VIII Fisheries Administration and Legislation	6	6	3	25	75	100
		ZVTP	Project	12	12	3	40	60	100
		ZVUI	Internship	12	12	3	40	60	100
			Total	**30**	**30**	**9**	**-**	**-**	**300**
Grand Total				**180**	**180**	**-**	**-**	**-**	**3800**

Semester-I / Core Course-I	**Fundamentals of Marine Edible Animals**	**Course Code: ZVA**
Instruction Hours: 4	**Credits: 4**	**Exam Hours: 3**
Internal Marks -25	**External Marks-75**	**Total Marks: 100**

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• To study planktons, the drifting life forms inhabiting water bodies that nourish the higher tropic levels in the ocean ecosystem and also act as indicator species. • To gain knowledge of Fishery Science with regards to Population Dynamics. • To consider the application of statistical tools to study fishery science. • To learn about aquaculture of fin fish as well as crustaceans and molluscs. • To attain a clear perception of the present status of sea farming in India	
UNIT	**CONTENT**	**HOURS**
I	History and definition of Taxonomy. Sea Weeds – Zooplanktons – PhytoPlanktons, Systematics. Binomial nomenclature. Classification of commercially important fishes, crustaceans and molluscs.	15
II	Morphology and Sexual dimorphism in fishes, crustaceans and molluscs. Maturation and spawning in fishes. Maturity stages, Gonado-somatic index, Fecundity, ova diameter studies, breeding cycles.	15
III	Life history of economically important fish species. Age and growth in fish. Methods employed for age determination, direct and indirect methods, scales, otoliths, length frequency studies, Length-weight relationships and relative condition factor. Types of migration in fishes. Breeding migration in fishes and Crustaceans.	15
IV	Structure of digestive system in fishes, molluscs and crustaceans. Digestive glands and enzymes. Modification of digestive tract in relation to feeding habits. Food and feeding habits of fishes, molluscs and crustaceans. Feeding in relation to age, sex, season and maturity. Food analysis indices.	15
V	Respiration-Structure of gills, branchial glands, mechanism of ventilation, respiratory pigments, mechanism of gas exchange.	15

	Accessory respiratory organs in fishes and its significance. Endocrine system,-Pituitary gland in fishes. Pheromones in fishes. Endocrine control of reproduction in crustaceans and molluscs.	

Text Book

1. Moyle and Cech Fishes and Introduction of Ichthyology
2. Nikolsky G.V Ecology of fishes

Reference Books

1.Purchol R.D. The Biology of Mollusca

2. Bliss D.E. Biology of Crustacean

3.Moyle,P.B. &Cech,J.J. Fishes – An Introduction to Ichthyology

Web Resources

https://www.pdfdrive.com/aquaculture-farming

Course Outcomes:

On completion of the course the learner will be able

CO 1: Living and non-living things in the sea - Marine flora and fauna - Basic characteristics of different sea species - The ocean zones

CO 2: Memorise the names of some sea creatures - Distinguish between sea animals and plants - Understand the relationship between species.

CO 3: To build a strong foundation in marine edible products.

CO 4:To prepeare Students for career options in aquaculture centres, marine products, etc.

CO 5: Students aquired knowledge in fishery science, as well as crustaceans and Molluscs.

Mapping with Cos with PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	M	S	S	S	S	S	S	M
CO2	S	S	S	S	S	S	S	S	S	S	S	M
CO3	S	S	S	S	S	S	S	S	S	S	M	S
CO4	S	S	S	S	S	S	M	S	M	S	S	S
CO5	S	S	S	S	S	S	M	M	S	M	S	M

S – Strongly correlating
M - Moderately correlating
W- Weakly correlating
N-No correlation

Semester-I / Core Practical –I	**Anatomy of Marine Edible Animals**	**Course Code: ZVBY**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -40	**External Marks-60**	**Total Marks: 100**

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• Course provides them comprehensive understanding about aquatic ecosystem and various economical important fishes. • Students gain knowledge in the areas of responses characterization and classification of Ostracoderms, placoderms, acanthodians, holocephali, elasmobranchs. • Students gain knowledge of integumentary system - basic structure of skin, dermal and epidermal pigments, fins, and scales. • Understanding of embryogenesis - Early development and post embryonic development. • Understanding of fishes habits and habitats and their functional anatomy.	
UNIT	**CONTENT**	**HOURS**
I	**Fins**-Microscopic Identification of Planktons External: Eyes, Nares, Mouth, Operculum, Fins, Vent, Scales, Barbels. Internal: Gills, Swim bladder. Fish Senses: Eyesight, Hearing, smell, Taste, lateral line, Muscle, Spinal cord, Digestive system, Reproductive system, skeletal system.	18
II	**Shrimp and prawn**-External - Appendages: Cephalic, Thoracic and Abdominal .Internal – Digestive system – Respiration	18

	system -circulatory system- reproductive system	
III	**Molluscs: Univalvia, Bivalvia and cuttle fish** External: shells, Operculum, Tentacles, Eyes, Foot, Propodium, Internal: Digestive system, Reproductive system.	18
IV	**Oysters and Clams** External – shell structure- morphometric measurement, Internal – Mantle, Gill, Adductor muscle, Tentacle, mouth- digestive system - reproductive system	18
V	**Crustacean: crab** **External** – Carapace – and larvae. Cephalothorax – Pleon –Appendages. **Internal** – Muscles – Nervous system – Sense organs – Digestive system – Circulatory system – Excretory system – Genital apparatus and reproduction – Endocrine system- Development.	18

Text Book:

1. Moyle and Cech Fishes and Introduction of Ichthyology
2. Nikolsky G.V Ecology of fishes

Reference Books:

1.Purchol R.D. The Biology of Mollusca

2. Bliss D.E. Biology of Crustaceans

3.Moyle,P.B. &Cech,J.J. Fishes – An Introduction to Ichthyology

Web Resources:

https://www.pdfdrive.com/aquaculture-farming

Course Outcomes:

On completion of the course the learner will be able

CO 1: Define sea animal
CO 2: Identify features of different types of sea animals.
CO 3: To build a strong foundation in marine edible products.
CO 4: Describe the various types of sea animal.
CO 5: Studentsaquired knowledge in fishery science, as well as crustaceans and Molluscs

Mapping with Cos with PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	M	S	S	S	S	S	S	M
CO2	S	S	S	S	S	S	S	S	M	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S	M	S
CO4	S	S	S	S	S	S	S	S	M	S	M	S
CO5	S	S	S	S	S	M	M	S	M	M	S	M

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-I / Core Practical -II	**Harvest and post-harvest handling of fishes**	**Course Code: ZVCY**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -40	**External Marks-60**	**Total Marks: 100**

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• Improvement of the processing and handling of fish in terms of quality, product range and volume results in increased economic activity and employment. • It is also one way of stabilizing fish marketing by providing an outlet for surplus and peak catch even during emergency harvest, thereby ensuring high fishing activities and stable prices. • .It can also contribute to the efforts related to nutritional goals. • Understanding of harvesting in fishes - Early development and post embryonic development. • Understanding of fishes habits and habitats and their functional anatomy.	
UNIT	**CONTENT**	**HOURS**
I	**I On board handling and preservation:**Hygienic handling of fish on board fishing vessel and on shore,Manufacture and storage,Quality of ice,Use of ice for handling, Quality of water tobe used in fish processing, Refrigerated sea water for fish preservation.Insulated containers for fresh fish transportation.Simplemechanical refrigeration systems**.**	18
II	**II Fishing Crafts and Gears:** Classification of fishing crafts; Dimensions and design of boats; Safety and stability of fishing boats; Care and maintenance of boats; Fishing accessories and deck	18

	equipments; Types of marine engines. Fishing methods of India.	
III	Modern commercial fishing methods- trawling, purse seining, gill netting and long lining. Classification of gears Care andpreservation of fishing gears.	18
IV	Pre-treatment of fish washing, gutting, filleting, deheading, peeling, deveining etc. Anti-oxidant treatment-Glazing of fish-Types of glazing- Packaging andpackaging materials for frozen fish and shrimps. Storage life, transportation and marketing.	18
V	Sanitary and phytosanitary requirements for maintenance of quality during post harvest handling of fish. Quality management of fish and fishery products. Processing engineering, refrigeration cycle, cold store, processing unit construction and management; Water budgeting; Waste management. Sanitation in processing plants and Quality control of fresh and processed fish andfishery products.	18

Text Book:

Balachandran,K.K. (2016) Post harvest Technology of fish and fish products. Daya publishing House, A division of Astral international pvt.Ltd., New Delhi-110 002.

Reference Books:

1. Clues,I.J. and Ward,A.R. (1996). Post-harvest Fisheries Development: A guide to handling, preservation, processing and quality.

2. Chatham Maritime, Kent, ME44TB, United kingdom. (1976). Seafood of south East Asia. Mac Milian, London.

3. Gopakumar, K. (1997). Tropical fisheries products, Oxford & IBH publishing co, New Delhi.

4. Mayer, V. (1965) Marinades. In fish as food, Borgstrom, G (ed.,), Vol .III, Academic Press Initial neurological consultation.New York.

Web Resources:

https://www.pdfdrive.com/aquaculture-farming

Course Outcomes:

On completion of the course the learner will be able

CO 1: Fishing craft in small-scale fisheries are generally small. They fish the area of the sea close to the shore

CO 2: Identify features of different types of sea animals.

CO 3: The gear they use often determines the fishing methods used. As the craft are small, there is very limited space onboard, which makes proper handling and preservation of the catch difficult.

CO 4: Fishing communities confront severe problems in handling, distributing and marketing fish.

CO 5: The lack of suitable infrastructure including transport and ice-making plants increases the problems of rapid spoilage.

Mapping with Cos with PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	M	S	S	S	S	S	S	M
CO2	S	S	S	S	S	S	S	S	M	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S	M	S
CO4	S	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	M	M	S	S	M	S	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-I / Allied Practical -I	**Instrumentation and computer application in Fisheries**	**Course Code: ZVA1Y**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -40	**External Marks-60**	**Total Marks: 100**

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• To learn, experiment, and explore computer applications in education. • The students will be able to: Define and explain various fundamentals of spectroscopy, qualitative and quantitative analysis. • .Differentiate between principle, instrumentation and operation of Atomic absorption and emission Spectroscopy. • Explain the various Separation techniques and its instrumentation. Describe the principle and working of various Radiation detectors. Discuss the principle and working of various Gas analyzers • Understanding of fishes habits and habitats and their function of Instruments.	
UNIT	**CONTENT**	**HOURS**
I	Principles and its applications of pH meter–Centrifuge–Spectrophotometer - Incubator – Autoclave – Waterbath.	18
II	Principles and its applications of BOD - Deep freezer (-20ºC) – Laminar air hood –Quebec colony counter – Electric shaker.	18
III	Principles and its applications of Microtome –Electric homogenizer – Recent trends in Fisheries –Refrigerator – Soxhlet apparatus	18
IV	Mean -Standard Deviation Correlation Regression.	18

V	Computer application: MS word Document – Power point- MS Excel.	18

Text Book:

1. Balachandran,K.K. (2016) Post harvest Technology of fish and fish products. Daya publishing House, A division of Astral international pvt.Ltd., New Delhi-110 002.

Reference Books:

1.Clues,I.J. and Ward,A.R. (1996). Post-harvest Fisheries Development: A guide to handling, preservation, processing and quality. Chatham Maritime, Kent, ME44TB,

2. United kingdom.(1976). Seafood of south East Asia. Mac Milian, London.

3.Gopakumar, K. (1997). Tropical fisheries products, Oxford & IBH publishing co, New Delhi.

4.Mayer, V. (1965) Marinades. In fish as food, Borgstrom, G (ed.,), Vol .III, Academic Press Initial neurological consultation.New York.

Web Resources:

fisheries –biotechnology-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: After successful completion of this course students will able handling of spectrophotometer.

CO 2: Prepare presentation and report on computer system.

CO 3: Identify the components of a computer system and demonstrate basic proficiency in commonly used applications

CO 4: Create, design, and produce professional documents using word processing software (i.e., MS Word).

CO 5: Process, manipulate, and represent numeric data using the basic functions of spreadsheet software (i.e., MS Excel).

Mapping with Cos with PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	M	M	S	S	S	S	S	S	M
CO2	S	S	S	S	M	S	S	S	M	S	S	S
CO3	S	S	S	S	S	S	M	S	S	M	M	S
CO4	S	S	S	S	S	S	S	S	S	S	S	M
CO5	S	S	S	S	S	S	M	S	M	M	S	M

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-II/ Core course-II	**Biochemical and Microbial changes in Fish-**	**Course Code: ZVD**
Instruction Hours: 4	**Credits: 4**	**Exam Hours: 3**
Internal Marks -25	**External Marks-75**	**Total Marks: 100**

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives:	• The course will provide an introduction to the various food components nutritional impact on growth, development, reproduction, health and quality of farmed fish. • This involves learning about the fish's digestive system and the various nutrients, digestion , absorption, metabolism, and biochemical function. • The course also covers relevant undesirable substances in feed that can be challenge for the health and for the seafood product produced. • This involves learning about of biochemical changes in fishes. • Understanding of fishes habits and habitats and their function of microbial anatomy.	
UNIT	**CONTENT**	**HOURS**
I	Biochemical composition of Raw fish: Protein, carbohydrate, Fat, Fish oil, Minerals, Vitamins – Nutritional value of raw fish – Nutritional value of preserved and Processed fish.	15
II	Fish decomposition: Post-mortem changes and Rigor mortis – post-rigor decay and spoilage of fish: Enzymatic spoilage, Microbial spoilage, Bacterial flora of fish and bacterial spoilage, chemical spoilage (Rancidity, Autolysis), spoilage due to other factors.	15

III	Fish preservation-principles of preservation: cleaning, lowering temperature, raising temperature, dehydration, use of salt, use of fish preservatives, Exposure to low radiation of gamma rays, Electrocuting by ion wind- Methods of preservation – special problems in fish preservation: denaturation due to freezing of fish, problems arising out of industrial processes in fish preservation industries.	15
IV	Food poisoning, intoxications, Allergies from fish: Histamine poisoning from badly preserved fish, Food-poisoning from eating a poisonous fish species, Food-poisoning of bacterial origin(*Salmonella, Staphylococcus, Botulism*), "Pink" spoilage and "Dun" spoilage of salted fish.	15
V	Utilization of fish as products: Fish liver oil, methods of extraction of fish liver oil from liver – standardization of Vitamin' A potency in the extracted oil (Biological estimation, colorimetric estimation with tintometer, photoelectric spectrophotometric estimation) - Prototype of fish liver oil manufacturing plant – simple model of fish – liver oil extractor for use in small scale cottage industry – Fish body oil – Fish meal – Others(Fish flour, fish silage, fish manure & guano, fish sausage and ham, fish glue, Isinglass, Fish leather, fish macroni, fish biscuits, fish insulin)-Cooking effect on nutritional value of fish –Health hazard from fish eating.	15

Text Book:

1. Hui, Y.H. 2006.(Ed). Food Biochemistry & Food Processing. Blackwell publishing Ltd.,USA
2. Brody, T. 2006. Nutritional Biochemistry 2nd Edition. Elsevier, India Pvt. Ltd. New Delhi.

Reference Books:

1. Luck, Erich, Jager, Martin 1997. Antimicrobial food additives, characteristics uses, effects – 2nd Edition, Springer – Verlag Berlin, Heidel berg – New York
2. PomeranzYeshajahu, 1985. Functional Properties of Food Components. Academic Press INC, London.

Web Resources:

fisheries –biotechnology-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: Keep track of food's quantitative importance in the production of farmed fish, which feed resources you use, and the ratios between the energizing nutrient (Protein, fat and carbohydarate) in commercial feeds.

CO 2: Possess detailed knowledge of the fish digestive system, including a deeper focus on the development of gastrointestinal tract of marine fish larvae.

CO 3: Show detailed knowledge of various energizing and micro (vitamins and nutrients digestion, absorption, metabolism and biochemical function.

CO 4: Explain the components of fish feed on fish product quality, both positive (nutrients) and negative (contaminents from food and environment).

CO 5: Have knowledge of fish reproduction and how diet affects egg and fry quality.

Mapping with Cos with PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	M	S	S	S	S	S	S	M
CO2	S	S	S	S	S	S	S	S	M	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	M	S	M	S
CO5	S	S	S	S	S	S	M	S	M	M	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-II/ Core Practical-III	**Chilling Technology**	**Course Code: ZVEY**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -40	**External Marks-60**	**Total Marks: 100**

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• This course with the preservation of seafoods by chilling and freezing techniques. • At ambient temperature fish muscle undergo rapid biochemical changes and creates a favourable environment for microorganisms to grow. • This in turn responsible for the production of fouls smell and makes muscle spoiled and unsuitable for human consumption. • The main principle of chilling by ice is, it lowers the temperature of fish body from 30◦C to 5◦C.. • This greatly affects the bacterial flora of fish and its growth is completely arrested by lowering of temperature and also slows down the biochemical activity, there by preserving quality to the extended time.	
UNIT	**CONTENT**	**HOURS**
I	Introduction to fish muscle function Introduction and historical developments in low temperature preservation of fish -Structure and function of fish muscle - Postmortem changes in fish - Bacteriological changes - Spoilage of fish.	18
II	**Chilling of fish l:** Fresh fish handling - Calculation of the ice requirement for cooling fish - Manufacturing of different types of Ice - Super chilling (0ºC to - 4ºC)- Application of ozone / chlorine in seafood processing.	18

III	**Freezing preservation of fish :**Principle of freezing – Physical, chemical and thermodynamic properties of refrigerants-Types of freezer- Methods of protective treatments-Calculation of freezer refrigeration load -Freeze drying fish.	18
IV	**Thawing of fish & Quality changes during frozen storage** Methods of fish thawing- Quality changes in fish during freezing & frozen storage-physical changes- Microbial growth at low temperature	18
V	Cold stores and containers, Packaging methods, HACCP Construction of cold store - Refrigerated containers- Good handling and shipping practices.	18
	Practical's • Sanitation and plant housekeeping; • Chilling and freezing equipment, instruments; packages and product styles; • Methods of icing fish; cooling rate; • Preservation by chilled sea water; • Freezing and thawing curves; • Freezing of different varieties of fish and shellfish; • Estimation of drip; • Determination of quality changes during frozen storage; • Inspection of frozen fishery products; • Visits to ice plants, cold storages and freezing plants;	

Text Book:

1. Freezing Technology Practical manual. 2006.Rathnakumar,K. and Velayutham,P. Dept. of Fish Processing Technology, Fisheries college and research institute, Thoothukudi.

Reference Books:

1. Freezing and refrigerated storage in fisheries. 1994**.**W.A. Johnston, F.J. Nicholson, A. Roger and G.D. Stroud, CSL Food Science Laboratory**,**Torry, Aberdeen, Scotland, UK M-47ISBN 92-5-103579-2
2. Aitken,A *et al.* (eds) 1982. Fish Handling and Processing. Second Edition, Edinburgh, Her Majesty's Stationery Office, £10.
3. International Institute of Refrigeration, Recommendations for the Processing and Handling of Frozen Foods. Recommendations pour la Préparationet la Distribution des Aliments Congelés. Paris, International Institute of Refrigeration, 3rd ed.

Web Resources:

fisheries –biotechnology-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: Explain the benefits of freezing and frozen storage of foods.

CO 2: Describe and explain the importance of the typical steps in freezing and subsequent freezer storage and distribution of various liquid and solid foods.

CO 3: Describe the important processes (freezing point depression, subcooling, nucleation, growth and recrystallization) involved in freezing foods and the effects of different extrinsic and intrinsic parameters on freezing of foods.

CO 4: Apply the phase/state diagram for various foods to freezing and freezer storage, with special attention to areas of equilibrium and non equilibrium.

CO 5: Compare and contrast different freezing technologies in terms of process characteristics and quality changes during freezing of different foods.

Mapping with Cos with PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	M	S	S	S	S	S	S	M
CO2	S	S	M	S	S	S	S	S	M	S	S	S
CO3	S	S	S	S	M	S	S	S	S	M	M	S
CO4	S	S	S	S	S	S	S	S	M	S	M	S
CO5	S	S	S	S	M	M	M	S	M	M	S	M

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-II/ Core Practical - IV	**Fish Canning Technology**	**Course Code: ZVFY**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -40	**External Marks-60**	**Total Marks: 100**

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• This course with the preservation of seafoods by canning and freezing techniques. • At ambient temperature fish muscle undergo rapid biochemical changes and creates a favourable environment for microorganisms to grow. • This in turn responsible for the production of fouls smell and makes muscle spoiled and unsuitable for human consumption. • The main principle of canning by ice is, it lowers the temperature of fish body from 30◦C to 5◦C.. • This greatly affects the bacterial flora of fish and its growth is completely arrested by lowering of temperature and also slows down the biochemical activity, there by preserving quality to the extended time.	
UNIT	**CONTENT**	**HOURS**
I	**Canning as a method of preservation & Historical developments in canning technology:** Introduction to canning-definition of canning-steps involved in canning-Advantage of canning-Landmark in the development of cane manufacture-progress in thermal processing-Development in fish canning industry.	18
II	**Unit operations in canning & Thermal process for canned foods:** Different unit operation in fish canning: Preparation of raw	18

	material for canning, Filling of cans, Exhausting of filled cans, Can closing /seaming of cans.	
III	**Thermal process for canned foods:** Heat processing/ retorting of cans, Can cooling, labelling and storage - Thermal Processing: Classification of acidity foods, Severity of thermal process, Heat Resistance of Microorganisms.	18
IV	**Changes in canned foods & Canning of commercially important fishes and shellfishes:** Changes in canned foods and spoilage- Causes of spoilage in canned foods- Canning of individual category to fish- Tuna and tuna like fish- Canning of crustaceans- Canning of Molluscs.	18
V	**Fish Packaging & Metal Containers:** Functions of Packaging- Presentation of the product- Levels of Packaging- Packaging Materials- Metal Containers- Types of metal containers.	18
	Practicals: • Canning of commercially important fishes and shellfishes • Preparation of Ingredients for canning • Preparation of Raw materials and sub-materials for canning • Can cooling, labelling and storage • Measures of Heat resistance of Microorganisms • Estimation of causes of spoilage in canned foods.	

Text Book:

1. Balachandran K.K., 2001. Post Harvest Technology of Fish and Fish Products, Daya Publishing House, New Delhi.
2. Horner WFA. 1997, Canning of Fish and Fish Products, In: Fish Processing Technology, 2nd Edn. G.M.Hall (Ed), Blackie Academic and Professional, London.

3. Ninawe A.S. and Rathnakumar K. 2008. Fish Processing Technology and Product development. Narendra Publishing House, Delhi – 110 006.
4. 1997. Wiley Encylopedia of Packaging Technology, 2nd Edn. John Wiley and Sons Inc. New York.

Reference Books:

1. Freezing and refrigerated storage in fisheries. 1994.W.A. Johnston, F.J. Nicholson, A. Roger and G.D. Stroud, CSL Food Science Laboratory,Torry, Aberdeen, Scotland, UK M-47ISBN 92-5-103579-2
2. Aitken,A *et al.* (eds) 1982. Fish Handling and Processing. Second Edition, Edinburgh, Her Majesty's Stationery Office, £10.
3. International Institute of Refrigeration, Recommendations for the Processing and Handling of Frozen Foods. Recommendations pour la Préparationet la Distribution des Aliments Congelés. Paris, International Institute of Refrigeration, 3rd ed.

Web Resources:

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Course Outcomes:

On completion of the course the learner will be able

CO 1: After completing this course students can able to, Deliver the different unit operations and its equipments involved in fish processing fishing resources.

CO 2: Develop value added products from fish. Able to know about quality control of fish processing Know about different methods of processing of fish Able to acquire a confident to get placement in any fish processing industry.

CO 3: Describe the important processes (Canning point depression, subcooling, nucleation, growth and recrystallization) involved in freezing foods and the effects of different extrinsic and intrinsic parameters on Canning of foods.

CO 4: Apply the phase/state diagram for various foods to Canning and freezer storage, with special attention to areas of equilibrium and non equilibrium.

CO 5: Compare and contrast different Canning technologies in terms of process characteristics and quality changes during Canning of different foods.

Mapping with Cos with PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	M	S	S	S	S	S	S	M
CO2	S	S	M	S	S	S	S	S	M	S	S	S
CO3	S	S	S	S	M	S	S	S	S	M	M	S
CO4	S	S	S	S	S	S	S	S	M	S	M	S
CO5	S	S	S	S	M	M	M	S	M	M	S	M

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-II/ Allied Practical-II	GENERAL FOOD CHEMISTRY	Course Code: ZVA2Y
Instruction Hours: 6	Credits: 6	Exam Hours: 3
Internal Marks -40	External Marks-60	Total Marks: 100

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create
Course Objectives	• To provide an optimum environment for students to gain an understanding of the chemical bases of food component reactivity and functionality. • To provide an opportunity for students to develop skills for experimenting with food systems and to test various approaches for manipulating the chemical and/or functional properties of foods. • To provide students an opportunity to enhance and test their critical thinking skills through structured problem solving. • The main principle of canning by ice is, it lowers the temperature of fish body from 30◦C to 5◦C. • This greatly affects the bacterial flora of fish and its growth is completely arrested by lowering of temperature and also slows down the biochemical activity, there by preserving quality to the extended time.

UNIT	CONTENT	HOURS
I	Composition of food and nutritional value- Factors affecting food composition - Moisture in Foods- Structure and Properties of water- Types of Water in foods- Water activity and Shelf life of foods	18
II	Food lipids- Types of fat- Fish lipids- Distribution of lipids in Fish- Role of Fish Lipids in Human Nutrition- Oxidation of lipids- Types of Oxidation- Effects of Lipid Oxidation in Foods- Metabolism of lipids- Digestion and absorption of lipids-	18

	Metabolism of Fat- Biosynthesis of lipids- Synthesis of fatty acid, phospholipid- phosphotidic acid- Cholesterol.	
III	Food Carbohydrates- Naturally Occurring Carbohydrates in Food- Role of Fiber in Food- Browning Reactions: Enzymatic Browning- Metabolism of Carbohydrates- Digestion and absorption of carbohydrates- Glycogenesis and Glycogenolysis- Oxidative degradation of glucose to CO2- Gluconeogenesis- Biological oxidation.	18
IV	Food proteins- Native proteins and denatured proteins- Food Proteins Sources- Functional properties of food proteins: .Water-Holding Capacity (WHC):. Foam formation and foam stabilization by proteins, Viscosity, Gel formation, Factors that have an effect on the formation and properties of protein gels- Metabolism of Protein- Digestion and Absorption of proteins- Amino acid catabolism and Urea Synthesis- Protein synthesis.	18
V	Nutritive values of proteins- Methods for the determination of nutritional quality of proteins- Fish Muscle Proteins- Chemical changes in muscle during contraction- Chemistry of taste, flavour, and odour- Food additives- types and their chemical nature- Enzymes, vitamins and amino acids- Energy values, Energy requirements and their estimation- Water, electrolyte and acid base balance- Assessment of quality in food by instrumental and Chemical methods .	18

	Practicals: • Estimation of moisture content in fish sample by hot air oven method, • Estimation of total Nitrogen and Protein Content of Fish by Microkjeldahl Method • Estimation of Crude Fat of Fish by Soxhlet Method • Determination of Ash in Fishery Products • Principles of Colorimeter and Spectrophotometer (Demonstration of Beef's law) • Estimation of Starch in Food • Estimation of crude fiber using Fibra plus • Paper Chromatography of Amino Acids • Estimation of Free Fatty Acid Content of Fish Fat / Oil • Estimation of sodium chloride in fishery products(mohr's method) • Estimation of total volatile base N & TMA in fish sample by ConweyMicrodiffusion method • Determination of histamine by fluorometric Methods.

Text Book:

1. Balachandran K.K., 2001. Post Harvest Technology of Fish and Fish Products, Daya Publishing House, New Delhi.
2. Horner WFA. 1997, Canning of Fish and Fish Products, In: Fish Processing Technology, 2nd Edn. G.M.Hall (Ed), Blackie Academic and Professional, London.
3. Ninawe A.S. and Rathnakumar K. 2008. Fish Processing Technology and Product development. Narendra Publishing House, Delhi – 110 006.
4. 1997. Wiley Encylopedia of Packaging Technology, 2nd Edn. John Wiley and Sons Inc. New York.

Reference Books:

1. Belitz. H. D., and Grosch, W. 1999. Food Chemistry. 2nd Edition, Springer ,Verlag Berlin, Heidelbery, New York.
2. Fennema Owen, R (Ed.). 1996. Food Chemistry, 3rd Edition, Marcel Dekker, Inc. New York.

3. Garard, Ira D. 1976. Introductory Food Chemistry. The Avi Publishing Company INC. Westport, Connecticut.
4. Berg J M, Tymoczko JL &Stryer L. 2002. Biochemistry. WH Freeman.
5. Voet D, Voet JG & Pratt CW. 2006. Fundamentals of Biochemistry. John Wiley & Sons.

Web Resources

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Course Outcomes:

On completion of the course the learner will be able

CO 1: Students will be able to name and describe the general chemical structures of the major components foods (water, proteins, carbohydrates, and lipids).
CO 2: Students will be able to give a molecular rationalization for the observed physical properties and reactivity of major food components.
CO 3: Students will be able to provide a theoretical explanation for observed extents and rates of reactions that are common to foods
CO 4: Students will be able to predict how changes in overall composition are likely to change the reactivity of individual food components.
CO 5: Compare and contrast different Biochemical technologies in terms of process characteristics and quality changes during Biochemical technologies of different foods.

Mapping with Cos with PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	M	S	S	S	S	M	S	M
CO2	S	S	S	S	M	S	S	S	M	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S	M	M
CO4	S	S	S	S	S	S	S	S	M	S	M	S
CO5	S	S	S	S	S	M	M	S	M	M	S	M

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-III/ Core Course-III	FOOD SAFETY IN SEA FOOD INDUSTRY	Course Code: ZVG
Instruction Hours: 4	Credits: 4	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• To provide an optimum environment for students to gain an understanding of the chemical bases of food component reactivity and functionality. • To provide an opportunity for students to develop skills for experimenting with food systems and to test various approaches for manipulating the chemical and/or functional properties of foods. • To understand the concept of safe food and types of hazards associated with food. • To control the potential threats to safety of food. • To familiarize with the Good Hygienic Practices, Food Safety Management Systems and Food Regulations.	
UNIT	**CONTENT**	**HOURS**
I	Microbiological standards in seafood industry. Source of microorganism to fish-Sanitary measures adopted to reduce microbial load in fish. Food borne nonbacterial infections and intoxications: Aflatoxins, patulin, ochratoxin and other fungal toxins found in food, toxin producer, source, nature of toxin, toxicity and significance in foods.	15
II	Public health microbiology- Food borne pathogens: Emerging food-borne pathogens. Waterand borne diseases. Bacteria of public health significance in fish/fishery products/environments *Salmonella, Clostridia, Staphylococcus, E. coli, Streptococcus,*	15

	Vibrio, Aeromonas, Listeria,Yersinia, Bacillus. Methods for Detection: Rapid detection and indirect detection methods of pathogens and parasites. Laboratory techniques for detection and identification of food poisoning bacteria.	
III	Total plate count Coliforms-concept- indicator organism-MPN estimation-isolation and identification-faecal coliforms. Salmonella-Isolation and identification. Vibrio- Isolation and identification. Streptococcus- Isolation and identification. *Listeriaspp* isolation and identification. *Pseudomonas aeroginosa*, General understanding about different microbiological methods. (FDA, CFIA, FSIS, NACMSF, AOAC).	15
IV	Quality control of Laboratories. Good Laboratory Practices (GLP), ISO/IEC 17025. Types of laboratories, General requirements for a food laboratory. (Lay out, Environmental requirements,Safety requirements etc) Food borne diseases-Food infection and food intoxication. Botulism.Typhoid and Paratyphoid, *Clostridium perfringens,* Listeriosis. Sources and transmission ofbacteria in foods: human, animal, environmental reservoirs; cross-contamination.	15
V	Antimicrobial systems and food preservation: ecological concepts: Lactoperoxidase. Nisin,Lysozyme, Bacteriocins. Packaging and modified atmosphere on the microbiology and shelf lifeof fishery products. Norms for using antimicrobial systems in food processing and preservation.Food Safety, Risk analysis. Potential health hazards and risks associated with fish products.Predictive modeling in quality and safety assurance of fishery products.	15

Text Book

1. Balachandran K.K., 2001. Post Harvest Technology of Fish and Fish Products, Daya Publishing House, New Delhi.
2. Chincheste, C.O and Graham, H.D. Microbial safety of Fishery products,
3. Frasier, W.C and Westhoff,D.C Food Microbiology ,
4. Jay, J.M. Van Nostrand.D. Modern Food Microbiology
5. Amerine,M.A, pangborm,R.M Principles of sensory evaluation of food
6. Connell.J.J Control of fish Quality

Reference Books

1. Belitz. H. D., and Grosch, W. 1999. Food Chemistry. 2nd Edition, Springer ,Verlag Berlin, Heidelbery, New York.
2. Fennema Owen, R (Ed.). 1996. Food Chemistry, 3rd Edition, Marcel Dekker, Inc. New York.
3. Garard, Ira D. 1976. Introductory Food Chemistry. The Avi Publishing Company INC. Westport, Connecticut.
4. Berg J M, Tymoczko JL &Stryer L. 2002. Biochemistry. WH Freeman.
5. Voet D, Voet JG & Pratt CW. 2006. Fundamentals of Biochemistry. John Wiley & Sons.

Web Resources

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Course Outcomes:

On completion of the course the learner will be able

CO 1: Understand the concept of food safety, types of hazards and their control measures .

CO 2: Identify and prevent potential sources of food contamination Comprehend the need of hygiene and sanitation for ensuring food safety.

CO 3: Students will be able to provide a theoretical explanation for observed extents and rates of reactions that are common to foods

CO 4: Students will be able to predict how changes in overall composition are likely to change the reactivity of individual food components.

CO 5:Knowledge of Food Safety Management tools.

Mapping with Cos with PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	S	S	S	S	S	S	S	M
CO2	S	S	S	S	M	S	S	S	M	M	S	S
CO3	S	S	S	S	M	S	S	S	S	S	S	M
CO4	S	S	S	S	M	M	S	S	S	S	M	M
CO5	S	S	S	S	M	M	S	S	M	S	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-III / Core Practical-V	**Fish Nutrition and Feed Technology**	**Course Code: ZVHY**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -40	**External Marks-60**	**Total Marks: 100**

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• The purpose of cage fish culture is to economically produce crops of fish. Economic feasibility is obtained through a balance of maintaining a productive ecosystem and adding sufficient nutritional inputs to achieve optimal crop yields. • The objective of feeding fish in cages is to economically provide proper nutrition for fish growth and good health while minimizing metabolic waste and ecosystem pollution. • Requirements for achieving the objective are providing proper quality and quantity feed, employing an in-cage feed enclosure, and using proper feeding methods. • To control the potential threats to safety of food. • To familiarize with the Good Hygienic Practices, Food Safety Management Systems and Food Regulations.	
UNIT	**CONTENT**	**HOURS**
I	**Fundamentals of fish nutrition** Introduction- Nutrient and growth .Protein, Amino acids and Lipid: structure – composition-chemical properties-classification – fatty acid structure and classification-steroids-cholesterol-Bile acids.	18
II	**Carbohydrate, Vitamins, Minerals, Energy** Carbohydrates; classification- non sugars and sugars.	18

	Vitamins classification. Minerals classification and functions. Energy: Laws of thermodynamics-energy unit-forms of energy partitioning-energy metabolism.	
III	**Nutritional requirements of cultivable fish and shell fish** Introduction - Methods of feed formulation and manufacturing: feed manufacturing- feed milling processes-extrusion pelleting. Different forms of feeds: feed based on life cycle of fish-product quality feeds-larval feeds- flakes-farm made feeds. Feed additives: Binders-antioxidants-enzymes-pigments-growth hormones-feed stimulants-immunostimulants.	18
IV	**Non-conventional feed ingredients and evaluation of feeds** Non-conventional feed ingredients and anti-nutritional factors: soya bean meal-single cell protein- Krill-poultry by products and feather meal-anti nutritional factors. Digestive enzyme, digestibility and factors affecting digestibility: digestion and absorption-characteristics of enzymes and other digestive secretions-protein, fat, carbohydrate, microbial digestion-factors affecting digestion. Evaluation of efficiency of fish feeds. Storage of fish feeds.	18
V	**Storage, Management and Nutritional deficiency**. Storage of fish feeds. Feeding devices and Methods: methods of feeding-demand feeder- automatic feeder-feeding crafts. Feed Management: ration size-feeding tables-factors affecting feed consumption-growth monitor. Nutritional deficiency disorders, symptoms and diseases in fishes: due to protein, lipid, minerals.	18

	Practicals P1. Proximate composition analysis of feed ingredients and prepared feeds 1. Determination of moisture 2. Determination of Crude Protein (Kjeldahl Method) 3. Determination of Crude Fat 4. Determination of Crude Fibre 5. Determination of Ash 6. Determination of carbohydrate P2. Preparation of formulated feeds using locally available feed ingredients 1. Standard fish feeds 2. Digestive enzyme based fish feeds 3. Carotenoid based fish feeds. 4. Phytase based fish feeds.

Text Book:

1. Balachandran K.K., 2001. Post Harvest Technology of Fish and Fish Products, Daya Publishing House, New Delhi.
2. Chincheste, C.O and Graham, H.D. Microbial safety of Fishery products,
3. Frasier, W.C and Westhoff,D.C Food Microbiology ,
4. Jay, J.M. Van Nostrand.D. Modern Food Microbiology
5. Amerine,M.A, pangborm,R.M Principles of sensory evaluation of food
6. Connell.J.J Control of fish Quality

Reference Books:

1. FAO., 1980. Aquaculture development and coordination programme. Fish feed technology. Lectures presented at the FAO/UNDP Training Course in Fish Feed Technology, Seattle, Washington, 9 October - 15 December 1978. FAO/ADCP/REP/80/11 1980: 400 pp.
2. Mohanty, N. A., 2006. Nutrition of fin fishes and shellfishes. In: Hand book of Fisheries and Aquaculture. Ayyappan, S., Jena, J. K., Gopalakrishnan, A. and Pandey, A. K. Published by Indian Council of Agricultural Research, New Delhi: 488-493.
3. Rath, R. K., 2000. Nutrition requirement of finfish. In: Fresh water Aquaculture. Published by Scientific Publishers (India), Jodhpur: 214-224.
4. Berg J M, Tymoczko JL &Stryer L. 2002. Biochemistry. WH Freeman.

5. Voet D, Voet JG & Pratt CW. 2006. Fundamentals of Biochemistry. John Wiley & Sons.

Web Resources:

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aquatic –animals-and-plants-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: Have experience with processes both for design and optimizing feed production units, as well as planning and conducting experiments in feed technology.

CO 2: Practical understanding of both feed ingredients and feed processing.

CO 3: Practical experience from all types of processing commonly used in industrial production of feed.

CO 4: Experience in the selection of ingredients and processing optimized for different animals, such as production animals, fish and companion animals.

CO 5: High research-based competence within the interaction between processing and nutritional value of feed, both for production animals, fish and companion animals.

Mapping with Cos With PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	S	S	S	M	S	M	S	S
CO2	S	S	S	M	S	S	S	S	S	S	S	S
CO3	S	S	S	S	M	S	S	M	S	M	S	S
CO4	S	S	S	S	M	M	S	S	S	M	M	M
CO5	S	S	S	S	M	M	S	S	M	S	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-III/ Core Practical-VI	**Fish Microbiology and Quality Assurance**	**Course Code: ZVIY**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -40	**External Marks-60**	**Total Marks: 100**

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• Formulation of specifications for raw materials, supplies, inplantprocesses,containers and finished products including shelf-life. • Development of test procedures. Quality levels and production variables are to be tested on some scale • Forms for recording and reporting, preparation of quality control charts etc. Attending to troubles and advice stoppage of production or rectification of defect. • Attending to special problems regarding quality and complaints. • To familiarize with the Good Hygienic Practices, Food Safety Management Systems and Food Regulations.	
UNIT	**CONTENT**	**HOURS**
I	**Role, significance and Factors affecting growth and survival of microorganisms in Seafood :** Introduction to fish microbiology and history of microorganisms in foods. Role and significance of microorganisms in nature and foods – microorganisms in aquatic environment, primary sources of microorganisms Found in foods. Intrinsic and extrinsic parameters affecting the growth of microorganisms in fish Intrinsic parameters - pH, moisture content, oxidation reduction potential, nutrient content, antimicrobial substances. Extrinsic	18

	parameters - temperature of storage, relative humidity of storage environment, presence and concentration of gases, and presence and activities of other organisms.	
II	**Enumeration of microorganisms in foods and Food preservation techniques** Study of microorganisms in foods by conventional methods – standard plate count, membrane filter and most probable number techniques. Study of microorganisms by rapid methods- thermostable nuclease, dye reduction test, limulus lysate test, ATP measurement, ELISA and PCR.Microbial principles of fish preservation and processing– by use of low temperature, high temperature and drying, radiation and chemicals Endospores and formation of cell aggregates.	18
III	**Food borne bacterial pathogens :** Study of food borne pathogens involved in infective and intoxication type of food poisoning, foodborne gastroenteritis caused by *Clostridium botulinum and Staphylococcus.* borne gastroenteritis caused by *E. coli* , *Salmonella*- distribution, pathotypes, growth conditions, incidence and survival in foods, virulence factors, gastroenteritis syndrome, prevention of outbreak.Food borne gastroenteritis caused by *Listeria* , *Campylobacter*- distribution, serotypes, growth conditions, incidence and survival in foods, virulence factors, gastroenteritis syndrome- listeriolysis, prevention of outbreak.Food borne gastroenteritis caused by clostridia *Vibrio cholerae and V. parahaemolyticus*distribution, growth conditions, incidence and survival in foods, virulencefactors, food poisoning- botulism, prevention of outbreak.	18
IV	**Biological hazards in foods and Sanitation and microbiological quality :** Biological hazards in foods: mycotoxins – aflatoxins- toxin	18

	production and occurrence in foods and problem associated; marine toxins: algal toxins – Paralytic shellfish poisoning (PSP), Diarrhetic shellfish poisoning (DSP), Neurotic shellfish poisoning (NSP), Amnesic shellfish poisoning (ASP), ciguatera toxin, pufferfish toxin and histamine poisoning.Biological hazards in foods: parasites – protozoan, flat worms and round worms associated with fish and shell fish. Food borne viruses - types, incidence in foods and food borne viral diseases. Fish plant sanitation - need for sanitation, cleaning schedule, Ciguatera Fish Poisoning (CFP)detergents, disinfectants/ sanitizers. Indices of fish sanitary quality -coliforms, E.coli and faecalstreptococcus.Process water quality- water source, water quality requirement.	
V	**Spoilage of fresh and processed fish and fishery products and Assurance and management of fish quality :** Spoilage of fish - microbial, enzymatic and non enzymatic spoilage. Spoilage of semi processed and processed fishery products - spoilage of fresh, chilled, frozen fish, canned, and dried fish.Assessment of fish quality – sensory, physical, chemical, microbiological and statistical quality. Waste management in processing industries. Concept of Quality Management – Total Quality Management(TQM), Sanitation Control procedure(SCP), Sanitation Standard Operating Procedure (SSOP), Good Manufacturing Practices (GMP); Hazard Analysis and Critical Control Point (HACCP). Quality standards – Bureau of Indian Standards (BIS), Export Inspection Agency(EIA), International Organization for Standardization (ISO),United States Food and Drug Administration (USFDA), European Union (EU) and CodexAlimentarius for fish and fishery products.	18

	Practicals 1. Enumeration of total bacterial load in fish and shellfish by plate count method. 2. Enumeration of total fungal load in cured fish and shellfish 3. Enumeration of total spoilage organism in fish and shellfish 4. Enumeration of anaerobic sulphate reducers in seafoods 5. Isolation and identification of *E. coli* from fish and fishery products by MPN and membrane filter methods 6. Isolation and identification of fecal streptococci from fish and fishery products 7. Isolation and identification of *Staphylococcus aureus* from fish and fishery products 8. Isolation and identification of V*ibrio cholerae* and V*ibrio parahaemolyticus* in fish and fishery products. 9. Isolation and identification of*Salmonella* from fish and fishery products 10. Isolation and identification of *Listeria* from fish and fishery products 11. Isolation and identification of Clostridia in fish and fishery products 12. Isolation and identification of *Campylobacter* from fish and fishery products 13. Determination of MIC and MCC of chemical preservatives 14. Enumeration of microorganisms by dye reduction test. 15. PCR detection of pathogenic microorganisms associated with fish. 16.Biochemical tests for the characterization of microorganisms – oxidase test,indoletest,methyl red test, Vogues-proskauer test, catalase test, citrate utilization,TSI, sugar fermentation test,aminoacid decarboxylase test etc. 17. Sensory method for assessing quality of fish 18. Physical method for assessing quality of fish. 19. Chemical method of assessing fish quality 20. Determination of available chlorine in process water. 21.Visit to fish processing plant and study of implementation Of HACCP.]

Text Book:

1. Balachandran K.K., 2001. Post Harvest Technology of Fish and Fish Products, Daya Publishing House, New Delhi.
2. Chincheste, C.O and Graham, H.D. Microbial safety of Fishery products,
3. Frasier, W.C and Westhoff,D.C Food Microbiology ,
4. Jay, J.M. Van Nostrand.D. Modern Food Microbiology
5. Amerine,M.A, pangborm,R.M Principles of sensory evaluation of food
6. Connell.J.J Control of fish Quality
7. Reference Books:
8. Food Microbiology 4th Edition (2008), William C. Frazer, The McGraw Hill publishers, India
9. Food Microbiology: Fundamentals and Frontiers (1997). Doyle, M. P., Beuchat, L. R. and Montville, T. J. (Editors). ASM Press, Washington.
10. Foodborne Diseases (2007). ShabbirSimjee (Editor). Humana Press Inc. New Jersy.
11. Principles of Food sanitation (2006). 5th Edition. Marriott, N G and Gravani, R. B. Springer Science Inc. New York.
12. Microorganisms in Foods 7: Microbiological Testing in Food Safety Management (2002). 2nd Edition. International Commission on Microbiological Specifications for Foods. Plenum Publishing Corporation.

Web Resources:

fisheries –microbiology-d164824899.html
aquatic –animals-and-plants-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: Explain the interactions between microorganisms and the food environment, and factors influencing their growth and survival.

CO 2: Describe the characteristics of foodborne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification.

CO 3: Explain why microbiological quality control programmes are necessary in food production

CO 4: Explain the effects of fermentation in food production and how it influences the microbiological quality and status of the food product.

CO 5: Discuss the rationale for the use of standard methods and procedures for the microbiological analysis of food.

Mapping with Cos With PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	M	S	M
CO3	S	S	M	S	M	S	S	M	S	S	S	M
CO4	S	S	M	S	M	M	S	M	S	S	M	M
CO5	S	S	S	S	M	M	S	S	M	S	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-III / Allied Practical(AP)-III	**FISH PROCESSING TECHNOLOGY**	**Course Code: ZVA3Y**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -40	**External Marks-60**	**Total Marks: 100**

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• To understand in detail the spoilage of fish along with associated factors • To understand the principles and practices associated with various methods of fish preservation • To introduce the bacterial quality of fish with an overview of the current quality assurance regimen. • Attending to special problems regarding quality and complaints. • To familiarize with the Good Hygienic Practices, Fish Safety Management Systems and Fish Regulations.	
UNIT	**CONTENT**	**HOURS**
I	Importance of fish in human diet. Nutritional quality of Fish. Proximate composition of fish. Spoilage of fish, Rigor mortis.	18
II	Drying: Basic principles, natural drying packing and storage of dried fish. Salting: principles, quality of salt, Kench salting, brine sailing. Smoking: Principles of smoking, cold smoking, hot smoking, fuel, packing and storage of smoked fish. Chilling: Manufacture and storage of ice, quality of ice, methods of chilling. Freezing: Basic principles, methods and application of chilling, Block freezing, Individual quick freezing (IQF), storage of chilled and frozen fish. Thermal processing. Canning. Other methods of processing and preservation. Spoilage in preserved seafood.	18
III	Fundamental aspects of quality control in sea food. Inspection of	18

	sea food quality. Different aspects of sea food quality. National agencies for sea food inspection. HACCP. Hygiene in processing plants.	
IV	Miscellaneous fishery products. Fishery by-products.	18
V	Bacteriology of fish and shellfish. Spoilage Bacteria. Bacteria of human health significance in seafood.	18
	Practicals 1. Visits to fish processing plant, ice plant and fish landing centre. 2. Proximate analysis of fish 3. Preparation of fishery products	

Text Book:

1. Balachandran K.K., 2001. Post Harvest Technology of Fish and Fish Products, Daya Publishing House, New Delhi.
2. Chincheste, C.O and Graham, H.D. Microbial safety of Fishery products,
3. Frasier, W.C and Westhoff,D.C Food Microbiology ,
4. Jay, J.M. Van Nostrand.D. Modern Food Microbiology
5. Amerine,M.A, pangborm,R.M Principles of sensory evaluation of food
6. Connell.J.J Control of fish Quality

Reference Books:

1. Bremmer, H.A. 2002. Safety and Quality Issues in Fish Processing. Woodhead Publ. Ltd., England, 507 pp.
2. Curting, C.L. 1999. Processing and Preservation. Agro Botanical Publ., Bikaner, India, 372 pp.
3. Gopakumar, K. 2002. Textbook of Fish Processing Technology. Indian Council of Agricultural Research, New Delhi, 491 pp.
4. Hall, G.M.1992 Fish Processing Technology. Chapman & Hall India, Madras, India, 309 pp.

5. ICAR 2006. Handbook of Fisheries and Aquaculture. Directorate of Information and Publication of Agriculture, ICAR, New Delhi, 755 pp.
6. Long, A.C. 2008. Fish Processing Technology. Cybertech Publ., New Delhi, 312 pp. 8. Moorjani, M.N. 1984. Fish Processing in India. Publ. Infor. Div., ICAR, New Delhi, 82 pp.

Web Resources:

fisheries –fisg processing technology-d164824899.html
aquatic –animals-and-plants-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: List marine and marine based products

CO 2: Recognize the fish processing and methods

CO 3: Locate the aquaculture and its functions

CO 4: Carryout the fish processing

CO 5: Interpret the fish and its economics .Describe fish processing with various adoptive methods

Mapping with Cos With PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	S	M	M	S	S	M	S	M
CO2	S	S	M	S	M	M	S	S	S	S	S	M
CO3	S	S	S	S	S	S	S	S	M	S	S	S
CO4	S	S	S	S	M	S	S	M	S	S	M	M
CO5	S	S	S	S	S	S	S	M	M	S	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-IV/ Core Course-IV	Packing and Labelling of Fish and Fishery Products	Course Code: ZVJ
Instruction Hours: 4	Credits: 4	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• Packaging may be defined as the means of ensuring the safe delivery of a product to the end consumer in sound condition at the minimum overall cost. • Foodpackaging is an external means of preservation of food during storage transportationand distribution. • They should facilitate storage, effective chilling, internal and long distance transport, easy determination of quantities and display in whole sale and retail markets. • Packaging materials protect the product from contamination or loss. The printing on the exterior of the package helps to identify the brand and attract the buyer's attention. • To familiarize with the Good Hygienic Practices, Fish Safety Management Systems and Fish Regulations.	
UNIT	**CONTENT**	**HOURS**
I	Food packaging, its purposes and procedures; technological aspects of packaging fisheryproducts; packing of fresh and frozen fish for consumers; packaging for transport, shipping and Institutional supplies; packaging standards for domestic AND International Trade.	15
II	Packaging materials; basic films and laminates, their manufacture and identification; resistance of packaging	15

	materials; development of protective packaging for fishery products.	
III	Methods of testing for packaging materials for their physical properties; containers and their testing and evaluation; package designs; resistance of packages to hazards in handling; transport and storage.	15
IV	Modified atmosphere packaging, controlled packaging and aseptic packaging. Flexible packing, retort pouch processing of fish and fishery products principles and techniques. Combination and synergistic effects.	15
V	Labelling and printing of packaging materials. Labeling requirements - national andinternational, legislation on labeling. Labeling for product traceability. Type of labeling fororganic foods, specific foods like organic foods, GM foods, irradiated foods, vegetarian and nonvegetarianfoods. Label design specification –size,colour.	15

Text Book:

1. Balachandran K.K., 2001. Post Harvest Technology of Fish and Fish Products, Daya Publishing House, New Delhi.
2. Desrosier N.W. and Treasler D.K Fundamentals of Food Freezing
3. Govindan T.K. Fish Processing Technology
4. Moorjani M.N. Fish Processing in India
5. Brody J. Fishery Byproduct Technology
6. Chicheste C.O. and Graham H.D. Microbial Safety of fishery Products
7. Amerien M.A. et.al. Principles of sensory evaluation of Food

Reference Books:

1. Bremmer, H.A. 2002. Safety and Quality Issues in Fish Processing .Woodhead Publ. Ltd., England, 507 pp.
2. Curting, C.L. 1999. Processing and Preservation. Agro Botanical Publ., Bikaner, India, 372 pp.

3. Gopakumar, K. 2002. Textbook of Fish Processing Technology. Indian Council of Agricultural Research, New Delhi, 491 pp.
4. Hall, G.M.1992 Fish Processing Technology. Chapman & Hall India, Madras, India, 309 pp.
5. ICAR 2006. Handbook of Fisheries and Aquaculture. Directorate of Information and Publication of Agriculture, ICAR, New Delhi, 755 pp.
6. Long, A.C. 2008. Fish Processing Technology. Cybertech Publ., New Delhi, 312 pp. 8. Moorjani, M.N. 1984. Fish Processing in India. Publ. Infor. Div., ICAR, New Delhi, 82 pp.

Web Resources:

https:/www.pdfdrive.com/handbook-of-fish biology-and-fisheries –volume-1-fish-biology-d183650412.html
aquatic –animals-and-plants-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: Identifies packing materials like Glass containers, Metal cans, Types of paper packages, Cellophane, LDPE, HDPE, Aluminium foil and Retort pouch
CO 2: Practises packing of Frozen Material like IQF products, Block frozen Products.
CO 3: Practises packing methods like, packing on stand pouch, packing in polythene covers.
CO 4: Categorises the packing of various value added fishery products and by products.
CO 5: Classifies the packaging of canned fish and fish pickle

Mapping with Cos With PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	M	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	M	S	S	M	M	S
CO3	S	S	M	S	S	S	S	M	S	S	S	S
CO4	S	S	M	S	M	M	S	S	S	S	M	M
CO5	S	S	S	S	M	M	S	S	M	S	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-IV/ Core Practical-VII	**Cured and Dried Fishery Products**	**Course Code: ZVKY**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -40	**External Marks-60**	**Total Marks: 100**

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• Discuss on methods of production of cured and smoked products; • Summarise the process of salting and drying; • explain the packaging methods of such products; • Describe storage and shelf life of these products. • To familiarize with the Good Hygienic Practices, Fish Safety Management Systems and Fish Regulations.	
UNIT	**CONTENT**	**HOURS**
I	Free and bound water in foods, water activity and sorption behaviours of foods, storagecharacteristics, microbial spoilage, effects of water activity on chemical deterioration, enzymatic reaction, non-enzymatic browning, lipid oxidation, reaction between lipids and proteins, dry fish,control of micro-organisms.	18
II	Principles of drying and dehydration: Psychometrics, drying calculation, constant rate and falling rate, drying time in air, moisture transport mechanism, natural drying, solar drying andmechanical drying. Different types of dryers: tunnel drier, vacuum drier, drum drier, solar drieretc. Freeze drying, preparation and its nutritive value. Dehydration of fish products: dehydrationratio, precautions to be taken in fish drying;	18

	denaturation of fish protein.	
III	Cured fish, types of salt curing, use of salt, factors affecting salt uptake by fish, lean and fattyfish, whole, gutted or split open, type and size of salt crystals, source of salts and impurities insalts, effect of impurities on salt penetration, temperature of salting.	18
IV	Smoke curing, chemistry of smoke, composition and properties, smoking methods: cold andhot method, use of smoke liquids, production of smoke, type of wood used, methods of smoke generation, carcinogens in smoke, smoke kilns.	18
V	Fermented products: different methods of fermentation, indigenious products and their principles of preservation. Marinades: Principles; processing of cold, cooked and fried marinades, shelf lifeand spoilage. Fish and shellfish pickles: production, shelf life Packaging requirements for dry, cured and fermented products.	18
	Practicals 1. Biochemical analysis of dry fish products 2. Microbial analysis of dry fish products 3. Smoking method cold and hot method 4. Processing of cold, cooked and fried marinades 5. Principles; processing of cold, cooked and fried marinades 6. Fish and shellfish pickles: production, 7. Shelf life Packaging requirements for dry,cured and fermented products.	

Text Book:

1. Balachandran K.K., 2001. Post Harvest Technology of Fish and Fish Products, Daya Publishing House, New Delhi.
2. Desrosier N.W. and Treasler D.K Fundamentals of Food Freezing
3. Govindan T.K. Fish Processing Technology

4. Moorjani M.N. Fish Processing in India
5. Brody J. Fishery Byproduct Technology
6. Chicheste C.O. and Graham H.D. Microbial Safety of fishery Products
7. Amerien M.A. et.al. Principles of sensory evaluation of Food

Reference Books

1. Gopakumar K. Text Book of Fish Processing Technology
2. Hall, G.M. Fish Processing Technology.
3. Hui,Y.H., Merle D.P., & J R. Gorham Food borne Disease Handbook.
4. Oefjen, G.W., Haseky& Peter Freeze drying.
5. Sen D. P. Advances in Fish Processing Technology.
6. Wheaton & Lawson Processing Aquatic Food Products

Web Resources:

https:/www.pdfdrive.com/handbook-of-fish biology-and-fisheries –volume-1-fish-biology-d183650412.html
aquatic –animals-and-plants-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: Polyester polyethylene laminated pouches have been found to be highly suitable for hygienic retail packaging of cured fish products.

CO 2: Preservation, nevertheless, is still the prime objective of fish smoking in most parts of the world.

CO 3: Hard woods, such as oak, hickory, cherry, apple and beech, burn to give a smoke with the more phenols, which both preserve and give a characteristic, 'medicated' flavours to the product. Dried, Cured and Smoked Products

CO 4: Colourimpared to the fish by the smoking process is due to carbonyl amino reactions of the Maillard type.

CO 5: These are splitting and cleaning, salting and hanging.

Mapping with Cos With PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	M	S	S
CO3	S	S	S	S	M	S	M	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	S	S	M
CO5	S	S	S	S	M	M	S	S	M	S	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-IV/ Core Practical-VIII	**Fish Products and by products Technology**	**Course Code: ZVLY**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -40	**External Marks-60**	**Total Marks: 100**

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• Principle of fish preservation and processing. Processing of fish by traditional methods – salting, sun drying, smoking, marinading and fermentation. • Theory of salting, methods of salting –wet salting and dry salting. • Drying and dehydration- theory, importance of water activity in relation to microbial growth .Sun drying and artificial drying- solar dryer. • Packaging and storage of salted and dried fish. Different types of spoilage in salt cured fish. Quality standard for salted and dry fish. • Fish preservation by smoking- chemical composition of wood smoke and their role in preservation. Methods of smoking and equipment's used for smoking.	
UNIT	**CONTENT**	**HOURS**
I	**Principles of Fish Preservation:** Composition of fish - Proximate composition - Seafood spoilage - Fish preservation. Fish preservation methods and principles :Chilling- Freezing - MAP (Modified Atmospheric Packaging) - Curing (drying, salting and smoking) - Canning and Retort pouch packaging Marinating- Boiling- Fermentation- Irradiation - Freeze-drying - Hurdle technology.	18
II	**Extrusion:** Extrusion- Extruder- Extrusion cooking- Extruded products- Extrusion processing steps. Types of extruders: Single screw extruder- Twin screw extruder. Difference between	18

	the single screw and twine screw extruder. Advantages of extrusion cooking.	
III	**Fish protein concentrate**: Fish protein concentrate- Methods used for preparation of Fish Protein Concentrate- Types of FPC- Proximate composition of FPC- Use of FPC. Fish Protein Hydrolysate: Fish protein hydrolysates. Methods of protein hydrolysis: Acid hydrolysis- Alkali Hydrolysis- Biochemical methods. Critical parameters while preparing Fish protein hydrolysate. Proximate composition and Nutritional value. Autolysis assisted hydrolysis of fish protein hydrolysate. Application of fish Protein Hydrolysate. Advantages of preparation of protein hydrolysates.	18
IV	**Fish meal and fish oil:**Fish meal- Use of fish meal as feed ingredient- Raw materials used in fish meal. Processing Method: Wet reduction/rendering process- Dry reduction/rendering process. Equipments used in fish meal plant- Fish meal quality. Fish oil: Production of fish oil- Wet Reduction Process- Dry reduction Process- Processing of fish oil. Unsaturated Fatty acids.	18
V	**Fish By- products**: Isinglass- Shark leather- Fish glue- Pearl Essence- Beche- de -mer.Chitin and Chitosan: Characteristics of chitin and chitosan- Preparation of Chitin and Chitosan- Uses of Chitin and chitosan. Seaweeds: Types of seaweeds- Species of seaweeds cultured- Seaweed resources of India- Utilization of seaweeds- Agaragar- Carrageenan- Other hydrocolloids. Diversified fish products/ value addition: Breaded and Battered Products- Fish finger and FIsh cutlet- Imitation products- HACCP in product preparation- Determination of CCPs- Specification of criteria for control- Monitoring and checking system- Corrective action, verification and documentation- Training of Personnel.	18

	Practicals 1. Fish preservation methods 2. Modified Atmospheric packaging(MAP) 3. Traditional method of fish preservation 4. Methods of fish drying: Natural, Solar, Artificial, Mechanical dryer 5. Preparation of extruded products using single screw and twin screw extruder. 6. Fish protein hydrolysate preparation 7. Production of fish oil by soxhlet extraction method. 8. Extraction of chitosan from shrimp shell waste by conventional chemical method 9. Culturing of sea weed 10. Preparation of any fish product/value addition 11. Document preparation for any product

Text Book:

1. Balachandran K.K., 2001. Post Harvest Technology of Fish and Fish Products, Daya Publishing House, New Delhi.
2. Desrosier N.W. and Treasler D.K Fundamentals of Food Freezing
3. Govindan T.K. Fish Processing Technology
4. Moorjani M.N. Fish Processing in India
5. Brody J. Fishery Byproduct Technology
6. Chicheste C.O. and Graham H.D. Microbial Safety of fishery Products
7. Amerien M.A. et.al. Principles of sensory evaluation of Food

Reference Books:

1. Fish Preservation and Processing Technique. Author: UgochukwuNwaigwe, Department of Food science and Technology, Michael Okpara University of Agriculture, Umudike : https://www.researchgate.net/publication/316918904 (All content following this page was uploaded by UgochukwuNwaigwe on 14 May 2017.)

2. Fisheries Technologies for Developing Countries. 1988. Washington, DC: The National Academies Press. https://doi.org/10.17226/1024. Publication Info 176 pages, ISBN: 978-0-309-03788-4 DOI: https://doi.org/10.17226/1024
3. Nutrient Requirements of Fish and Shrimp,(2011) The National Academies Press, Washington DC.ISBN-13:978-0-309-16338-5. www.nap.edu

Web Resources:

https:/www.pdfdrive.com/handbook-of-fish biology-and-fisheries –volume-1-fish-biology-d183650412.html
aquatic –animals-and-plants-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: Has profound and detailed scientific knowledge and understanding of the (bio)chemical processes in biological raw materials during postharvest storage and their transformation into food products.

CO 2:Has profound and detailed scientific knowledge and understanding of ecology, physiology, detection, use and combat microorganisms in food systems.

CO 3: Has profound and detailed scientific knowledge in different fields of product technology such as vegetable products, dairy products, meat products, fish products, cereal derived products and fermented products including aspects of product development in relation to consumer behavior.

CO 4: Colourimpared to the fish by the smoking process is due to carbonyl amino reactions of the Maillard type.

CO 5: These are splitting and cleaning, salting and hanging.

Mapping with Cos With PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	S	S	S	S	S	S	S	S
CO2	S	S	M	S	M	S	M	S	S	S	M	S
CO3	S	S	S	S	S	S	S	S	M	S	S	S
CO4	S	S	M	M	M	M	S	S	S	S	M	M
CO5	S	S	S	S	M	M	S	S	M	S	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-IV/ Allied Practical(AP)- IV	**Storage and transportation of fishery products**	**Course Code: ZVA4Y**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -40	**External Marks-60**	**Total Marks: 100**

Cognitive Level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• The transport vehicle should be examined for overall hygienic condition. • Products subject to fifth, taint or contamination should be rejected. • The transport vehicle should be examined for possible cross contamination of ready-to-eat fish and fishery products by raw fish and fishery products. • Determine that cooked-ready-to-eat product has not been exposed to raw product or juices or live molluscan shellfish and that raw molluscan shellfish have not been exposed to other raw fish or shellfish. • Fish preservation by smoking- chemical composition of wood smoke and their role in preservation. Methods of smoking and equipments used for smoking.	
UNIT	**CONTENT**	**HOURS**
I	Fish as raw material for processing: Body structure, physical properties, shape, specific weight,bulk weight, angle of slip, weight composition. Factors affecting quality offresh fish: intrinsicand extrinsic factors. Post-harvest Fishery losses, Methods to reduce losses during storage and transportation.	18
II	Changes in Fish muscle during freezing and in the cold storage- ice crystal formation, shrinkage,driploss, organoleptic changes, freezer burn, texture, protein denaturation, nutritional changes,enzyme denaturation, declaining of bacterial load, discolouration.	18

III	Layout and factors to be considered during storage- Chute, raw material receiving room,chill room, processing hall, working table and utensiles, freezers, cold storage, machinery,ventillation, measures for controlling flies and animals, lighting, potable water and ice, toiletacilities, laboratory etc.	18
IV	Types of fish storage. Functions of cold storage, Types of cold storage. Chill storage and frozenstorage. Heat load calculation, storage methods. insulated boxes and insulation thickness,different types of ice, physical, chemical, microbiological and sensory changes during chillstorage, iced storage shelf life, cold shock, physical,chemical and sensory methods of analysis.	18
V	Various types of fish transport systems. Transportation: Live fish/shell fish, Transportationof raw fish to local markets and processing centres, Improvements needed in transportation,Refrigerated transport systems, Classification of transport vehicles, Cold chain.	18
	Practicals 1. Chill storage and frozenstorage 2. Transportationof raw fish to local markets and processing centres, 3. Refrigerated transport systems 4. Methods to reduce losses during storage and transportation 5. Types of fish storage. Functions of cold storage, Types of cold storage 6. Physical, chemical and sensory methods of analysis 7. Various types of fish transport systems. Transportation: Live fish/shell fish.	

Text Book:

1. Balachandran K.K., 2001. Post Harvest Technology of Fish and Fish Products, Daya Publishing House, New Delhi.
2. Desrosier N.W. and Treasler D.K Fundamentals of Food Freezing

3. Govindan T.K. Fish Processing Technology
4. Moorjani M.N. Fish Processing in India
5. Brody J. Fishery Byproduct Technology
6. Chicheste C.O. and Graham H.D. Microbial Safety of fishery Products
7. Amerien M.A. et.al. Principles of sensory evaluation of Food

Reference Books:

1. Fish Preservation and Processing Technique. Author: UgochukwuNwaigwe, Department of Food science and Technology, Michael Okpara University of Agriculture, Umudike : https://www.researchgate.net/publication/316918904 (All content following this page was uploaded by UgochukwuNwaigwe on 14 May 2017.)
2. Aitken, A., et al. Fish handling and processing.
3. Balachandran, K. K. Post harvest technology of fish and fish products.
4. Connell, J. J. Advances in fish sciences and technology.
5. George, M. Hall. Fish processing technology.
6. Gopakumar K. Text Book of Fish Processing Technology.
7. Sen D. P. Advances in Fish Processing Technology.

Web Resources:

https:/www.pdfdrive.com/handbook-of-fish biology-and-fisheries –volume-1-fish-biology-d183650412.html
aquatic –animals-and-plants-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: To maintain fish quality, both at sea and onshore, the specification of the production, storage and delivery system should enable the levels and patterns of demand to be serviced at all times.
CO 2: It is recommended that in most circumstances this is best achieved by the provision of an ice plant at the place of landing.
CO 3: Where there is a significant supply to vessels, the plant is best located on a dedicated berth that enables direct delivery to the vessels.
CO 4: The delivery system should be able to accommodate the various hatch positions and shelterdeck arrangements etc.
CO 5: These are splitting and cleaning, salting and hanging.

Mapping with Cos With PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	S	S	S	S	S	S	M	S
CO2	S	S	S	M	S	S	S	S	S	S	S	S
CO3	S	M	S	S	S	S	S	S	S	M	S	S
CO4	S	M	S	S	M	S	S	S	S	M	M	M
CO5	S	S	S	S	S	M	S	S	M	M	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-V/ Core Course-V	**Entrepreneurship Development**	**Course Code: ZVM**
Instruction Hours: 3	**Credits: 3**	**Exam Hours: 3**
Internal Marks -25	**External Marks-75**	**Total Marks: 100**

Cognitive level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• Understand the meaning of entrepreneur and entrepreneurship. • Explain the characteristics of entrepreneur and entrepreneurship. • Discuss the different types of entrepreneurs. • Highlight the entrepreneurial traits. • Understand the meaning of Evaluates the Marine fish landings in India (QTY).	
UNIT	**CONTENT**	**HOURS**
I	Entrepreneurial development: Environmental factors influencing entrepreneurship- Social Factors- Psychological environment- Governmental Influence- Factors Influencing entrepreneurship	12
II	Entrepreneurship: Concept of Entrepreneur- characteristics, profile and importance of Entrepreneurship - Kinds of entrepreneurs- Role and Functions of an Entrepreneur- Qualities of a Successful Entrepreneur- Circumstances Favouring Entrepreneurship.	12
III	Managing an enterprise – Motivation and entrepreneurship development: Motivation concepts - Categories of Motivation- Types of motivation- Motivation is important to an individual as.	12

IV	Entrepreneurs Development Programmes (EDPs) and SWOT Analysis- Government Schemes and Incentives for Promotion of Entrepreneurship.	12
V	Government policy on Small and Medium Enterprises- Export and Import policies of Fisheries Sector- Joint ventures, sub contracting, venture capital and public and private partnerships	12

Text Book:

1. Bartlett C &Piramal G. 2000. World Class in India: A Case Book of Companies in Transformation. Penguin India.
2. FICCI. 2000. A Pictorial History of Indian Business. Oxford University Press
3. Krueger NF. 2002. Entrepreneurship – Critical Perspectives on Business Management. Taylor & Francis.
4. Ojha SN &Slaim SS.2000. Entrepreneurship Development and Project Formulation. CIFE, Mumbai,.
5. Brody J. Fishery Byproduct Technology
6. Chicheste C.O. and Graham H.D. Microbial Safety of fishery Products
7. Amerien M.A. et.al. Principles of sensory evaluation of Food

Reference Books:

1. Fish Preservation and Processing Technique. Author: UgochukwuNwaigwe, Department of Food science and Technology, Michael Okpara University of Agriculture, Umudike : https://www.researchgate.net/publication/316918904 (All content following this page was uploaded by UgochukwuNwaigwe on 14 May 2017.)
2. Aitken, A., et al. Fish handling and processing.
3. Balachandran, K. K. Post harvest technology of fish and fish products.
4. Connell, J. J. Advances in fish sciences and technology.
5. George, M. Hall. Fish processing technology.
6. Gopakumar K. Text Book of Fish Processing Technology.
7. Sen D. P. Advances in Fish Processing Technology.

Web Resources:

https:/www.pdfdrive.com/handbook-of-fish biology-and-fisheries –volume-1-fish-biology-d183650412.html

aquatic –animals-and-plants-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: The amount of subsidies provided is much less with less than 8 per cent of the total value even though challenged internationally.

CO 2: The marine fisheries sector in India is subsistence fishing and much different from the factory / commercial fishing of developed countries.

CO 3: In addition the fuel subsidy provided contributes to less than 5 per cent of the total value of landings.

CO 4: But on the other side the welfare measures, saving cum relief, housing and other transfer payment adds to the subsidy component in the Indian context. Evaluates the Marine fish landings in India (Qty)

CO 5: Records in Value of marine landings at landing centre.Value of marine landings at retail level of the delivery system should be maintained.Total subsidy of Entrepreneurs.

Mapping with Cos With PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	M	M	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	M	S	S	M	S
CO3	S	S	S	M	S	S	S	M	S	S	S	S
CO4	S	S	S	S	S	M	S	S	S	M	M	M
CO5	S	S	S	S	M	S	S	S	M	S	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-V/ Core Course-VI	**Fisheries Economics**	**Course Code:-ZVN**
Instruction Hours: 3	**Credits: 3**	**Exam Hours: 3**
Internal Marks -25	**External Marks-75**	**Total Marks: 100**

Cognitive level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• To understand the concept of safe food and types of hazards associated with food. • To control the potential threats to Micro Economics . • To familiarize with the Good Hygienic Practices, Food Safety Management Systems and Food Regulations. • Highlight the General Agreement on Tariffs and Trade(GATT). • Understand the meaning of Evaluates the Marine fish landings in India(QTY).	
UNIT	**CONTENT**	**HOURS**
I	Introduction to economics- Micro economics- Demand, -Elasticity of demand –Supply & market Prices-law of diminishing marginal utility.	12
II	Production- Production function- Costs & Returns of scale and Break-even analysis in fish production system.	12
III	Profit maximization- Farm planning and budgeting- Preparation of Enterprise budget for Integrated fish farming. Macroeconomics: National Economy- Contribution of fisheries in GNP and employement- International trade and exchange.	12
IV	Introduction to General Agreement on Tariffs and Trade (GATT)	12

	& World Trade Organization (WTO), WTO-Framework- Intellectual property rights (IPRs) and different forms- Agreement on Trade – Related Aspects of Intellectual Property Rights (TRIPS)- Biopiracy.	
V	Economic Growth - Fisheries Trade and Environment- Patents in Indian Fisheries Sector- GMOs in fisheries- Concepts of externality and social cost.	12

Text Book

1. Bartlett C &Piramal G. 2000. World Class in India: A Case Book of Companies in Transformation. Penguin India.
2. FICCI. 2000. A Pictorial History of Fisheries Economics. Oxford University Press
3. Krueger NF. 2002. Fisheries Economics – Critical Perspectives on Business Management. Taylor & Francis.
4. Ojha SN &Slaim SS.2000. Entrepreneurship Development and Project Formulation. CIFE, Mumbai,.
5. Brody J. Fishery By product Technology
6. Chicheste C.O. and Graham H.D. Microbial Safety of fishery Products
7. Amerien M.A. et.al. Principles of sensory evaluation of Food

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3. Balachandran, K. K. Post harvest technology of fish and fish products.
4. Connell, J. J. Advances in fish sciences and technology.
5. George, M. Hall. Fish processing technology.
6. Gopakumar K. Text Book of Fish Processing Technology.

Web Resources:

https:/www.pdfdrive.com/handbook-of- Fisheries Economics -and-fisheries –volume-1-fish-biology-d183650412.html

aquatic –animals-and-plants-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1:To control the potential threats to Micro Economics .

CO 2: The marine fisheries sector in India is subsistence fishing and much different from the factory / commercial fishing of developed countries.

CO 3: In addition the fuel subsidy provided contributes to less than 5 per cent of the total value of landings.

CO 4: But on the other side the welfare measures, saving cum relief, housing and other transfer payment adds to the subsidy component in the Indian context. Evaluates the Marine fish landings in India (Qty)

CO 5: The delivery system should be able to accommodate the externality social cost.

Mapping with Cos With PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	S	S	S	S	S	S	S	S
CO2	S	S	M	S	S	S	S	S	M	S	S	M
CO3	S	S	M	S	M	S	S	S	S	S	S	S
CO4	S	S	S	M	S	M	S	S	S	S	M	M
CO5	S	S	S	S	M	M	S	S	M	S	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-V/ Core Course-VII	**Quality Control of fish and fishery products**	**Course Code: ZVO**
Instruction Hours: 4	**Credits: 4**	**Exam Hours: 3**
Internal Marks -25	**External Marks-75**	**Total Marks: 100**

Cognitive level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• To enable the knowledge can get students about the experiment , fresh fish quality, fish spoilage process. • the microbiological quality methods in determination of spoilage. • The course will provide cured fish quality crystal formation process and methodology.. • This involves learning about sea food production methods HACCP in biological methods. • Understand the meaning of Evaluates the Marine fish landings in India(QTY).	
UNIT	**CONTENT**	**HOURS**
I	Fresh fish quality: Maintenance of quality-intrinsic quality- fish spoilage-sanitation- assessment of quality-HACCP in processing raw shrimp. Frozen fish quality: crystal formation- freezing rate-deterioration- rancidity-processing specification and checking-inspection of raw material and product- recording, reporting and action	15
II	Cured fish quality: schedule of quality control in the production of sun dried fish- salted fish-type of salt-quality of salt- schedule of quality control in the production of salted fishes- schedule of quality control in the production of hot smoked fish.	15

III	Canned fish quality: schedule of quality control in the production of fishery products-defects and rejection of canned fish product-quality defect in canned fish products-cut out test for canned fishery products.	15
IV	Microbiological quality: method for determination of the content of bacteria in fish- determination of spoilage.	15
V	Sanitation: Hygenic practices- cleaning procedures- hygienic practices check list- phases of good cleaning procedures Hazard Analysis Critical Control Point (HACCP)- introduction-definition-hazard analysis of food-critical control point- rules in applying HACCP- reason for applying HACCP- Developing HACCP plan- Biological hazards-chemical hazards. **Hygenic practices:** Employee health-employee appearance-finger nailpolish- jewellery- smoking/spitting/gum or tobacco chewing- handwashing-head gear- Beared employee- outer garments- protective hand covering- toilet areas- personnel permitted in processing area- foot dips.	15

Text Book:

1. Bartlett C &Piramal G. 2000. World Class in India: A Case Book of Companies in Transformation. Penguin India.
2. Quality control of fish and fishery products. 1999. CBT rajagopalan and P Velayutham. Fisheries college and research institute, TANVASU, Thoothukkudi.
3. Krueger NF. 2002. Fisheries Economics – Critical Perspectives on Business Management. Taylor & Francis.
4. Ojha SN &Slaim SS.2000. Entrepreneurship Development and Project Formulation. CIFE, Mumbai,.
5. Brody J. Fishery By product Technology
6. Chicheste C.O. and Graham H.D. Microbial Safety of fishery Products
7. Amerien M.A. et.al. Principles of sensory evaluation of Food

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3. Balachandran, K. K. Post harvest technology of fish and fish products.
4. Connell, J. J. Advances in fish sciences and technology.
5. George, M. Hall. Fish processing technology.
6. Gopakumar K. Text Book of Fish Processing Technology.

Web Resources:

https:/www.pdfdrive.com/handbook-of- Fisheries Economics -and-fisheries –volume-1-fish-biology-d183650412.html
aquatic –animals-and-plants-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1:Possess knowledge of the fish quality and intrinsic quality.

CO 2: Fish preservation methods.

CO 3: Modified Atmospheric packaging(MAP)

CO 4: Traditional method of fish preservation

CO 5: Methods of fish drying: Natural, Solar, Artificial, Mechanical dryer. Preparation of extruded products using single screw and twin screw extruder.

Mapping with Cos With PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	S	S	S	S	S	S	M	S
CO2	S	S	S	M	S	M	S	S	S	S	M	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	S	M	M
CO5	S	S	S	S	M	S	S	S	S	S	S	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-V/ Core Practical-IX	**Fisheries Extension Education**	**Course Code: ZVPY**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -40	**External Marks-60**	**Total Marks: 100**

Cognitive level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• To understand the concept of Extension Education and types of objectives associated with food. • To the fundamental objective of exension is to develop the rural people economically, socially and culturally by means of education. • To familiarize assist people to discover and analyse their problems and identify the felt needs. • This involves learning about sea food production methods HACCP in biological methods. • Understand the meaning of Evaluates the Marine fish landings in India(QTY).	
UNIT	**CONTENT**	**HOURS**
I	Extension Education , meaning ,definitions and concepts, objective of extension. Principles of extension: fisheries extension- scope-history of fisheries extension in India.	18
II	Extension Teaching Methods and their classification: Individual contact methods 1 : farm and Home visit – office calls- personal letters- phone call. Method-II: conducting demonstration. Group contact method 1: demonstration, field trip and tours. Group contact method-II: general meeting- group discussion-lectures- seminars-forum- workshop-role playing. Mass contact method-I: Campaign-Exhibition- Mass contact method-II: Radio talk- Public Address	18

	system- Audio visual Aid- Television telecast.	
III	Profit maximization- Farm planning and budgeting- Preparation of Enterprise budget for Integrated fish farming. Macroeconomics: National Economy- Contribution of fisheries in GNP and employement- International trade and exchange.	18
IV	Adoption and Diffusion of Innovations: communication 1: definition-meaning- importance and types. Communication-II: introduction-Aristotle model of communication-Lasswell's model-Shannon and weaver model – David Berlo's model. Communication-III: messages/content-treatment of messages-channels of communication- receiver/audience- audience response. Adopter categories: introduction-Innovators-laggards. Innovation and Decision process: knowledge-persuasion-decision-implementation-confirmation-over adoption-diffusion effect-consequences of innovations. Barriers to diffusion of fisheries innovations.	18
V	Extension programme planning-: introduction-extension programme-programme planning- objectives- principles-nature of programme planning. Steps in extension programme planning; introduction-collection of facts and analysis of situation-identification of problems- developing plan of work and calendar operation-evaluation of progress-revision of programme. Participatory programme planning: planning process- purpose.	18
	Practicals: • P1: Visit to the State Department of Fisheries- To Learn any on technique & Document preparation • P2: Visit to Marine Products Export Development Authority - To Learn any on technique & Document preparation • P3: Visit to KVKs to study the activities and extension approaches of the KVKs - To Learn any on technique & Document preparation	

	• P4: Visit to state Agriculture Department to study the extension approaches adopted by the organisation • P5: Visit to an NGO to study their extension works and approaches in fisheries • P9: Conducting field studies on village institutions and organizations and their role in the village development • P10: Field study on participation of women in fisheries • P12: Field studies an impact of extension programmes • P13: Practical exercise on conducting method demonstration P14: Practical exercise on preparation of charts,posters and Flash cards.

Text Book

1. Das Gupta, D., Extension education.Core contents and emerging areas.Agrobios (India) , Jodhpur.2006.
2. Dahama, O.P., and O.P. Bhatnagar. Education and communication for development. Oxford & IBH Publishing House, New Delhi. 1980.

Reference Books

1. Fish Preservation and Processing Technique. Author: UgochukwuNwaigwe, Department of Food science and Technology, Michael Okpara University of Agriculture, Umudike : https://www.researchgate.net/publication/316918904 (All content following this page was uploaded by UgochukwuNwaigwe on 14 May 2017.)
2. Aitken, A., et al. Fish handling and processing.
3. Balachandran, K. K. Post harvest technology of fish and fish products.
4. Connell, J. J. Advances in fish sciences and technology.
5. George, M. Hall. Fish processing technology.
6. Gopakumar K. Text Book of Fish Processing Technology.

Web Resources

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aquatic –animals-and-plants-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: Visit to live fish market to know the availability of fishes and record keeping of relevant data

CO 2: Visit to dry fish market to know the preserved and processed fishes and record keeping of relevant data

CO 3: Collection of fish, molluscs and crustacean from adjacent fishing harbours to study identification, anatomy and record keeping of Relevant Data.

CO 4: Traditional method of fish preservation

CO 5: Methods of fish drying: Natural, Solar, Artificial, Mechanical dryer.Preparation of extruded products using single screw and twin screw extruder.

Mapping with Cos With PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	S	S	S	S	S	S	S	M
CO2	S	S	S	S	S	S	M	S	M	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	M	S	S	S	S	M	M
CO5	S	S	S	S	M	M	S	M	S	S	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-V/ Core Practical-X	**Marine Biotechnology**	**Course Code: ZVQY**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -40	**External Marks-60**	**Total Marks: 100**

Cognitive level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• To understand The Marine Ecosystem has rich Biodiversity, and the organism themselves contain vital biochemical compounds. • To the fundamental objective of exension is to develop the rural people economically, socially and culturally by means of education. • To understand the principles and practices associated with various methods of fish preservation , Marine Biodiversity. • This involves learning about sea food production methods HACCP in biological methods. • Understand the meaning of Evaluates the Marine fish landings in India(QTY).	
UNIT	**CONTENT**	**HOURS**
I	Bioactive compounds from marine organisms: Introduction-marine bacteria- fungi- microalgae—sponges and sea anemone.	18
II	Waste water treatment: characteristics of aquaculture waste water-Effect of aquaculture wastewaters-treatment of aquaculture wastewater-Oxidation and synthesis-Nitrogen removal-Nitrification-Denitrification-Heterotrophic denitrification-Autotrophic denitrification- Phosphate removal- Recent studies on treatment of aquaculture waste water-. Bioremediation in aquaculture systems: Bioremediation of organic detritus, Nitrogenous compounds, HydrogenSulphide. Bioremediators as	18

	disease controlling agents. Bioremediation of aquaculture effluent using microbial mat-Wastewater related from seafood processing plant.	
III	Biofilters in aquaculture: General water quality maintenance principles-Aeration or oxygenating systems-Particulate Filters-Foam fractionators-Ozone-UV light-Carbon dioxide strippers-Characteristics of the "Ideal" biofilter- Characteristics of real biofilters-Aquatic plant systems-Fluidized bed sand filters-Bead filters-Biodisks or RBC (Rotating Biological Contactors)- Trickling filters-Submerged bed filters-Submerged filters.	18
IV	Biofertilizers: Introduction- Potentials of Azolla-Application of Azolla in aquatic system-Cultivation of Azolla-Applications in fish farming.	18
V	Probiotics: The use of probiotics in aquaculture-Rationale for the use of probiotics in aquaculture-Probiotic preparation-Bacillus spp.-*Saccharomyces cerevisiae-S*afety and evaluation of probiotics-Prebiotics. Biosensor: Introduction- Advantages (bioavailability, etc) and concept-Prokaryotic biosensors-Eukaryotic biosensors-Components of a biosensor-Applications-Biosensors in food analysis.	18
	Practicals: 1. Isolation of Bioactive compounds from marine organisms 2. Waste water treatment 3. Cultivation of Azolla 4. Isolation of bacteria from commercial probiotic products	

Text Book

1. Sadasivam. S. and A. Manickam. 1992. Biochemical methods for agricultural sciences. Wiley Eastern limited and TNAU. 246pp.
2. Antony , S.P. and Philip. R., 2006.Bioremediation of shrimp culture systems, NAGA World Fish Centre, 29: (3 & 4).

3. Beaumont , A.R., Boudry, P. and Hoare,K.2010. Biotechnology and Genetics in Fisheries and Aquaculture. 2nd edition.Wiley-blackwell,Singapore 202p.

Reference Books

1. Fish Preservation and Processing Technique. Author: UgochukwuNwaigwe, Department of Food science and Technology, Michael Okpara University of Agriculture, Umudike : https://www.researchgate.net/publication/316918904 (All content following this page was uploaded by UgochukwuNwaigwe on 14 May 2017.)
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aquatic –animals-and-plants-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: After successful completion of this course students will able to the Marine Ecosystem has Rich Biodiversity, and the organism themselves contain vital biochemical compounds.

CO 2: Identify the components of awide array of uses in medicine, environment, and other industries.

CO 3: Collection of fish, molluscs and crustacean from adjacent fishing harbours to study identification, anatomy and record keeping of Relevant Data.

CO 4: Traditional method of fish preservation

CO 5: Methods of fish drying: Natural, Solar, Artificial, Mechanical dryer. Preparation of extruded products using single screw and twin screw extruder.

Mapping with Cos With PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	S	S	S	S	M	S	S	S
CO2	S	S	S	S	S	S	S	S	S	M	S	M
CO3	S	S	S	S	S	M	S	S	S	S	S	S
CO4	S	S	M	S	S	M	S	S	M	S	M	M
CO5	S	S	S	S	S	M	S	S	M	S	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation

Semester-VI/ Core Course-VIII	**Fisheries Administrations and Legislation**	**Course Code: ZVS**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks -25	**External Marks-75**	**Total Marks: 100**

Cognitive level	K - 1 Acquire / Remember K - 2 Understand K - 3 Apply K - 4 Analyze K - 5 Evaluate K - 6 Create	
Course Objectives	• To study the research on this field is vital to tap the vast potential of the marine environment to improve human life in any way possible. • .To gain knowledge of Fishery Science with regards to Population Dynamics. • To consider the application of statistical tools to study fishery science. . • To learn about definition and scope of public administration , principles of management of public enterprises. • Understand the meaning of Evaluates the Marine fish landings in India(QTY).	
UNIT	**CONTENT**	**HOURS**
I	Public administration: Principles of organization- Public sector enterprises- Current scenario- Public sector enterprises- Forms of organization of enterprises- Importance of public sector enterprises- Producer companies & Trusts. Legal and organizational framework: Fisheries administration in India- Work allocation- Key State Government Organizations- Fisheries administration in Tamilnadu.	18
II	Fisheries development over five year plans: Sectoral Growth- Marine fisheries: Contributions to state economy- Development of marine fisheries during Five Year Plans- Investment in fisheries sector- An analysis of growth in production and fishing capacity- The 2002 Tenth Five Year Plan and the 2004 India Marine Fishing Policy.	18

III	General background on law: Introduction- M.C. Mehta v. Kamal Nath- 'Span Motel Case'- Legislations covering IPRs in India- Indian constitution. Marine fisheries legislations: The Indian Fisheries Act, No. 4 of 1897- The Maritime Zones of India (Regulation of fishing by foreign vessels) Rules, 1982.	18
IV	Laws and policies related to the environment: The Environment Protection Act, 1986- The Water (Prevention and Control of Pollution) Act,1974- The Air (Prevention and Control of Pollution) act, 1981- National Environment Policy 2006- Protected area Management- Integrated coastal and ocean management (ICM)- Legislations Related to Protected Area Management- CITES- Biological Diversity Act 2002 (No. 18 of 2003).	18
V	Laws relating to fish products and fish marketing: Introduction- Some important acts regulating fish products- Trade and other matters- Consumer Protection and Regulations. International law of the sea: Introduction- Shared fish Stocks- Prohibition of Driftnet Fishing- Sustainable Fishing- European Union Fish Labeling Requirements- Shrimp-turtle case- WTO- Code of conduct for responsible fisheries- SEZ Law(s) and India's Coastal Areas.	18

Text Book

1. Anon. 1998. Maritime Law of India in the International Context.Bhadarkar Publ.
2. Brahtz JFP. 1972. Coastal Zone Management. U.N. International Economicand Social Affairs, New York
3. Churchill RR & Lowe AV. 1988. Law of the Sea. Manchester University Press.
4. Henkin L, Pugh RC &Smit H. 1993. International Law: Cases and Materials. West Publ. Co.
5. Sinha RK. (Ed.). 1996. Marine Resources and Applicable Laws (World Environmental Series - 009). Commonwealth Publ.
6. Verghese CP. 1989. Fishing Regulation in India's Territorial Waters.World Fishing.

7. Cairns J Jr. 1994. Implementing Integrated Environmental Management. Virginia Tech. University.

Reference Book

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4. Connell, J. J. Advances in fish sciences and technology.
5. George, M. Hall. Fish processing technology.
6. Gopakumar K. Text Book of Fish Processing Technology.

Web Resources

https:/www.pdfdrive.com/handbook-of- Fisheries Economics -and-fisheries –volume-1-fish-biology-d183650412.html

aquatic –animals-and-plants-d164824899.html

Course Outcomes:

On completion of the course the learner will be able

CO 1: After Successful completion of this course work students will able to Fisheries Administration's tasks have shifted from general authority in fisheries to technical support to decentralized institutions, but this is not generally reflected in the actual functioning of the administration.

CO 2: The fisheries administration and decentralized authorities suffer from financial constraints and a lackof specialized personnel at community level.

CO 3: Views of fisheries staff on fisheries management differ between the national and the local level.

CO 4: Continuous reorganization and decentralization processes have reduced transparency and complicated communnication line (both horizontal and vertical)

CO 5: A multitude of non fisheriesinstitutues increasingly have key roles to play in fisheries management fisheries legislation, with as one result that procedures are becoming long and complicated and the outcomes unsure.

Mapping with Cos With PO & PSOs

CO/PO	PO						PSO					
	1	2	3	4	5	6	1	2	3	4	5	6
CO1	S	S	S	S	S	S	S	S	S	S	S	S
CO2	S	S	M	S	S	M	S	S	M	S	S	M
CO3	S	M	M	S	S	M	S	S	M	M	S	M
CO4	S	S	M	S	M	M	S	S	M	M	M	M
CO5	S	S	S	S	M	M	S	S	M	M	M	S

S – Strongly correlating
M- Moderately correlating
W- Weakly correlating
N-No correlation