

VOCATIONAL HIGHER SECONDARY
FIRST YEAR

FISH PROCESSING TECHNOLOGY
TEACHERS' SOURCEBOOK



GOVERNMENT OF KERALA
Department of Education

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State Council of Educational Research & Training (SCERT)

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Preface

Dear Teachers,

The activity based, process oriented and learner centred pedagogy is being introduced in the Vocational Higher Secondary classes. It becomes imperative to make significant changes in the learning process as well as in the evaluation system for its successful implementation.

Sourcebook is to assist the teacher to transact the modified curriculum through learner centred and activity oriented strategies. The sourcebook on 'Fish Processing Technology' has been designed in such a way to help the teacher to provide suitable learning activities for effective teaching. This book has enough opportunities to improve the proficiency of the teacher and to develop diversified teaching strategies.

Thiruvananthapuram
25.11. 05

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GENERAL APPROACH

Introduction

The ultimate aim of education is human refinement. Education should enable the learner to formulate a positive outlook towards life and to accept a stand which suits the well being of the society and the individual as well.

The attitude and potential to 'to work' has determined the destiny, progress and cultural development of the human race. As we all are aware, the objective of education to form a society and individuals having a positive work culture. The educational process expected in and outside our formal schools should concentrate upon inculcating concepts, abilities, attitudes and values in tune with these 'work culture.' Hence vocationalised education cannot be isolated from the main stream of education. In another sense, every educational process should be vocationalised. However, due to our inability to utilise the resources wisely, scarcity of job opportunities is a severe issue of the present society. For overcoming this deep crisis, emergent techniques have to be sorted out and appropriate researches have to be seriously carried out. It is in the sense that the content and methodology of vocational Higher Secondary Education have to be approached.

The Vocational Higher Secondary course was envisaged as a part of the National Policy on Education with the noble idea of securing a job along with education. The relevance of Vocational education is very great in this age of unemployment. This education system, which ensures a job along with higher education, stands aloof from other systems of education.

A learning environment which ensures vocational aptitude, vocational training, basic life skills, competencies related to different subjects, appropriate values and attitudes and existential readiness has to be provided here.

The curriculum should be one which recognises the specific personality of the learner and should develop it in a desirable way. It should provide opportunity to imbibe novel ideas to follow a critical approach and for learning through experiences.

The competency to transform ones own resources for the betterment of the society and the individual is to be ensured in each individual. Training in the sense of equality, democratic sense, environmental consciousness and devotion to the constitution is an inseparable factor of the curriculum.

The need of a systematic curriculum is prevailing in vocational subjects. A scientifically structured curriculum incorporating the unique features peculiarity of Kerala ensuring the possibility of higher education and utilising the national and international possibilities of employment is required.

The new curriculum should be capable of assimilating the life skills, scientific temper, attitude of coexistence, leadership qualities and mental health to face the challenges of life. It should be capable of strengthening the competencies imbibed by the learners up to the tenth class.

A curriculum for selecting vocational areas according to the aptitude of the students, learning it in depth, acquire general awareness in the basic areas and to secure jobs has become the social need of the day. A learner centered, process oriented, need based vocational curriculum is envisaged.

What is learning?

- Learning is construction of knowledge and so it is a live and continuous mental process.
- Learning is a process of advancement through adding and correcting in the light of comparing the new issue with the previously learned concepts.
- Learning takes place as a part of the effort to solve problems.
- Learning takes place by assimilating bits of knowledge into ones own cognitive structure.
- Learning is not a linear process. It is a spiral process growing deeper and wider.
- Learning is an intellectual process rather than the mere memorisation of facts. Learning is a conglomeration of a variety activities like problem analysis, elucidation, critical thinking, rational thinking, finding out co-relations, prediction, arriving at conclusions, applications, grouping for other possibilities and extracting the crux. When opportunities are provided for intellectual processes learning will become effective and intellectual ability will get strengthened.

Theoretical foundations of learning

Education is the best device that can be adopted for creation of a new society. It should be democratic in content and process and should acknowledge the rights of the learner. It should also provide opportunity for better citizenship training. The concept of equality at all areas should get recognition in theory and practice.

There should be conscious programme of action to develop nationality, humanness and love and against the encroachment of the sectarianism of caste and religion.

The learner should be able to take firm steps and deferred against the social crisis like privatisation, liberalisation, globalisation etc. and against all kinds of dominations.

They should develop a discrimination to use the acquired learning as a liberative weapon.

They should be able to view education and life with the perspective of social well being.

They should get opportunity to recognise that co-operation is better than competition and that co-operation is the key to social life and culture.

A basic awareness of all the subjects needed for life essential for all students.

The remnants of perspectives formed in us during the colonial period still influence our educational philosophy. The solution to the present day perplexities of the society which approaches education on the basis of competitions and marketisation is only a comprehensive view of life.

It is high time that education was recognised on the basis of the philosophy of human education. The human approach to education has to reflect in its content, learning process and outlook. The perspective of 'learning to be ' and learning to live together as expressed by the UNESCO and the concepts of existentialist intelligence intrapersonal and interpersonal intelligence.

The basis of new approaches on curriculum, teaching- learning process are derived from the developments place in the east and west of the world.

When we begin to see the learner at the centre of the learning process, the teaching process has to be changed timely. It is the result of the rapid growth and development of Science and Technology and Pedagogy. If we want to undergo the changing process, we have to imbibe the modern hypothesis regarding learner, they have;

- Great curiosity
- Good imagination
- Numerous other qualities and interests
- Independent individuality
- Interest in free thinking and working in a fearless atmosphere.
- Have interest in enquiring and questioning.
- Ability to reach conclusions after logical thinking.
- ability for manifest and establish freely the conclusions arrived at.
- Interest for recognition in the society.
- Determination to face the interference of society and make components which is a part of social life.
-

When we consider the learning system, the domains to be stressed in education according to the modern development becomes relevant.

The **knowledge** domain consists of

- Facts
- Ideas
- Laws
- The temporary conclusions and principles used presently by scientists.

The learning is a process. The continuous procedures we undergo to reach a particular goal is process. The skills which are parts of the process to analyse the collected ideas and proofs and come to a conclusion is called *process skills*. Some important **process skills** are,

the skills;

- To observe
- To collect data and record
- To classify
- To measure and prepare charts
- To experiment
- To predict
- To recognise and control the variables
- To raise questions
- To generalise
- To form a hypothesis and check.
- To conclude
- To communicate
- To predict and infer
- To use tools.
-

Observation is the process of acquiring knowledge through the senses. It is purely objective oriented. Learning experiences which provide the opportunity to use all the senses may be used.

The process of grouping is known as **classifying**. Starting from simple groupings of data, it can extend to the level of classification into minute sub-groups.

In addition to this, consider the skills related to **creative domain** also, they are skills:

- To visualize
- To connect facts and ideas in new ways

- To find out new and uncommon uses of objects
- To fantasize
- To dream
- To develop creative isolated thoughts
-

Creativity is an essential component of process and activities. The element of creativity is involved in finding out problems, formation of hypothesis, finding 'solutions' to problems etc. Through activity oriented learning experiences, opportunities to express creativity can be created.

Again, the following factors consisting in the **Attitudinal domain** are also important as;

- Self confidence
- Love for scientific knowledge
- Attitude to know and value history
- Respect human emotions
- Decide with reasonable present problems
- Take logical decisions regarding personal values

'Hypothesis' is a temporary conclusion drawn using insight. Based on knowledge and experiences relating to the problems the causes and solutions can be guessed.

As regards the **application domain** the important factors are the ability to:

- observe in daily life examples of ideas acquired.
- take the help of scientific process to solve the problems of daily life.
- choose a scientific life style
- connect the ideas acquired with other subjects.
- integrate the subjects with other subjects.

Some basic stands have to be taken on the new scientific knowledge about intelligence learning and teaching. When such basic concepts are accepted changes are required in the following factors.

- The vision, approach, structure and content of the curriculum.
- The vision, approach, structure and content of the textbooks.
- Role of the teacher and the learner.
- Learner atmosphere, learning materials and learning techniques.

Some scientific perspectives accepted by modern world in educational psychology are given below.

Constructivism

This approach puts forward the concept that the learner constructs knowledge. New knowledge is constructed when ideas are examined and practiced in new situations relating them with the previously acquired knowledge and experience. That is assimilated into the cognitive structure of one's knowledge. This method which gives priority to critical thinking and problem solving provides opportunity for self-motivated learning.

Social Constructivism

Social constructivism is a sub-section of constructivism. Knowledge is formed, spread and imbibed and it becomes relevant in a social environment. Interactive learning, group learning, co-operative participatory learning, all these are concepts put forward by social constructivism.

The main propounders of constructivism are Piaget, Vygotsky and Bruner.

Discovery learning and interactive learning have prime importance. Learning takes place as a part of the attempt for problem solving. The activities of a learner who confronts cognitive disequilibrium in a learning situation when he tries to overcome it leads to the renewal of cognitive structure. It is through this process construction of new knowledge and the assimilation of them that learning takes place. Observation and enquiry are unavoidable factors. The learner advances towards new areas of acquisition of knowledge where he tries to compare his new findings with the existing conceptions.

Learning is a live mental process. Rather than the ability for memorisation of facts cognitive process has to be given emphasis. The process of problem analysis, elucidation, critical thinking, rational thinking, finding out co-relation, prediction, hypothesis formation, application, probing for other possibilities, extracting the crux and other processes are of critical importance in learning.

Constructivism gives greater predominance to co-operative learning. Social and cultural factors influence learning. Sharing of knowledge and experience among learners, collective enquiry, assessment and improvement, group activity and collaborative learning, by sharing responsibilities with the objective of public activity, provide opportunity for effective learning.

In learning internal motivation is more important than external motivation. The learner should have interest and initiative in learning. Learning situation should be capable of forming a sense of ownership in the learner regarding the learning process.

Learning is not a linear process. It progresses in a spiralled way advancing deeper and wider.

Learner-his nature and features

The learners in standard XI has undergone a learner centered and process oriented learning experience up to X standard. He is adequately competent to select vocational subjects according to his aptitude and interest and to acquire higher education and profession as he wishes. The aspirations about future life is framed in this particular age foreseeing national and international job oppurtunities. Some of the peculiarities of the learner at this stage are:

- Physical, intellectual an emotional planes are intensive changes during this age and their reflections can be observed.
- Ability to enquire, discover and establish cause-effect relationship between phenomena.
- Readiness to undertake challenges.
- Capacity to shoulder leadership roles.
- Attempt to interprest oneself.
- Susceptibility to different pressures.
- Doubts, anxieties and eagerness about sex.
- Longing for social recognition.

Needs of the learner

- To make acquaintance with a job through vocational education.
- To acquire more knowledge in the concerned area through higher education.
- To recognise and encourage the peculiar personality of the later adolescent period.
- To enable him to defend against the unfavourable circumstances without any help

Role of the Learner

- Active participant in the learning process.
- Acts as a researcher
- Sharer of information
- Sharer of responsibilities
- Collects information
- Takes leadership
- Involves in group work
- Acts as a co- participant
- Observes his environment
- Experiments and realises
- Makes interpretations and draws inferences.
-

Role of the Teacher

The teacher should;

- consider the 'Stress and strain' of the teenagers
- understand the socio- economic and cultural background of the students.
- promote and motivate the students to construct knowledge.
- arrange proper situations to interact in and outside of the classroom.
- guide the students by explanations, demonstrations etc.
- promote opportunity for co-operative learning and collaborative learning.
- facilitate interpersonal and intra-personal interactions.
- act as a democratic leader.
- act as a problem solver
- effectively guide the students for the selection and conduct of various continuous evaluation elements.
- continuously evaluate the progress of the learners.
- gives scaffolding/support wherever necessary.
- motivate for learning
- promote divergent thinking.
- act as a democratic group leader.
- act as a co-learner
- gives variety of learning experiences.
- be a constant student
- facilitate for reference/data collection
- have a clear understanding about the age, needs, peculiarities, abilities, nature, aptitude etc. of the learner.
- have the ability to motivate the learner in order to acquire and enrich their knowledge.
- be a guide to the learner in developing insights and creating responses on current affairs.
- be capable to lead the learner into a variety of learning methods and process based on curricular objectives.
- be a link between school and community.
- be a good organiser, guide, friend, philosopher and co-learner.
- have an inter disciplinary approach in learning activities.
- be able to guide the learner in his/her career prospects based on his interest aptitude and ability.
- be impartial and democratic.
- provide ample experiences to attain the basic values and objectives of the curriculum.
-

New Concepts of Learning

1. Discovery Learning-

The teacher has to create a motivating atmosphere for the learner to discover concepts and facts, instead of listening always. Creating occasion to progress towards discovery is preferred. Instead of telling everything before and compelling to initiate the models, situations are to be created to help the children act models as themselves.

2. Learning by discussion

That discussion leads to learning is Burner's theory. Here discussion is not opposing each other. It is a sharing on the plane of ideas. New ideas are arrived at by seeking explanations, by mutual giving and taking of ideas and by problem solving.

3. Problem solving and learning

Only when the learner feels that some thing is a problem to be solved that he takes the responsibility of learning it. It is an inborn tendency to act to solve a problem that causes cognitive disequilibrium in a particular area. It is also needed to have confidence that one is capable of doing it. The problems are to be presented in consideration of the ability and level of attainment of the learner.

4. Collaborative learning

This is the learning in which the responsibilities are distributed among the members of the group keeping common learning objectives. The common responsibility of the group will be successful only if each member discharges his duties. All the members will reach a stage of sharing the result of learning, equally through the activity with mutual understanding. The teachers who arrange collaborative learning will have to make clear the responsibilities to be discharged. This is possible through the discussion with the learners. Collaborative learning will help to avoid the situations of one person working for the whole group.

5. Co-operative learning

This is the learning in which the learners help one another. Those who have more knowledge, experience and competency, will help others. By this exchange of resources the learners develop a plane of social system in learning also. As there are no high ups and low ones according to status among the learners they can ask the fellow students doubts and for helps without any hesitation or in hesitation Care should be taken not to lead this seeking of help to mechanical copying. It should be on the basis of actual needs. So even while encouraging this exchange of ideas among the members of the group cautions acceptance is to be observed as a convention. There should be an understanding that satisfactory responses should come from each member and that the achievement of the group will be assessed on the basis of the achievement of all the members

6 Zone of Proximal Development

Vygotsky observes that there is a stage of achievement where a learner can reach by himself and another higher zone where he can reach with the help of his teachers and peers and elders. Even though some can fulfil the learning activity by themselves there is the possibility of a higher excellence. If appropriate help is forth covering every learner can better himself.

7 Scaffolding

It is natural that the learner may not be able to complete his work if he does not get support at the proper time. The learner may require the help of the teacher in several learning activities. Here helping means to make the learner complete the activity taking responsibility by himself. The teacher has to keep in mind the objective of enabling the learner to take the responsibility and to make it successful.

8 Learning: a live mental process

Learning is a cognitive process, only a teacher who has an awareness as to what the cognitive process is alone can arrange learning situations to the learner to involve in it. Learning can be made effectively and intellectual sharpness can be improved by giving opportunity for the cognitive processes like reminding, recognising, compromising, co-relating, comparing, guessing, summarising and so on. How is cognitive process considered in language learning? Take guessing and prediction for example.

- Guessing the meaning from the context.
- Guessing the content from the heading.
- Predicting the end of the story.
- Guessing the incident, story from the picture.
- Guessing the facts from indications.
- and other such activities can be given the following activities can be given for the cognitive process of summarisation.
- Preparation of blue print.
- Preparation of list.
- Preparation of flow chart.
- Epitomising in one word.
- Giving titles and so on.
- Symbols, performance of characters indications, lines of a poem, tables, pictures, concepts, actions, body language and such things can be given for interpretation. Process based language given for interpretation. Process based language learning has to give prime importance to the cognitive process.

9 Internal motivation

Internal motivation is given more importance than external motivation. The teacher

has to arouse the internal motivation of the learner, A person internally motivated like this alone can immerse in learning and own its responsibility. How motivating is each of the activities is to be assessed.

10 Multiple intelligence

The Theory of Multiple Intelligence put forward by Howard Gardener has created a turning point in the field of education. The National curriculum document has recommended that the curriculum is to be designed taking into consideration of this theory.

Main factors of the intellect :

1. Verbal/linguistic Intelligence -

Ability to read and write, making linguistic creations , ability to lecture competence effective a communication , all these come under this . This can be developed by engaging in language games and by teaching others.

2. Logical /mathematical Intelligence

Thinking rationally with causes and effect relation and finding out patterns and relations come under this area, finding out relations and explaining things sequential and arithmetical calculations are capable of developing this area of intelligence.

3. Visual /spatial Intelligence

In those who are able to visualise models and bringing what is in the imagination into visual form and in philosophers, designers and sculptors this area of intelligence is developed. The activities like modelling using clay and pulp, making of art equipments, sculpture, and giving illustrations to stories can help the development of this ability.

4 Bodily Kinaesthetic Intelligence

The activities using body language come under this. This area of intelligence is more developed in dancers and actors who are able to express ideas through body movements and in experts in sports, gymnastics etc.

5 Musical Intelligence

This is an area of intelligence which is highly developed in those who are able to recognise the different elements of music in musicians and in those who can here and enjoy songs. Playing musical instruments, initiating the songs of musicians, listening silently to the rhythms and activities like this are capable of developing this area of intelligence.

6 Interpersonal Intelligence

Those in whom this area of intelligence is developed show qualities of leadership and behave with others in a noble manner. They are capable of understanding the thought of others and carrying on activities like discussion successfully.

7 Intrapersonal Intelligence

This is the ability to understand oneself. These people can recognise their own abilities and disabilities. Writing diaries truthfully and in an analysing way and assessing the ideas and activities of others will help developing this areas of intelligence

8 Naturalistic Intelligence

A great interest in the flora and fauna of the nature, love towards fellow beings interest in spiritual and natural factors will be capable of developing this area.

9. Existential Intelligence

The ability to see and distinguish ours own existence as a part of the universe, ability to distinguish the meaning and meaninglessness of life, the ability to realise the ultimate nature of mental and physical existences, all these are the peculiarities of this faculty of intelligence.

Emotional Intelligence

The concept of emotional intelligence put forward by **Daniel Golman** was used in framing the new curriculum. The fact that one's **Emotional Quotient (E.Q)** is the greatest factor affecting success in life is now widely accepted. The teacher who aims to focus on improving the emotional intelligence of students need to concentrate on the following.

i) Ability to take decisions

Rather than imposing decision on students while planning and executing activities, the students may be allowed to take part in the decision making process. Taking decisions through open discussion in the class, inviting students suggestions on common problems etc. are habits to be cultivated.

ii) Ability to reach consensus

- When different opinions, ideas and positions arise the students may be given the responsibility to reach a consensus.
- Imaging what would be the course of action in some situations, allowing to intervene in a healthy way in problems between individuals.

iii) Problem solving

- Developing the idea that there is reason and solution to any problem.
- Training in finding reasons for problems.
- Suggesting solutions through individual or group efforts.
- Discussing social problems.
- Analysing the shortcomings in methods to solve problems.

Whether plastic can be banned within school premises can be given as a problem. Group discussion will provide reasons and solutions. Problems which can influence classroom learning and for which the learner can actively contribute solutions need to be posed.

- Self criticism, evaluation
- Ability to face problem-situation in life
- Thinking what one would do if placed in the situation of others, how one would respond to certain experiences of others - All these foster the growth of emotional intelligence.

iv) Life skills

Life skills need to be given a prominent place in education. W.H.O. has listed ten skills required for success in life.

- Self awareness
- Empathy
- Inter personal relations
- Communication
- Critical thinking
- Creative thinking
- Decision making
- Problem solving
- Coping with emotion
- Coping with stress

The new curriculum addresses these areas.

Knowing the characteristics of the learner, role of the teacher and how to use the teachers handbook help the teacher to plan and effectively implement learning activities.

Objectives of the Vocational Higher Secondary Curriculum.

- To facilitate higher education while giving opportunity to enter in the field of employment.
- To develop environmental awareness, sense of national integration, tolerance and human values so as to ensure social and cultural improvement.
- To enable the learner to find on his own employment.
- To inculcate mental courage in the learner to face unfavourable situations.
- To make human resource development possible.
- To enable the learner to understand social problems and to react appropriately.
- To develop the learner to identify and develop his own competencies.
- To develop vocational aptitude, work culture and attitude in the learner so as to provide useful products and services to the society.
- To create an awareness about mental and physical health.
- To acquire awareness about different job areas and to provide backgrounds for acquiring higher level training in subjects of interest.
- To develop possibilities of higher education by creating awareness about common entrance examinations.

- To provide situation for the encouragement of creative thinking and organising training programmes in each area, creative abilities and to develop artistic talents.

Nature of Approach

The learning device is to be organised in the selected vocational subjects in such a way that adequate practical experience should be given, making use of the modern technology. The development in each area on the basis of information technology is to be brought to the learner. The work experience in the respective fields (OJT, Field trip, Production/Service training, Survey, Workshop, Exhibition, Youth festival, Physical fitness etc.) are to be adjusted suitable to the learning and evaluation process. The participation and leadership of the students in planning and execution is to be ensured through this kind of activities. Social service is to be made a part of the course.

Approach towards Vocational Higher Secondary Education

The learning methodology has to be organised so as the learning provide adequate practical thinking on the opted vocational subject utilising the new technology. The development of information technology should be made available in each sector. Work experience, OJT, Field trip production, Service cum training centre, Survey, Workshops, Exhibitions, Youth festivals, Physical fitness etc should be systematised well appropriate to learning and evaluation. Learner participation should be ensured in the planning and implementation of these activities. Social service should be a part of the course. If a learner has to change his school, he should be provided an opportunity to continue his studies in the new school. While considering criteria for admission to higher courses, grades of vocational subjects should also be given due weightage. In tune with the changes in the Vocational Higher Secondary Education changes should be ensured in the field of higher education.

The teachers have to take special care in arranging learning activities for the development of all the faculties of intelligence.

Learning activities and learning atmosphere.

A proper learning atmosphere is essential for the betterment of learning activities.

They are:

- Proper physical environment
- Healthy mental atmosphere
- Suitable social atmosphere
- Active participation of PTA, Local bodies and SRG
- Reference materials and visual media equipments.
- Academic monitoring
- School Resource Group (SRG)

APPROACH TO FISHERIES

Introduction

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

The courses like Fishing Craft and Gear Technology, Fish processing Technology, Aqua-culture offer scope in studying new technologies, and help to improve the fishing industry, which directly or indirectly helps to improve the standard of living of fisher folk and also generate employment opportunities.

Aims

- To create general awareness about the fisheries sector, its resources and their significances.
- To impart knowledge and training on various fish culture, capture and processing techniques.
- To create and develop confidence and skills for initiatives in self employment in fisheries sector.

Educational Approach

The studies conducted by UNESCO, SCERT on the various defects of teacher centred education evolved a new idea of student centred educational approach. According to their approach the learning activities should pave way for the construction of knowledge. While selecting the learning activities we should take into account the nature, mental ability and skills of students. This approach should explore the activities like problem solving and self studying. It is important that the new educational approach should create opportunities for individual learning, co-learning and group learning.

For this we can adopt different strategies and techniques.

1. Discovery learning

The teacher has to create an atmosphere that encourages the learner to discover ideas and facts of his own. For example the teacher can assign the students to identify and classify different marine fishes. This gives an opportunity for the learner to observe the different ***** fishes available in the local market and can collect information from different sources like internet and journals. Their observation can be consolidated and presented.

2. Co-operative learning

In this method the learners learn by helping each other. The negotiation among peers take place here. For example, if we want to make an awareness among the students about different preservative methods, the students can be divided into different groups and a group discussion on the topic can be conducted. The ideas evolved from the discussion can be consolidated and presented in the class by one person from each group.

3. Collaborative learning

The two important aspects of this method of learning are sharing of ideas and negotiation among the learners. Suppose we have to deal with different packaging materials for fishery products. A group discussion can be conducted. Divide the class into four groups ask them to collect different types of packaging materials and to analyse their merits and demerits. For this prepare discussion points.

- Traditional packing materials.
- Modern packing materials.
- Merits and demerits of packing materials.
- Impact on the environment.

Assign each group to discuss about one of the discussion points. Encourage the group leaders to present the findings of their group and allow the class to comment on it. When the presentations are over teacher may consolidate it and ask each one to prepare the report. This type of learning is called Collaborative learning.

4. Socio-Cultural related learning

This method of learning pertains to social and cultural aspect of the society. For example to study the problems faced by the fishermen for keeping the fish in fresh condition, conduct an informal interview among the fishermen to collect the problems faced by them and findout the solutions to tackle the problems and prepare a report.

CURRICULUM OBJECTIVES

- To understand the status of Indian fisheries and export.
- To identify the maritime states, fishing zones, major fishing harbours and ports of India.
- To understand various fishing methods briefly.
- To develop skills to identify the morphological characters of typical fish and prawn.
- To develop skills to differentiate teleost and elasmobranch.
- To understand the commercially important fishery resources of India.
- To develop the skills to familiarise different varieties of fishes, crustaceans and molluscs.
- To understand the proximate composition of fish.
- To understand the classification of protein based on its solubility.
- To understand the importance of fish in human diet.
- To develop a skill to compare the nutritive value of fish with other food items.
- To apply the knowledge acquired about nutrition in real life situations.
- To understand the post mortem changes taking place in the fish muscle.
- To understand different causative agents of fish spoilage.
- To develop the skill for evaluating shrimp organoleptically.
- To develop the skill to differentiate fresh and spoiled fish.
- To understand the structure of bacteria.
- To understand the effect of environmental factors on bacterial growth.
- To understand the methods to prevent fish spoilage.
- Apply the knowledge acquired in new situations
- To understand different types of food poisoning caused by the pathogenic bacteria.

- To develop skill for identifying the types of food poisoning through their symptoms.
- Understand the different methods of controlling food poisoning.
- Apply the acquired skill in unfamiliar situation.
- To understand the hygienic handling of fish and prawn on board fishing vessel and on shore.
- To develop the skill for fish handling.
- To develop the steps in the preparation of fish for processing.
- To understand the principle of chilling.
- To understand the different methods of icing.
- To understand the process of ice manufacture.
- To develop the skill for icing the fish.
- To identify different types of ice.
- To develop skill for chlorinating water.
- To understand the significance of quality of ice and water to be used in fish processing.
- To understand the need for chlorination of water in fish processing.
- To understand the use of Refrigerated Sea Water (RSW) and Chilled Sea Water (CSW) for fish storage.
- To familiarise the different equipments in fish processing industry.
- Apply the acquired skills to new situations.
- To understand refrigeration and different types of refrigerants.
- To understand the concept of freezing as a preservative method.
- To develop a skill to differentiate freezing and chilling.
- To develop a skill to differentiate slow freezing and quick freezing.
- To understand the terms related to freezing.
- To understand the factors affecting freezing rate.
- To understand different freezing methods.
- To understand different product styles of cephalopods and fishes.
- To apply the acquired skills in new situations.
- To familiarise with different steps in freezing.
- To familiarise with common types of freezers.
- To develop skills in preparing different product styles of prawns.

- To develop skills for the freezing of shrimps.
- To understand the functions of a cold storage
- To understand different types of cold storage
- To understand the chilled storage and frozen storage
- To understand fish transportation and distribution
- To understand the changes in fish muscle during freezing and in the cold storage.
- To get an awareness about the minimum infrastructural facilities required for a fish processing plant.
- To understand the details about factory hygiene and sanitation.
- To understand the significance of sanitation in sea food industry.
- To develop skills to maintain personal hygiene and sanitation.
- To apply the acquired knowledge in new situations.
- To understand the concept of packing and its importance
- To familiarise with different types of packaging materials.
- To understand recent trends in packaging.
- To apply the knowledge in new situations.
- To develop skills for identifying and applying different types of packing materials.

SYLLABUS

Unit. 1 General Introduction

Morphology and biology of typical fish and shell fish. Major Indian fisheries: marine, estuarine and fresh water. Pelagic and demersal fisheries of India. Fishing methods. Marine fish production in India. Export of marine products from India

Unit. 2 Fish as a Food Material

Importance of fish in human diet.

Chemical aspects of fish flesh components- Water, fat (oil), protien, carbohydrate, vitamins.

Unit. 3 Fish Spoilage

Rigor mortis, Autolytic spoilage, Bacterial spoilage, oxidation of fat.

Unit. 4 Microbiology of Fish Spoilage

Structure and growth of bacteria, Role of bacteria in fish spoilage, Effect of temperature, pH, Oxygen, Salinity etc. on bacterial growth, methods of controlling spoilage.

Unit. 5 Microbes in Public Health

Microbes that cause infection to man- *Staphylococcus aureus*, *Salmonella* sp. *Clostridium botulinum*, *Vibrio cholera*, *Escherichia coli*, feacal *Streptococci*.

Unit. 6 Fish Handling

Hygienic handling of fish on board fishing vessel and on shore, Manufacture and storage of ice, Quality of ice, Use of ice for handling, transportation and processing of fish, Quality of water to be used in fish processing, Chlorination of water, Refrigerated sea water for fish preservation.

Unit. 7 Freezing

Principles involved in freezing of fish.

Different freezing methods, freezing of fishery products and the steps involved.

Slow freezing Vs Quick freezing, Double freezing, Post freezing treatment.

Unit. 8 Freezers

Airblast freezers

Contact plate freezers

Spray and Immersion freezers

Other types of freezers

Freezing time and freezer operating temperatures

Unit. 9 Freezing of Shrimps

How to make good frozen products

Freezing of shrimps in different styles like whole, HL, PD, PUD, CPD, Block and IQF products.

Unit. 10 Cold Storage

Types of cold store

Unit. 11 Storage, Transportation and Distribution

Chilled storage

Frozen storage

Change in fish muscle during frozen storage

Unit. 12 Lay out of Processing Plants

Site, building, water supply, equipments and clothing

Unit. 13 Factory Hygiene and Sanitation

Building, equipment and staff sanitation

Maintenance of Quality control

Unit. 14 Modern Packing Methods

Choice of packing materials

Types of modern packaging

Topics added to Syllabus

Unit - VIII - Freezing

Different freezing methods, freezing of fishery products and the steps involve in freezing

Note: As a Vocational course the students should have a knowledge about the newly added topics.

Topics Deleted from Syllabus

Unit- II - Fish as food material

Analysis of major components - Moisture, fat, protien, carbohydrate, ash.

Unit- III - Fish Spoilage

Measurement of spoilage in fish

Unit- IV - Microbiology of fish spoilage

Yeast and moulds.

Unit- V - Microbes in Public health

Shigella species, Clotridium perfringens, Vibrio prahaemolyticus, Bacillus cereus.

Unit- VI - Fish Handling

Insulated containers for fresh fish transportation

Unit- X - Cold Storage

Important design factors

Unit- XI - Storage, Transport and Distribution

Requirments for chill and cold storage

Note: The above mentioned topics are deleted from the syllabus. The topics donot have any vocational importance at this stage.

PLANNING

The role of teacher as well as the learner has changed in the emerging scenario. So teacher being the facilitator should bear in mind the fact that the C.O's are to be accomplished within the specified time schedule. In order to fulfill this goal the facilitator should prepare necessary plan. Four such plans are given below which include field visit to a collaborative institutions, OJT, Surveys, Exhibition and all the teaching learning activities include and outside the class room.

- Year Plan
- Unit Plan
- Daily Plan

Year plan covers all the unit and the entire activities to be completed with in a year.

Unit plan include all the portions, processes and activities before studying a unit. This plan must give reveal the actual information about the curriculum objectives, concepts, process skills, activities, material required and evaluation.

Daily plan is the daytoday plan to provide activities for a period (one hour). The structure of daily plan is given with each chapter.

YEAR PLAN

Unit	Name of Unit	Name of Sub Unit	Number of hrs.	Month planned To Teach	Activity/Suggestion
1	General Introduction	Status of Indian Fisheries and Export Identification of maritime states, harbours and ports. Various fishing methods. Morphology of typical fish and prawn. Difference between Teleost and Elasmobranch. Commercially important fishery resources of India. Different varieties of fishes, crustaceans and molluscs	2 2 6 2 1 6 6	June July	Field visit and Data collection. Demonstration Discussion Assignments Seminar.
2	Fish as a food material	Proximate composition of fish Classification of protien Importance of fish in human diet Nutrative value of fish and other food	3 2 2 3	August	Discussion

Unit	Name of Unit	Name of Sub Unit	Number of hrs.	Month planned To Teach	Activity/Suggestion
3	Fish Spoilage	Post mortum changes taking place in fish. Causative agents of fish spoilage Organoleptic evaluation of shrimp. Differentiation of fresh and spoiled fish	4 2 10 hours 2 2	September	Demonstration of Samples
4	Microbiology of fish spoilage	Structure of Bacteria Environmental factors on bacterial growth Methods to prevent fish spoilage	3 5 3 11 hours	September	Discussion with the help of OHP and Charts. Demonstration
5	Microbes in public health	Different types of food poisoning. Methods of controlling food poisoning	4 4 8 hours	October	Field visit, Quiz, Discussion Assignment.

Unit	Name of Unit	Name of Sub Unit	Number of hrs.	Month planned To Teach	Activity/Suggestion
6	Fish Handling	Handling on board and on shore Manufacture of Ice Chlorination of water RSW and CSW	7 4 1 3 15 hours	October	Field visit and Demonstration Discussion
7	Freezing	Refrigeration and Refrigerants Concept of freezing Freezing and chilling Freezing methods Product styles Different steps in freezing	2 2 2 3 2 3 14 hours	November	Field visit Discussion
8	Freezers	Common type of freezers	8 hours	November	Field visit Demonstration Discussion,
9	Freezing of shrimps.	Different product styles of prawn Freezing of prawns	3 7 10 hours	December	Video show, Discussion with the help of charts and samples.

Unit	Name of Unit	Name of Sub Unit	Number of hrs.	Month planned To Teach	Activity/Suggestion
10	Cold Storage	Functions of cold storage Types of cold storage	2 5 hours 3	January	Field visit Discussion
11	Storage, Transport and Distribution	Chill storage and frozen storage Transportation and distribution. Changes in fish muscle during freezing and cold storage.	1 5 hours 2 2	January	Field visit Discussion
12	Lay out of processing plant	Infrastructure facilities required for a processing plant.	5 hours	January	Field visit, Discussion
13	Factory hygiene and Sanitation	Hygiene and sanitation Significance of sanitation Personal hygiene	3 1 6 hours 2	January	Discussion
14	Modern Packing methods	Concept Types of packaging materials Recent trends	1 4 8 hours 3	February	Collection Debate Discussion

UNIT PLAN

UNIT. 2 FISH AS A FOOD MATERIAL

Curriculum Objectives Concepts	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation	Total Nos.
<ul style="list-style-type: none"> Understand the proximate composition of fish. 	Water, Fat, Protein, Carbohydrate, Minerals, Vitamins, NPN Compounds	Observation Communication Comparison	Observation of charts. Discussion	Charts and Reference	Participation Interest Preparation of notes.	3
<ul style="list-style-type: none"> Understand the classification of protein based on its solubility. 	Sarcoplasmic protein. Fibrillar protein Stroma protein	Observation Classification Communication	Observation of charts. Discussion	Charts and Reference	Participation Interest. Preparation of notes.	2
<ul style="list-style-type: none"> Understand the importance of fish in human diet. 	Deficiency diseases.	Observation Communication Comparison	Observation of charts and comparison	Charts and Reference	Participation Preparation of notes.	2

Curriculum Objectives Concepts	Ideas/	Process Skill	Activities	Materials	Evaluation	Total Nos.
<ul style="list-style-type: none"> Develop skills to compare the nutritive value of fish with other food items. 	Comparison of fish protein with vegetable and meat protein.	Observation Communication Comparison	Observation of charts and Comparison	Charts	Participation Interest.	3
<ul style="list-style-type: none"> Apply the knowledge acquired about nutrition to other situation. 	Essential aminoacids. Polyunsaturated fatty acids. Vitamin A and D Iodine Calcium Phosphorous	Communication	Discussion Preparation of notes.	Reference	Participation Presentation of notes.	

DAILY PLAN

UNIT. 2 FISH AS A FOOD MATERIAL

Name of Teacher :	Class : I st VHSE
Name of the School :	Division :
Subject : Fish Processing Technology	Strength : 30
Topic : Nutrative value of fish	Average age :
	Duration : 1 hour
<p>Curriculum Objectives</p> <p>Develop skills to compare the nutritive value of fish with other food items.</p> <p>Concepts and Ideas</p> <p>The nutritive value of fish in regards to protein, fat, viatmins and minerals is better compared to meat and vegetables.</p> <p>Process Skill</p> <p>Observation</p> <p> Comunication</p> <p> Comparison</p> <p>Previous Knowledge</p> <p>Students have knowledge about the proximate composition of fish, meat and vegetables.</p> <p>Materials required</p> <p> Charts showing the percentage of proximate composition of fish, meat and vegetables.</p> <p>Response/ Feed back</p> <p>Interest, Comparison</p>	

Participation in discussion

Presentation of findings based on charts.

Activities

Prepare three different charts showing the percentage of proximate composition of fish, meat and vegetable. Divide the whole class into five or six groups. Ask the groups to observe the charts and discuss the nutritive value of fish compared to meat and vegetables. Ask each group to present their findings. After the presentation teacher summarises that the nutritive value of fish is better than others.

Consolidation

- Fish contains more soluble protein than meat.
- The proteins in fish are easily digestible, hence fish is a good nutritive food for children.
- The presence of Vitamin A and D in fish increases its nutritive value.
- Minerals like Iodine, Calcium and Phosphorus also increase its nutritive value.

Assignment

- Write an assignment on the nutritive value of fish compared to meat and vegetables.

EVALUATION

Introduction

As the curriculum is based on a particular vocation, evaluation becomes an inevitable procedure. Evaluation is done along with learning process throughout the course of study. In order to make an evaluation, the teacher should be able to understand the students, their scholastic and co-scholastic knowledge. Capacity building in the selected vocation is the most important part in vocational education and it should be evaluated accordingly. The technical skills, interest and devotion in the particular field, communication skills, analysis, organising and presentation skills etc. have to be evaluated. The personal and social qualities also have to be evaluated. Thus evaluation is an integral part of learning process which assesses the implementation of the curriculum.

Need and importance of Evaluation

Evaluation is to assess the scientific knowledge of students and to recognise to what extent they have achieved the specified capabilities. A written examination at the end of an year which is purely based on a textbook is not of much use. “Evaluation is a systematic process of collecting, analysing and interpreting evidence of students’ progress and achievement both in cognitive and non-cognitive areas of learning for the purpose of taking a variety of discussions”.

The teacher can properly assess the level of the learner and can identify his/her strength and weakness. This will help each student to evaluate themselves and to improve their level of learning by taking necessary assistance from the teacher (self evaluation) classmates can evaluate themselves through interaction (peer group evaluation) Evaluation even help the teacher to analyse and improve their performance. Evaluation helps to integrate the teacher, learner and even the parents. Thus student who are socially useful and can perform productive work are created. This will improve the quality of our young generation.

Features of Evaluation

- Evaluation should be humane in nature. It must help the students grow as social beings.

- Evaluation should be the responsibility of the teacher who teaches the students and is responsible for developing the requisites healthy attributes in them.
- Evaluation should be consistent with its purpose and must provide a reliable and valid measure of the student's performance.
- Evaluation should reflect the outcome of each learning intervention and should provide all the students with equal opportunity to display their individual potential.
- Evaluation should take into account both the background and the prior experience of the students.
- Procedures for grading and their reporting should be appropriate and easily understood by one and all.
- Evaluation should restore the faith and trust of the masses by ensuring transparency in the procedure.

Theories of constructivism and multiple intelligence are the basis of modern learning. So evaluation strategies have also to be changed. Evaluation must be;

- Continuous and comprehensive
- Scholastic and co-scholastic
- Depending on grading system.
- Depending on a vocational or trade proficiency.

Continuous and Comprehensive Evaluation

Most of our traditional evaluation methods are related only to the area of scientific knowledge or the memory of students. To eliminate the limitations of this method we are forced to evaluate the multi-dimensional competencies of the learner with respect to the practicability and nature of the subject.

Continuous and Comprehensive Evaluation is an essential ingredient of any learning process. It helps the learner to understand and evaluate his own progress and to develop adequate strategy for further improvement. Continuous Evaluation also helps us to measure the attained goals of formulated curriculum objectives.

Merits of Continuous and Comprehensive Evaluation system are:

1. Making student's learning regular
2. Provides for a variety of activities
3. Effective feedback is possible
4. Assess the all round development of the learner on a continuous basis through a variety of activities.
5. Remedial and diagnostic teaching is possible.
6. The process as well as the product is assessed.

Different tools are used to evaluate the multi dimensional competencies of the learners. The Continuous and Comprehensive Evaluation (CCE) includes not only written test (class tests) but also oral tests, observation, interview, debates, discussions, seminars etc.

The learner proceeds through a variety of learning experiences. Therefore the level of progress should be evaluated in a comprehensive and continuous manner. More over, the learner is to be made aware of the findings and it helps him to measure his progress. Necessary help should be provided to them in time. As such we can generate the environment and opportunity for Continuous Evaluation.

In order to evaluate the multi- dimensional competencies of the learner, different tools and techniques have to be used. The multi- dimensional competencies of the learner include :

- Class -room interaction
- Task orientation
- Creative expression
- Field/institutional interactions
- Knowledge assessment/ expression

Continuous Evaluation Items

1. Assignment
2. Seminar
3. Class test
4. Project etc.

* For continuous evaluation class test (CT) is made compulsory taking any two of the above said indicators. CT can be a written test, oral test (viva), Practical test.

CE Item	Evaluation Indicators	Weightage	Score
1. Assignment	1. Awareness of the content	4/3/2/1	20
	2. Comprehensiveness of the content	4/3/2/1	
	3. Systematic and sequential arrangement	4/3/2/1	
	4. Observation/suggestions/Views Judgements/ Evaluation	4/3/2/1	
	5. Timely Submission	4/3/2/1	
2. Seminar	1. Ability to plan and organise	4/3/2/1	
	2. Skills in the collection of data	4/3/2/1	
	3. Awareness of the content (presentation of the paper, participation in discussion, ability to substantiate the ideas and views)	4/3/2/1	

	4. Ability to prepare the report (sequence in the presentaionof the concepts, authenticity and clarity of ideas/views/concepts)	4/3/2/1	
	5. Quality of Seminar Document	4/3/2/1	20
3. Project	1. Ability to plan (Selection of the method for solution of the problem, identifying suitable tools, planning the various activities to be carried out in each stage)	4/3/2/1	
	2. Ability to collect data (sufficiency and Relevance of data. Classification and arrangement of data for analysis, reliability and authenticity of the Collected data.)	4/3/2/1	
	3. Ability to analyse the elements and procedure (Structuring of elements and developing logic. Efficiency in using the package/tool. Recognising design errors and correcting them)	4/3/2/1	
	4. Ability to prepare the project report (Reflection of the process skills. Communicability and authenticity of the report in relation with the Project diary	4/3/2/1	
	5. Viva Voce(Knowledge of the content and Process)	4/3/2/1	20

CE item calculation

Subject		item: Assignment					Total Score (20)
Sl. No	Name	Evaluation Indicators					
		I (4)	II (4)	III (4)	IV (4)	V (4)	
1	Anand	2	3	4	4	4	17
2	Shibu	4	3	4	4	4	19

Consolidated statement of CE

Class: 1st year

Stream: Fisheries

Subject: Fish Processing Technology

Sl. No	Name	CE Items			Total (60)	Total CE Out of 20 Score obtained $\times \frac{20}{60}$
		1 Class Test (20)	2 Assignment (20)	3 Seminar/ Project (20)		
1	Anand	18	17	19	54	18
2	Shibu	20	19	18	57	19

No minimum score for CE

Terminal Evaluation (TE)

Terminal Evaluation is in written form. The test should not be aimed to test the memory alone. The terminal evaluation questions give more emphasis on application level, analysis and synthesis. The questions are framed so that the students are able to apply their different mental process. The maximum score is 80 and the minimum score of TE is 24 (30%).

The terminal evaluation questionnaire should be capable of measuring

- Content validity
- Criterion validity
- Constant validity
- Reliability
- Class test, term evaluation and annual examination should be in tune with the new approach.
- Should not be prepared to test the rote memory.
- Questions asked should provoke the thinking abilities of students.
- Questions to test the competency of application analysis, synthesis and evaluation are to be given. In other words the questions should be framed in such a way that the students are able to apply their various mental processes.
- Questions should be based on the learning process and the new approach to each subject.
- Results should be scientifically analysed.

- Evaluation results should be analysed and follow up may be carried out at relevant levels (remedial measures).
- Eighty percent marks are set apart for the common examination as the part of the Term Evaluation

The Question Paper must have

- Application level questions
- Synthesis level questions
- Comparison of facts
- Challenging questions
- Scope for obtaining innovative ideas
- Giving creative thinking by the students
- Questions based on the objectives of learning activities
- Practical oriented questions
- Environment related questions
- Divergent thinking level questions

Role of the Teacher in the Evaluation Process

- Preparation for the effective execution of evaluation
- Preparation of daily planning notes (teaching manual) and helping learners in their activities.
- While learners are engaged in doing seminars/collections/assignments/collections, conduct interim evaluation and provide necessary help.
- Consider assignment, seminar, collections etc. as learning activities and approach them as evaluation materials.
- Prepare a format to record continuous evaluation.
- Identify and evaluate the progress at different stage.
- Find out learner's difficulty by conducting feedback.
- Make use of the support mechanism fully, provided by the department of education.
- Make the parents aware of the new approach to curriculum and evaluation system through class P.T.A.
- Make use of the training programme for professional excellence and transparency in work.
- Make use of the Humanities Teachers Council for academic progress.
- Identify and make use of the possibility of action research to resolve classroom learning problems.

Grading

It is not scientific to assess the achievement of a student solely based in the marks in the terminal examinations. Marking system proved unscientific in evaluating the growth and development of students both in cognitive and non-cognitive areas. To overcome this shortcomings, a popular mode of evaluation based on

students' performance- grading system- has been evolved. At the Higher Secondary stage, it is desirable to use a point absolute grading to co-ordinate and record the evaluation. After giving the score, they are changed into percentages and appropriate letter grades are awarded corresponding to each percentage. The score percentage and corresponding letter grade in Fish Processing Technology is given below.

Score in percentage	Grade
90-100	A+
80-89	A
70 -79	B+
60-69	B
50-59	C+
40-49	C
30-39	D+
20-29	D
Below 20	E

Consolidated statement of CE & TE

Class: 1st year

Stream: Fisheries

Subject: Fish Processing Technology

Sl. No	Name	CE (20)	TE (80)	Total CE+ TE (100)	Grade
1	Anand	18	60	78	B+
2	Shibu	19	72	91	A+

The maximum score of CE+TE is 100 and the minimum score is 30. (30%)

Practical Evaluation (PE)

PE is the important part of vocational practicals. The practical skills must be evaluated after completing all practical experiments in each term and at the end of the academic year. PE must cover all required indicators to evaluate the technical skill and practical knowledge of the different topics covered.

Syllabus

Practical	420 hrs
1. Collection and identification of commercially important teleosts, elasmobranches, crustaceans and molluscs.	50 hrs.
2. Study and recording of morphological characters of selected telecosts, elasmobranches, crustacean and molluscs.	25 hrs
3. Preparation of charts showing fish landing centres, fishing harbours and ports in India and Kerala. Compilation of data of fish landings (item-wise and quantity wise) of India and Kerala for the past 10 years.	30 hrs
4. Estimation of the proximate composition of fish: Moisture content, glycogen content, fat content, protein content and ash.	30 hrs
5. Visit to fisheries bacteriology laboratory for familiarisation with bacteriological methods and demonstration of procedures for isolation and identification of bacterial from fish.	75 hrs
6. Organoleptic evaluation: Organoleptic evaluation tests on fish and shellfish and organoleptic tests for detection of spoilage.	50 hrs
7. Analysis of water for chlorine and pH.	10 hrs
8. Familiarisation of techniques of handling for processing of fish and shellfish. On-hand training for handling and dressing fish and shell fish for processing.	75 hrs
9. Familiarisation of freezing and processing of fish and fish products. Visit to ice plants, freezing units, peeling sheds and cold storage.	75 hrs

Indicators for Practical evaluation and their score

No	Indicators	Percentage	Score
1	Procedure and demonstration	40%	60
2	Calculation	10%	15
3	Identification	20%	30
4	Spotters	10%	15
5	Record	10%	15
6	Viva	10%	15
		Total	150

Consolidated statement of Practical Evaluation

Class: 1st year

Stream: Fisheries

Subject: Fish Processing Technology

No	Name	Procedure and demonstration	Calculation	Identification	Spotters	Record	Viva	Total	Grade
		60	15	30	15	15	15	150	
1	Anand	40	10	20	10	12	13	105	B+
2	Shibu	55	13	25	13	13	13	142	A+

How will you find out grade for PE

Convert the total score into percentage and find out the grade

eg: Total score: 105, percentage $\frac{105}{150} \times 100 = 70$, Grade B+

The minimum score to be obtained is fixed at 40% that is 60 out of 150.
Grade B

Vocational Competency Evaluation

Being a vocational course, a system to judiciously evaluate the required value addition and consequent capacity building in the selected vocational subject is highly essential. As the other evaluation components like CE, PE and TE cannot assess the vocational competencies and professional skills acquired by the students, an internship evaluation (IE) component has been introduced to meet this requirement.

Internship evaluation should be done based on the following components.

I. Regularity and punctuality.

A regular presence and habit of time bound completion of task is a must for attaining maximum efficiency.

Regularity and Punctuality can be evaluated by 5 Point scale.

Rating Scale

		1	2	3	4	5
1	Regularity	Never regular	Often regular	Usually regular	Most of the time regular	Always regular
2	Punctuality	Never Punctual	Often Punctual	Usually Punctual	Most of the time Punctual	Always Punctual

Regularity and punctuality can be assessed by using attendance of the student and time bound completion of tasks.

II. Value addition

Value addition can be evaluated through conducting field visits/survey. The experiences gained through field visit and survey increases the level of intrinsic motivation and positive attitude towards the vocational field and there by increase his value as a skilled semi- professional.

The aim of value addition is to measure the interest, devotion Group management, perseverance of the learner in specific areas Value addition can be evaluated from field visit, survey and simulated experiments.

III. Capacity building

Capacity building can be evaluated through conducting the following activities.

1. OJT/Simulated experiment
2. Performance- Camp/ Exhibition/ Clinic.
3. Performance- Production/Service cum Training centre.

These components helps the students to practice the acquired skills in the real situation and there by increasing self confidence and promoting self reliance.

Capacity building is aimed at measuring the skills of the learner from OJT/ production cum training centre/ research and development/graded area exposure.

IE Item	Evaluation Indicators	Weightage	Score
1. Regularity and Punctuality			10
2. Value addition	<p>Field Visit</p> <p>1. Attitude and readiness towards the task.</p> <p>2. Capacity for observation.</p> <p>3. Data collection.</p> <p>4. Application of ideas.</p> <p>5. Documentation/ recording.</p> <p style="text-align: center;">OR</p> <p>Survey</p> <p>1. Planning.</p> <p>2. Data collection.</p> <p>3. Consolidation of data and analysis.</p> <p>4. Drawing inference.</p> <p>5. Reporting.</p>	<p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p>	20
3. Capacity building	<p>OJT/ Simulated Experiment/ Practical skill</p> <p>1. Involvement/ Participation.</p> <p>2. Skills in doing work/ Communication skill.</p> <p>3. Time bound action.</p> <p>4. Capacity for observation, analysis and innovation.</p> <p>5. Documentation, Recording and display.</p> <p style="text-align: center;">OR</p> <p>Performance in camp/ Exhibition/ clinic</p> <p>1. Ability for planning and organising.</p> <p>2. Mastery of subject.</p> <p>3. Ability for communication.</p>	<p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p> <p>4/3/2/1</p>	20

IE Item	Evaluation Indicators	Weightage	Score
	4. Innovation.	4/3/2/1	
	5. Involvement/Social commitment.	4/3/2/1	
	OR		
	Performace in production/ service cum training centre (PSCTC)		
	1. Mastery of vocational skills.	4/3/2/1	
	2. Managerial capacity.	4/3/2/1	
	3. Promoting self confidence.	4/3/2/1	
	4. Innovative approach.	4/3/2/1	
	5. Promoting self - reliance.	4/3/2/1	

Vocational Competency Items for Internship Evaluation

Items	Score
Regularity & Punctuality	10
Field visit/survey(any one)	20
OJT/simulated experiment/ Practical Skill/ Performance- Camp/exhibition/Clinic Performance- PSCTC (any one)	20
Total	50

A minimum of 80% attendance is required for promotion to the second year. Those who have shortage of attendance should repeat first year. Those who have 80% and above attendance but failed to achieve 30% of Internship Evaluation (IE) will be promoted to the second year. He has to improve the component in which he performed poor. He has to attain the minimum by improving the particular component to get eligible for appearing second year public examination.

Consolidated statement of IE

Class: 1st year

Stream: Fisheries

Subject: Fish Processing Technology

SI No	Name	Regularity & Punctuality	Field visit or survey	OJT or Practical skill	Total Score	Grade
		10	20	20	50	
1	Anand	5	12	10	27	C+
2	Shibu	6	15	16	37	B+

UNIT. 1

GENERAL INTRODUCTION

Introduction

Fisheries is a multidisciplinary sector which deals with aquaculture, fish capturing, fish processing, etc. Since the students have limited knowledge about fisheries, this unit aims to convey the fundamental aspects such as status of fisheries in Indian economy, morphology of fishes, commercially important Indian fish resources and various fishing methods.

Syllabus

Morphology and biology of typical fish and shell fish. Major Indian fisheries: marine, estuarine and fresh water. Pelagic and demersal fisheries of India. Fishing methods. Marine fish production in India. Export of marine products from India.

Curriculum Objectives

- To understand the status of Indian fisheries and export.
- To identify the maritime states, fishing zones, major fishing harbours and ports of India.
- To understand various fishing methods briefly.
- To develop skills to identify the morphological characters of typical fish and prawn.
- To develop skills to differentiate teleost and elasmobranch.
- To understand the commercially important fishery resources of India.
- To develop the skills to familiarise different varieties of fishes, crustaceans and molluscs.

Sub Topic - Status of Indian Fisheries and Export

Suggested Activities - Data Collection

Ask the students to collect the data of fish landings and exports from journals, internet and economic reviews. Based on the collected data plot graphs and discuss the fluctuations and trends in landings and export. This activity aims to acquire a knowledge about the status of Indian fisheries and export.

Sub Topic - Indian Coast Line

Suggested Activities - Demonstration

Demonstrate a map of India. Ask them to draw the map and mark the maritime states, different fishing zones, important harbours and ports.

Sub Topic - Fishing Methods

Suggested Activities - Field trip with Discussion

A field trip is preferable as a strategy to study different fishing methods. Teacher may enable the students to visit a suitable fish landing centre to familiarise with various fishing methods. On the basis of the field trip a discussion can be conducted.

Points for discussion

Discuss methods such as gillnetting, trawling, purse-seining, shore seining, boat seining, line fishing and fish traps.

Sub Topic - Morphological Characters of Typical Fish and Prawn

Suggested Activities - Group Discussion

The students are divided into groups. Each group shall not exceed six students. Each group is provided with a typical fish and prawn. Groups are asked to discuss the morphological characters of the given specimens with the help of labelled chart.

Points for discussion

Discuss the general features of fish such as body shape, fins, scales, gills and operculum, eyes and air bladder.

Discuss general features of prawn such as body shape, gills, eyes, exoskeleton and appendages.

Sub Topic - Teleost and Elasmobranchs

Suggested Activities - Group Discussion

Students have previous knowledge about external characters of fishes. On the basis of that knowledge arrange a general discussion on different characters of a typical teleost and an elasmobranch. Teacher may consolidate the differences between a teleost and an elasmobranch and ask them to prepare a note.

Points for discussion

Discuss the differences in vertebral column, scales, caudal fin, position of mouth, operculum, number of gills and mode of reproduction.

Sub Topic - Commercially Important Fishery Resources of India

Suggested Activities - Assignments and Seminar

Students have a basic idea about fishery resources of their area. Hence it is better to give assignments and seminar based on the topic. Class may be divided into small groups and ask them to collect information on different fishery resources such as oil sardine, Mackerel, Tuna, Bombay duck, Shark and Prawns. Teacher may guide the seminar by giving specific points for presentation.

Points for discussion

Scientific names of economically important fishes and prawns, geographical distribution in India food and feeding habits, habitats, spawning season, fishing season, fishing methods and utilization.

Sub Topic - Different varieties of Fishes, Crustaceans and Molluscs

Suggested Activities - Field trip

Arrange a visit to fishlanding centre or fish market and ask the students to collect and list the names and features of various fishes, crustaceans and molluscs, they came across. In addition to this, the students are asked to classify the specimens.

The teacher may guide the students to familiarise fishes such as Oil sardine, Mackerel, Anchovies, Tuna, Seer fish, Ribbon fish, Carangids, Sharks, Rays, Skates, Scianids, Silver bellies, Pomfrets, Cat fishes, Flat fishes, Polynemids, Codes, Thread fin bream, White fish, Pearl spot, Mulletts, Milk fish, Carps, Prawns, Lobsters, Cephalopods, Mussels, Clams, Oysters etc.

Additional Points

Total coast line of India	-	8129 Kms
Total coastline of Kerala	-	590 Kms
Marine fish production in India (2004- 2005)	-	2.99 Million M Ton.
Total fish production in India (2004- 2005)	-	5.98 Million M Ton.
Area of Indian EEZ	-	2.02 Million sq. Km
Area of Continental shelf	-	0.506 Million sq. Km

Major Fishing zones

North West Zone	-	Gujarath, Maharashtra
South West Zone	-	Kerala, Karnataka, Goa
South East Zone	-	Tamilnadu, Pondichery and Andrapradesh
North East Zone	-	Orissa and West Bengal

Important Ports

Chennai, Kochi, Visakhapatnam, Tuticorin, Kolkata, Mangalore, Mumbai, Kandla, Marmagoa, Nhevasheva, Paradeep, Haldia and Ennore.

Important Fishing Harbours of India

Neendakara, Kochi, Baypore, Mangalore, Karwar, Ratnagiri, Jafuabad, Tuticorin, Mumbai, Veraval, Mandapam, Nagapattanam, Chennai, Visakhapatnam, Kakinada, Paradeep.

Marine products export from India (2004 - 2005)

Quantity	-	461329 MT
Value	-	6646.69 Crores

Commercially Important Fishery Resources of India

Name of Fishery	Scientific Name	Major Distribution	Common Feeding habits	Common Spawning Season	Peak Fishing Season	General Fishing Methods	Common Utilisation
1. Oil Sardine	Sardinella longiceps	Kollam to Ratnagiri	Plankton feeder (Mainly feeds on Fragillaria oceanica)	June to October	July to March	Purse seining, Boat seining, Shore seining, Gill netting.	Fresh, iced form. By products - Body oil, fish meal, fish manure etc.
2. Indian Mackerel	Rastrelliger kanagurta	Kollam to Ratnagiri	Zoo plankton feeder	South west monsoon	August to April	Purse seining, Boat seining, Shore seining, (Rampani in Karnataka) Gill netting.	Fresh, iced, salt dried, wet cured, colombo cured. By products- Fish meal, fish manure etc.
3. Bombay Duck	Harpodon nehereus	North West Zone	Carnivores (Even cannibalistic)	November to March	September to December	Bagnet (Dol net) Boat seining, Gill netting, Trawl netting.	Fresh and sun dried etc. By products - Laminated Bombay duck, manure etc.
4. Tuna	1. Auxis sp. 2. Euthynnus affinis 3. Thunnus albacares 4. Katsuwonus pelamis	Lakshadweep Minicoy Islands, Kerala and Tamilnadu	Voracious, Carnivores and predatory	Through out the year.	Through out the year.	Purse seining Pole and lining. (Lakshadweep) Tuna long lining	Fresh, frozen, canned smoked form etc. By product - Masmin

Name of Fishery	Scientific Name	Major Distribution	Common Feeding habits	Common Spawning Season	Peak Fishing Season	General Fishing Methods	Common Utilisation
5. Elasmobranchs	Scoliodon sp. Dasyatis sp.	North West Zone, Kerala and South East Zone	Carnivores	Through out the year.	Through out the year.	Hook and lining.	Wet cured, sun dried etc. By products - Shark liver oil, shark fin rays, shark skin, shark cartilage.
6. Prawn	Penaeus monodon Penaeus indicus Parapenaeopsis stylifera. Metapenaeus monoceros Metapenaeus dobsoni	Kerala	Omnivores	Monsoon	Monsoon	Bottom trawling Trammel netting Drift gill netting Stake netting	Fresh, frozen. canned, sun dried form etc. By products - Chitin, chitosan etc.

Unit : 1 General Introduction

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> To Understand the status of Indian Fisheries and export. 	Total fish landings and Total export from India.	Collection	Collection of data	Journals, Internet, Economic reviews.	Authenticity Interpretation Interest.
<ul style="list-style-type: none"> To identify the maritime states, fishing zones, major fishing harbours and ports of India. 	Maritime states, fishing zones, ports and harbours	Drawing	Drawing and Marking.	Map	Interest Participation.
<ul style="list-style-type: none"> To understand various fishing methods briefly 	Trawling Gill netting Seining etc.	Observation Communication	Field visit Demonstration. Discussion	Models.	Participation Interest Presentation.
<ul style="list-style-type: none"> To develop skills to identify the morphological characters of typical fish and prawn. 	Morphology of fish and prawn.	Identification. Communication	Group discussion	Specimen	Participation Interest Presentation
<ul style="list-style-type: none"> To develop skills to differentiate teleost and elasmobranch. 	Teleost Elasmobranch	Observation Differentiation Communication	Group discussion	Specimen Charts	Participation Interest Presentation.
<ul style="list-style-type: none"> To understand the commercially important fishery resources of India. 	Fishes, Prawns	Identification Observation Classification.	Assignment Seminar	Specimen Charts.	Presentation Depth of knowledge.
<ul style="list-style-type: none"> To develop skills to familiarise different varieties of fishes, crustaceans and molluscs. 	Fin fishes Shell fishes	Identification Observation Classification.	Field trip	Specimens. Charts.	Observation Interest Participation

UNIT. 2

FISH AS A FOOD MATERIAL

Introduction

Fish is a food of excellent nutritional value providing high quality of proteins, fats and a wide variety of vitamins and minerals. Its protein is easily digestible and contains more essential amino acids and essential fatty acids than in cereals and legumes.

People in developed countries are much more dependent on fish as part of their daily diet. It reveals the importance of fish as food material. In this unit an attempt has been made to make the students aware of different biochemical components in the fish muscle. In addition, this unit deals with the nutritional value and the importance of fish in human diet.

Syllabus

Importance of fish in human diet.

Chemical aspects of fish flesh components- Water, fat (oil), protein, carbohydrate, vitamins.

Curriculum Objectives

- To understand the proximate composition of fish.
- To understand the classification of protein based on its solubility.
- To understand the importance of fish in human diet.
- To develop a skill to compare the nutritive value of fish with other food items.
- To apply the knowledge acquired about nutrition in real life situations.

Suggested Activities- Discussion

Use charts showing percentage of different components in fish, meat and vegetables. Compare the proximate composition of fish with others. Discuss nutrition in general and connect it with the nutritional value of fish. Thus let them understand that nutritive value of fish is superior.

Points for discussion

- ➔ About water, fat, protein, carbohydrates, minerals, vitamins and NPN compounds in fish muscle.

- Classification of proteins according to their solubility and mention their percentage in fish muscle.
- Compare the protein, fat and vitamins in fish with meat and vegetable.
- Deficiency diseases caused by the inadequate consumption of fish such as goiter kwashiorkor, night blindness, rickets etc.
- Nutritive value of essential amino acids, PUFA, Vitamin A and D, Iodine, Calcium and Phosphorus in the fish.

Additional information

1. Fats

Fats are triglycerides of higher fatty acids, usually containing even numbers of carbon atoms. Fish fats have a high content of poly-unsaturated long chain fatty acids with four to six double bonds, which is uncommon in mammalian fats, fatty acids eg: Palmitic acid, oleic acid, arachidonic acid etc.

2. Proteins

Proteins are basically complex nitrogenous organic substances. These are long chains of polypeptides having of very high molecular weights ranging from thousands to lakhs. Basic building units of proteins are amino acids. Compared to meat, digestible proteins are more in fish. In fish muscle 95% of total protein are easily digestible.

3. Non- Protein Nitrogenous Compounds (NPN Compounds)

NPN Compounds play a very important role in the physiological functions of live fish muscle. They are generally encountered in fish muscle and comprises ammonia, urea, tri- methyl amine oxide, guanidine and imidazole and miscellaneous substances like purins and pyrimidines. The details are given below:

Tri Methyl Amine Oxide (TMAO)

It is considered to be one of the compounds responsible for the characteristic fishy odour and flavour of marine fish.

Free Alpha Amino Acids

Attractive flavour of prawns and other crustaceans are due to their comparatively higher contents of Free Alpha Amino Acids. Quicker rates of spoilage of invertebrates are also due to the presence of free Amino Acids in their muscles. There are two types of Free Alpha Amino Acids viz. essential and non- essential.

4. Vitamins

Low molecular weight substance performs an important role in regulating the body functions. Vitamins are not synthesised by body and hence can be substituted through the food. Fat soluble and water soluble vitamins are there.

Vitamins A, D, E and K are fat soluble.

Riboflavin, Nicotinic acids, Pyridoxine, Cyanocobalamine are water soluble vitamins.

Proximate Composition

Components	Percentage in Fish
Protein	18 - 24
Lipids and Fat	0.2 - 22
Water	66 - 84
Minerals	0.4 - 2
Carbohydrate	below 0.1
Vitamins	Trace
NPN compounds	0.3 - 0.6

Different types of proteins in Fish Muscle

Types of protein	Sarcoplasmic proteins	Myofibrillar proteins	Stroma proteins
Solubility	In water or salt solution of low ionic concentration.	In salt solution or 0.1 N NaOH.	Only in strong acid or alkali
Percentage to total protein	16 - 22	65 - 75	3
Function	Metabolism	Muscle movement	Connective tissue
Example	Myogen, myoglobin, Haemocyanin	Actin, myosin, Tropomyosin, Troponin	Collagen and Elastin

Classification of Fishes based on Fat content

Lean Fishes	Less than 2.5% of fat	eg: Anchovies, Silver bellies
Semi fatty fishes	2.5% - 5% of fat	eg. Ribbon fish, Carangids
Fatty fish	More than 5% of fat	eg. Oil sardine, mackerel

Unit : 2 Fish as a Food Material

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Understand the Proximate composition of fish. 	Water, Fat, Protein, Carbohydrate, Minerals, Vitamins, NPN Compounds	Observation Communication Comparison	Observation of charts. Discussion	Charts and Reference	Participation Interest Preparation of notes.
<ul style="list-style-type: none"> Understand the classification of protein based on its solubility. 	Sarcoplasmic protein. Fibrillar protein Stroma protein	Observation Classification Communication	Observation of charts. Discussion	Charts and Reference	Participation Interest. Preparation of notes.
<ul style="list-style-type: none"> Understand the importance of fish in human diet. 	Deficiency diseases.	Observation Communication Comparison	Observation of charts and comparison	Charts and Reference	Participation Preparation of notes.

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Develop skills to compare the nutritive value of fish with other food items. 	<p>Comparison of fish protien with vegetable and meat protein.</p>	<p>Observation Communication Comparison</p>	<p>Observation of charts and Comparison</p>	<p>Charts</p>	<p>Participation Interest.</p>
<ul style="list-style-type: none"> Apply the knowledge acquired about nutrition to other situation. 	<p>Essential aminoacids. Polyunsaturated fatty acids. Vitamin A and D Iodine Calcium Phosporous</p>	<p>Communication</p>	<p>Discussion Preparation of notes.</p>	<p>Reference</p>	<p>Participation Presentation of notes.</p>

UNIT. 3

FISH SPOILAGE

Introduction

Fish is a highly perishable food and starts spoiling at the moment they are taken out of water. Post mortem changes take place in fishes in atmospheric and refrigerated temperatures. Post mortem changes taking place in fish are sensory changes, Autolytic changes, Bacteriological changes and lipid oxidation. This unit reveals the students about the post mortem changes taking place in fish muscle and the causative agents of fish spoilage. Besides, it equips the students to differentiate the spoiled fish from the fresh one.

Syllabus

Rigor mortis, Autolytic spoilage, Bacterial spoilage, oxidation of fat.

Curriculum Objectives

- To understand the post mortem changes taking place in the fish muscle.
- To understand different causative agents of fish spoilage.
- To develop the skill for evaluating shrimp organoleptically.
- To develop the skill to differentiate fresh and spoiled fish.

Suggested Activities - Demonstration

Students have to acquire the skill to recognise the spoiled fish. Hence it is necessary to include demonstration as an activity. Bring samples of fresh and spoiled fishes of the same species to the class room. Teacher should ask the groups to evaluate and compare the appearance of gills, eyes, belly and texture of the spoiled fish with that of the fresh fish and make a report on the basis of this organoleptic evaluation. The report should be presented in the class by the group leader and discuss the report in detail.

Points for discussion

- ⇒ Sensory evaluation of fish and shrimp.
- ⇒ Post mortem changes such as Rigor mortis, Autolysis, Microbial changes Belly burst and Rancidity.
- ⇒ Role of enzymes, microbes and oxygen in fish spoilage.

Additional Information

Comparison of Fresh and Spoiled Fish

Fresh Fish	Spoiled Fish
Flesh firm, elastic, cannot easily be separated from the bone.	Loose, non elastic, can easily be separated from the bone.
Sea weedy or fishy odour	Off odour
Gills have bright red colour	Colour faded into brown and finally yellow.
Eyes are bright, clear and transparent	Red in colour, cloudy, opaque
Skin is slimy with un faded colour	Not slimy and colour faded
Sweet characteristic flavour	Un pleasant flavour
Bright colour	Dull colour
Scales are firm and strong	Not firm and easily detachable

Unit : 3 Fish Spoilage

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Understand the post mortem changes taking place in fish muscle. 	Rigor mortis Autolysis microbial changes Belly burst Rancidity	Observation Communication Comparison	Demonstration Discussion	Specimens Reference	Participation Interest. Presentation of notes.
<ul style="list-style-type: none"> Understand different causative agents for fish spoilage. 	Enzymes Microbes Oxygen	Communication Prediction	Discussion Preparation of notes	Reference	Presentation of notes. Participation in discussion.
<ul style="list-style-type: none"> Develop the skill for evaluate shrimp organoleptically. 	Black spot loose shell	Observation Communication	Demonstration Discussion Preparation of notes	Specimens Reference	Participation in discussion.
<ul style="list-style-type: none"> Develop skills to differentiate fresh and spoiled fish. 	Appearance of gills, eyes, flesh etc.	Observation Communication	Demonstration Discussion Preparation of notes	Specimens Reference	Participation in discussion.

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Develop skills to differentiate fresh and spoiled fish. 	Appearance of gills, eyes, flesh etc.	Observation Communication	Demonstration Discussion Preparation of notes	Specimens Reference	Participation in discussion.

UNIT. 4

MICROBIOLOGY OF FISH SPOILAGE

Introduction

Students have previous knowledge about the role of micro organism in fish spoilage. They have got a basic idea about the micro organisms at school level. Our aim is to give an idea about bacteria present in fish and fishery products. This unit deals with the effect of various environmental factors on bacterial growth and methods of controlling fish spoilage. In addition, they should also get an idea about the structure of bacteria. On completion of this unit the students get the concept of preventing the bacterial spoilage by altering different environmental conditions.

Syllabus

Structure and growth of bacteria, Role of bacteria in fish spoilage, Effect of temperature, pH, Oxygen, Salinity etc. on bacterial growth, methods of controlling spoilage.

Curriculum Objectives

- To understand the structure of bacteria.
- To understand the effect of environmental factors on bacterial growth.
- To understand the methods to prevent fish spoilage.
- Apply the knowledge acquired in new situations.

Sub Topic - Reproduction of Bacteria

Suggested Activity - Discussion

With the help of OHP and charts discuss binary fission and spore formation. Let the students prepare notes by observing it.

Points for Discussion

- During the favourable environmental conditions bacteria multiply by binary fission at a faster rate within a short period.
- Bacteria produce spores to withstand unfavourable environmental conditions.

Sub Topic - Structure and Shape of Bacteria

Suggested Activity - Demonstration with Discussion

Recall the previous knowledge that gained by the students in lower classes about the structure and shape of bacteria through a discussion. Charts showing the structure and shape of bacteria can be exhibited. Permanent microscopic slides can also be shown. Let the students understand the structure and shapes of bacteria by observation. Let them recognise the shapes and ask them to classify based on their shape, such as spherical (coccus), rod (Bacillus), Spiral (Spirillum) and Coma (Vibrio).

Ask the students to record labelled diagram and let them prepare notes. Based on this, conduct a group discussion.

Points for discussion

- How the bacterial cell differs from a typical plant cell.
- The shapes of bacteria.

Sub Topic - Effect of environmental factors on bacterial growth

Suggested Activity - Discussion

Salinity

Discuss the effect of fresh water on marine organism and saline water on fresh water organisms and lead them to halophilic and halophobic bacteria.

Temperature

Plot a temperature scale on black board ranging from 0 - 100° C. Let the students identify the range of normal atmospheric temperature and help them to divide the whole range into three sections- cold condition, normal condition and hot condition. Lead them to understand psychrophiles, mesophiles and thermophiles.

pH

Students have acquired the concept of acidic pH, neutral pH and alkaline pH in their previous classes. Let the students get aware that most of the bacteria generally live in neutral pH and a few exceptions are inhabiting in acidic pH.

Oxygen

The students have learned of the necessity of oxygen for living organisms. Make them aware of that certain organisms can withstand in the absence of oxygen. Based on this, teacher leads the students to understand about aerobes and anaerobes.

Moisture

Water is necessary for the existence of life. The students realise that microbes cannot survive without free water in their habitat.

Sub Topic - Bacterial Growth

Suggested Activity - Discussion with Demonstration

Using a growth curve chart discuss different phases of bacterial growth such as Lagphase, Logarithmic phase, Stationary phase and Mortality phase.

Sub Topic - Methods of controlling microbial spoilage

Suggested Activity - Group Discussion

Students are divided into groups. Each group should not exceed six students. Ask them to discuss how to control fish spoilage with the knowledge acquired from the effect of environmental factors on microbial growth. Additional skills for discussion should be given as “at which temperature, salinity, pH or water content bacteria destroys”. Consolidation should be done in order to make the student understand that the conditions prevailing in fish favours the multiplication of bacteria. Students should understand that by altering the temperature, salt content, pH and water content, we can destroy or prevent the growth of bacteria. Thus the students must understand that icing, freezing, salt curing, drying, canning, smoking irradiation and marinating can be employed as methods of fish preservation.

Additional Points

Differences between bacteria and a typical plant cell

Bacteria	Typical Plant Cell
1. Prokaryotic (without clear nucleus, posses only genetic material)	Eukaryotic. (with nucleus)
2. Cell wall is made of mucopeptides	Cell wall is made of cellulose
3. Membraneous organels absent	Present

Examples of different morphological types

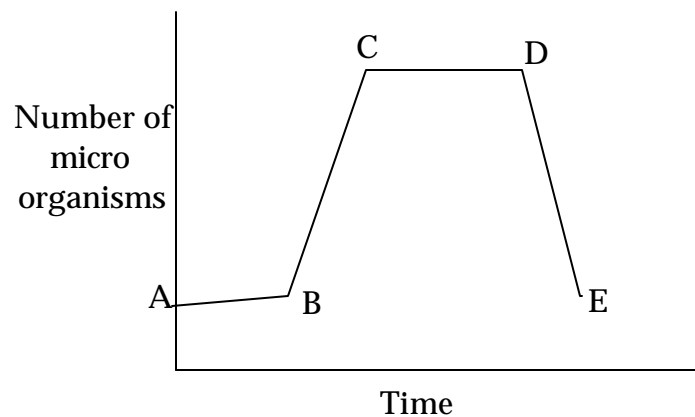
- Coccus - *Staphylococcus, Streptococcus*
- Bacillus - *Clostridium sp, E. coli, Bacillus sp.*
- Coma - *Vibrio cholera*
- Spirillum - *Spirillum sp.*

Classification of Bacteria based on Environmental factors

- Psychrophiles - Bacteria which grow at a temperature of 0- 20°C with an optimum at 15°C.
eg. *Psuedomonas*.

- Mesophiles - Bacteria which survive at a temperature of 20- 45°C with an optimum growth at 30 - 37° C.
eg. *Salmonella typhi*.
- Thermophiles - Bacteria which survive at a temperature of 45- 90°C with an optimum growth at 55° C.
eg. *Clostridium botulinum*.
- Halophilic - Bacteria which grow best in the presence of salt.
eg. *Serratea salinaria*.
- Halophobic - Bacteria which cannot tolerate salt concentrations higher than 6%.
eg. *Achromobacter, Pseudomonas*.
- Acidophiles - Bacteria which can survive at a pH of 4.5 and below.
eg. Lactic acid bacteria.
- Aerobic - Bacteria which grow only in the presence of air.
eg. *Salmonella typhi*.
- Anaerobic - Bacteria which grow only in the absence of oxygen
eg. *Clostridium sp.*
- Autotrophs - Bacteria which can synthesis their own food material.
eg. Green sulphur bacteria.
- Heterotrophs - Bacteria which depends on others for their food.
eg. *Vibrio cholera*.

Growth Curve of Bacteria



AB - Lag Phase

BC - Logarithmic Phase

CD - Stationary Phase

DE - Mortality Phase

Unit : 4 Microbiology of Fish Spoilage

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Understand the structure of bacteria 	Structure and shape of bacteria.	Observation Differentiation Communication Drawing	Observation of charts Discussion Labelling diagrams	Charts, Permanent slides Diagrams	Participation in discussion. Presentation of labelled diagrams.
<ul style="list-style-type: none"> Understand the effect of environmental factors on bacterial growth. 	Temperature Salinity Oxygen Humidity pH	Communication Observation	Discussion Preparation of notes Demonstration	Reference Charts/ OHP	Participation in discussion. Presentation of notes
<ul style="list-style-type: none"> Understand the methods to prevent fish spoilage 	Icing Freezing Salt curing Drying etc.	Communication	Discussion	Reference	Participation in discussion.
<ul style="list-style-type: none"> Apply the knowledge acquired in new situations. 					

UNIT. 5

MICROBES IN PUBLIC HEALTH

Introduction

Students are aware of food poisoning caused by micro organisms. Some of the micro organisms present in fish and fishery products cause food poisoning and affects public health adversely. This unit aims to develop a skill to understand and identify food poisoning, causative organisms, its symptoms and preventive measures.

Syllabus

Microbes that cause infection to man- *Staphylococcus aureus*, *Salmonella* sp. *Clostridium botulinum*, *Vibrio cholera*, *Escherichia coli*, fecal *Streptococci*.

Curriculum Objectives

- To understand different types of food poisoning caused by the pathogenic bacteria.
- To develop skill for identifying the types of food poisoning through their symptoms.
- Understand the different methods of controlling food poisoning.
- Apply the acquired skill in unfamiliar situation.

Suggested Activities - Field visit, Quiz, Assignment

Interact with the students about food poisoning caused in there area. Then divide the whole class into two groups and ask them to collect information about food poisoning from pamphlets published by health department, posters, magazines and news papers. Conduct a field visit to a microbiology laboratory and ask them to prepare an assignment with the help of the information collected. Teacher may consolidate about the food poisoning caused by *Salmonella*, *Staphylococcus aureus*, *V. cholera*, *Clostridium botulinum*, *E. Coli* and fecal *Streptococci*.

Additional Points

Bacterial Food Poisoning

Bacteria	Characteristics	Source of Contamination	Symptoms	Preventive measures
Clostridium	Anaerobic, gram +ve, rod shaped, spore forming. Produce a neurotoxin botulin	Sea mud and under processed canned food.	At the beginning diarrhoea, weakness, uneasiness, tiredness, head ache, dizziness. Later, constipation occurs with difficulty to talk and disturbance in vision. Muscles of neck become fatigued. Death may occur due to respiratory failure.	Proper fish handling methods. Good sanitary practices. Chlorination of water. Ideal process conditions.
Salmonella	Aerobic, gram -ve, rod shaped, non- spore forming, motile.	Contaminated water, sorting of fish on contaminated beach, handling by potential carriers, inadequate personal hygiene and factory sanitation.	Severe fever, head ache, vomiting, diarrhoea, abdominal pain.	Proper fish handling methods. Good sanitary practices. Chlorination of water. Ideal process conditions. Avoid potential carriers from handling the fish. Avoid fishing from near shore waters.

Bacteria	Characteristics	Source of Contamination	Symptoms	Preventive measures
Staphylococcus	Aerobic gram +ve, coccoid, non spore forming, non motile.	Poor fish handling practices and personal hygiene.	Nausea, vomiting, diarrhoea, abdominal pain, weakness, abnormal blood pressure.	Proper fish handling methods. Good sanitary practices. Chlorination of water. Ideal process conditions. Avoid potential carriers from handling the fish. Maintenance of cool temperature during fish handling and processing.
* Escherichia coli	Aerobic gram -ve, rod shaped, non-spore forming.	Poor fish handling practices and personal hygiene. Presence of E. coli in fish and fishery products is an indication of faecal contamination.	Bloody diarrhoea followed by kidney failure.	Proper fish handling methods. Good sanitary practices. Chlorination of water. Ideal process conditions. Avoid potential carriers from handling the fish. Avoid fishing from near shore waters.

* Presence of E. coli in fish and fishery products is an indication of faecal contamination.

Bacteria	Characteristics	Source of Contamination	Symptoms	Preventive measures
Vibrio cholera	Aerobic, gram -ve, comma shaped, non- spore forming, motile.	Contaminated water, sorting of fish on contaminated beach, handling by potential carriers, inadequate personal hygiene and factory sanitation.	Nausea, vomiting, profuse diarrhoea with abdominal cramps, Dehydration.	Proper fish handling methods. Good sanitary practices. Chlorination of water. Ideal process conditions. Avoid potential carriers from handling the fish. Avoid fishing from near shore waters.

Bacterial Food poisoning - incubation period and duration of illness

Causes of Poisoning	Incubation Period (hrs)	Duration of illness
Salmonella (Infection)	6 to 36	1 to 7 days
Staphylococcus aureus (Food intoxication)	2 to 6	6 to 24 hrs.
Clostridium botulinum (Food intoxication)	12 to 96	Death in 24 hrs to 8 days or slow convalescence over 6 - 8 months
Escherichia coli (Infection and toxin)	12 - 72	1 - 7 days
Vibrio (Infection)	2 - 48	2 - 5 days

Unit : 5 Microbiology of Fish Spoilage

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Understand different types of food poisoning caused by the pathogenic bacteria. 	Salmonella E. coli Staphylococcus V. cholera C. botulinum	Observation Identification Communication	Assignments Field trips.	Reference Microbial colonies.	Presentation Interest.
<ul style="list-style-type: none"> Develop skill for identifying the type of food poisoning through their symptoms. 	Diarrhoea Vomitting Headache Stomachache	Observation Communication Identification	Collection of information.	Reference	Participation Presentation
<ul style="list-style-type: none"> Understand the different methods of controlling food poisoning. 	Proper fish handling Sanitation Chlorination	Observation Communication	Collection of informations.	Journals Magazines Internet	Presentation of notes.
<ul style="list-style-type: none"> Apply the acquired skill in unfamiliar situations. 					

UNIT. 6

FISH HANDLING

Introduction

Fishing Industry has given great importance for hygienic handling of fish on board and on shore, because it determines the quality of the final product. This unit aims to get an awareness about the importance of hygienic handling practices, and use of different chilling methods to keep the fish fresh. This unit also describes the use of chlorine for disinfection in various stages of processing to reduce the bacterial load considerably. The students should acquire skills to handle the fish hygienically, when the completion of this unit.

Syllabus

Hygienic handling of fish on board fishing vessel and on shore, Manufacture and storage of ice, Quality of ice, Use of ice for handling, transportation and processing of fish, Quality of water to be used in fish processing, Chlorination of water, Refrigerated sea water for fish preservation.

Curriculum Objectives

- To understand the hygienic handling of fish and prawn on board fishing vessel and on shore.
- To develop the skill for fish handling.
- To develop the steps in the preparation of fish for processing.
- To understand the principle of chilling.
- To understand the different methods of icing.
- To understand the process of ice manufacture.
- To develop the skill for icing the fish.
- To identify different types of ice.
- To develop skill for chlorinating water.
- To understand the significance of quality of ice and water to be used in fish processing.
- To understand the need for chlorination of water in fish processing.
- To understand the use of Refrigerated Sea Water (RSW) and Chilled Sea Water (CSW) for fish storage.

- To familiarise the different equipments in fish processing industry.
- Apply the acquired skills to new situations.

Sub Topic. 1 - Hygienic handling of Fish on board and on shore

Suggested Activities - Field visit and discussion

Students have already learned the need for hygienic handling practices. To familiarise them with hygienic handling practices conduct a field visit to a nearby fishing harbour and a pre- processing centre. Ask the students to acquire the skill for proper hygienic fish handling on board and on shore. They can also collect details group wise. On the basis of field visit prepare a report and arrange a group discussion.

Points for discussion

Washing, sorting, beheading, gutting, splitting, filleting, bleeding, icing, storing and transport.

Sub Topic. 2 - Manufacture and storage of Ice

Suggested Activities - Field visit

Conduct a field visit to nearby ice plant and familiarise with the manufacturing process of ice; on the basis of this a discussion can be arranged.

Points for discussion

Icing methods- bulking, shelving, boxing.

Types of ice- block ice and flake ice.

Manufacture of block ice.

Insulated containers- Plastic box, thermocol box, MPEDA box, Matsyafed box.

Sub Topic. 3 - Chlorination of Water

Suggested Activities - Discussion

Conduct a discussion about the use of bleaching powder on the purification of water. On the basis of discussion teacher should consolidate the bactericidal property of chlorine.

Points for discussion

1. Bactericidal property of chlorine.
2. Use of chlorinated water in fish handling.
3. Advantages of Chlorination

Sub Topic. 4 - Refrigerated Sea Water(RSW)

Suggested Activities - Demonstration

Using charts/LCD/OHP discuss the structure and working of RSW and CSW and its advantages and disadvantages.

Unit : 6 Fish Handling

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Understand the hygienic handling of fish and prawn onboard and on shore. 	hygenic handling on board and on shore. Sanitary operations	Observation	Field visit. Discussion.	Fishing vessel.	Participation in discussion. Interest in field visit.
<ul style="list-style-type: none"> Develop a skill for fish handling 					
<ul style="list-style-type: none"> Understand the steps in the preparation of fish for processing. 	Beheading. Gutting, Splitting, Filleting.	Observation	Field visit. Discussion.	Specimen	Field visit report. Participation in discussion.
<ul style="list-style-type: none"> Understand the principle of chilling 	Chilling.	Communication	Discussion	References	Participation
<ul style="list-style-type: none"> Understand the process of ice manufacture 	Ice manufacture	Observation	Field visit. Discussion.	Ice plant	Participation Interest

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Understand different methods of icing. 	Bulking Shelving Boxing.	Communication	Discussion	Ice	Participation
<ul style="list-style-type: none"> Develop skills for icing. the fish. 					
<ul style="list-style-type: none"> Identify different types of ice. 	Block ice Flake ice	Observation	Field visit.	Ice	Acquired concept.
<ul style="list-style-type: none"> Understand the significance of quality of ice and water. 	Potable water	Observation	Experiments	Ice and water.	Participation
<ul style="list-style-type: none"> Understand need for chlorination of water in fish processing. 	Bactericidal property of chlorine.	Observation	Discussion	Bleaching powder. Sodium hypochlorite.	Participation in discussion.
<ul style="list-style-type: none"> Develop skills for chlorinating water. 					
<ul style="list-style-type: none"> To understand the use of Refrigerated sea water (RSW) and chilled sea water (CSW) for fish storage. 	Fish storage	Observation	Demonstration Discussion	Charts OHP LCD	Participation in discussion.

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Familiarise the different equipments in fish processing industry. 	General awareness	Observation	Field visit	Equipments	Participation Interest
<ul style="list-style-type: none"> Apply the acquired skills in new situations. 					

UNIT. 7

FREEZING

Introduction

Freezing is basically the removal of heat from a substance until it attains sub zero temperatures and assumes a hard consistency by the solidification of its water content. From this unit the student learns the fact that microbes are inactivated or destroyed due to the solidification of free water and the enzymes are denatured due to the lowering of temperature. A thorough knowledge on different types of freezing techniques is also essential to adopt appropriate methods in accordance with consumer demand. This unit deals with the principle of freezing, different steps involved in the freezing of fishery products and helps to develop skills for selecting suitable freezing techniques.

Syllabus

Principles involved in freezing of fish.

Different freezing methods, freezing of fishery products and the steps involved.

Slow freezing Vs Quick freezing

Double freezing

Post freezing treatment

Curriculum Objectives

- To understand refrigeration and different types of refrigerants.
- To understand the concept of freezing as a preservative method.
- To develop a skill to differentiate freezing and chilling.
- To develop a skill to differentiate slow freezing and quick freezing.
- To understand the terms related to freezing.
- To understand the factors affecting freezing rate.
- To understand different freezing methods.
- To understand different product styles of cephalopods and fishes.
- To apply the acquired skills in new situations.
- To familiarise with different steps in freezing.

Suggested Activities - Field visit

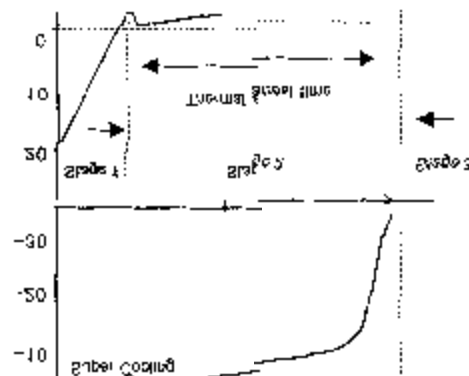
Visit a freezing plant and familiarise with different steps in freezing, different product styles and refrigeration system. Ask the students to prepare a report based on the visit and show flow charts for the different stages of frozen fish products.

Group discussion

Students are divided into various groups and each group does not exceed six students. Ask them to discuss why the food products kept in the freezer is not get spoiled easily and lead them to understand how the enzymatic spoilage and microbial spoilage are controlled by freezing.

Points for discussion

- ⦿ Principles of Refrigeration
- ⦿ Different types of refrigerants - Ammonia, Freon, Liquid nitrogen and Dry ice.
- ⦿ Effects of freezing on enzymes, microbes and rancidity.
- ⦿ Freezing point, zone of maximum crystallisation, Thermal arrest period, Freezing time, freezing curve.
- ⦿ Factors affecting freezing rate such as freezing temperature, product thickness, thermal conductivity of packaging material.
- ⦿ Different freezing methods such as Block freezing, Individual Quick Freezing (IQF), double freezing, carton freezing, vacuum freezing, cryogenic freezing.
- ⦿ Raw material preparation, washing, size grading, weighing, setting, glazing, freezing, re- glazing, packing and labelling, cold storing and shipment.
- ⦿ Thawing, Thaw rigor, Thaw drip, drip loss.
- ⦿ Mention product styles.
 - Squid - squid rings, squid tentacles, squid fillets, squid wings.
 - Cuttle fish - Whole, Whole cleaned, Fillets, roe, tentacles, wings.
 - Octopus - Whole gutted.
 - Fish - Whole, whole gutted, fillets, steaks, minced, loins.
 - Crab - Whole, Cut crab, crab meat
 - Lobster - Whole, lobster tail, cooked.
- ⦿ Slow freezing and quick freezing.



Freezing Curve

Unit : 7 Freezing

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Understand refrigeration and different types of refrigerants. 	Principle of refrigeration. Different refrigerants.	Observation Communication	Field visit Discussion Preparation of report	Reference	Participation in discussion Presentation of reports.
<ul style="list-style-type: none"> Develop skills to differentiate freezing and chilling. 	Short term storage and long term storage.	Comparison Communication	Field visit Discussion Preparation of reports	Reference	Participation in discussion. Presentation of reports.
<ul style="list-style-type: none"> Understand the concept of freezing as a preservative method. 	Prevention of microbial and enzymatic spoilage Reduction in rate of rancidity.	Comparison Communication	Field visit Discussion Preparation of a report.	Reference	Participating in discussion. Presentation of reports.
<ul style="list-style-type: none"> Understand freezing methods. 	Block, IQF, double carton, vacuum and cryogenic freezing	Observation Communication	Field visit Discussion Preparation of a report	Reference	Participation in discussion. Presentation of reports.

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Understand product style of cephalopods and fishes. 	Different product styles.	Observation Communication	Field visit Discussion Preparation of reports.	Reference	Participation in discussion Presentation of reports.
<ul style="list-style-type: none"> Apply the acquired skills in unfamiliar situation. 					
<ul style="list-style-type: none"> Familiarise with steps in freezing. 	Various steps in freezing	Observation Communication	Field visit Discussion Preparation of report.	Reference	Participation in discussion Presentation of reports.
<ul style="list-style-type: none"> To understand the factors affecting freezing rate. 	Temperature Thickness of product. Thermal conductivity of packaging material.	Observation Communication	Discussion	Reference	Participation in discussion

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> To understand the terms related to freezing. 	Freezing point Maximum zone of crystallisation Thermal arrest period Freezing time. Freezing curve.	Observation Communication	Discussion	Reference	Participation in discussion
<ul style="list-style-type: none"> To understand slow and quick freezing. 	Slow activities	Observation Communication	Discussion	Reference	Participation in discussion

UNIT. 8

FREEZERS

Introduction

Several types of freezers are used in seafood industry for freezing of fish. In this unit we are going to familiarise different types of freezers and their working. We also intend to classify freezers based on freezing techniques, so that a comparison may be drawn among them. During this process of learning the students realise how to select a type of freezer for a specific head.

Syllabus

Airblast freezers

Contact plate freezers

Spray and Immersion freezers

Other types of freezers

Freezing time and freezer operating temperatures

Curriculum Objectives

- To familiarise with common types of freezers.

Suggested Activities - General discussion with Demonstration and Field visit

Teacher can explain different types of freezers with the help of charts, OHP and models. A trip can be arranged to a nearby freezing plant to familiarise with the structure and operations of different freezers. An assignment will be given to the students based on the field trip. In order to get more ideas about freezers a class seminar may be arranged. Teacher may guide the students to attain the curriculum objectives through discussion and seminar.

Points for Discussion

Discuss about the structure and operation of different types of freezers such as Plate freezers, Air blast freezers, Drum freezers, Immersion freezers, Fluidised bed freezers, Spray freezers and their merits and demerits.

Unit : 8 Freezers

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Familiarise with common types of freezers. 	Structure Operation Freezing time Freezing temperature Refrigerant.	Observation Communication	Field visit Discussion Seminar Assignment	Freezers References	Interest Presentation of seminar Participation in discussion Preparation and Presentation of assignment

UNIT. 9

FREEZING OF SHRIMPS

Introduction

Students have already learned that freezing is one of the methods of fish preservation by lowering the temperature. Likewise the students should get an awareness about the method of freezing of shrimp also. Here an attempt has been made to make the students understand about different steps in freezing of shrimps and its' product styles.

Syllabus

How to make good frozen products

Freezing of shrimps in different styles like whole, HL, PD, PUD, CPD, Block and IQF products.

Curriculum Objectives

- To develop skills in preparing different product styles of prawns.
- To develop skills for the freezing of shrimps.

Suggested Activities - Discussion with the help of Charts, Samples and Video show

Students have previous knowledge in the freezing of fish. Teacher can introduce additional steps involved in freezing of shrimps through a general discussion with the help of a flow chart showing important steps in freezing. Teacher can also depend on visual media in connection with shrimp processing to familiarise the different steps comprehensively. Using flow charts, photographs and video shows discuss with the students about different styles of frozen shrimp products. Based on this students may be asked to evaluate different product styles and prepare a report.

Points for Discussion

- ⊃ Different steps- Raw material preparation, grading, weighing, filling, glazing, freezing, reglazing, packing cold storage and shipment.
- ⊃ Product styles- Whole, HL,PD,PUD,CPD and Fantail.
- ⊃ IQF products and Block frozen prawn products.

Unit : 9 Freezing of Shrimps

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Develop skills in preparing different product style. 	Whole HL PD PUD CPD Block IQF products	Observation Communication	Discussion	Flow charts Samples Visualmedia	Participation Preparation of notes and flow charts.
<ul style="list-style-type: none"> Develop skills for the freezing of shrimp 	Raw material preparation grading, weighing filling, glazing, freezing, re- glazing, packing clod storage	Observation Communication	Field visit Discussion	Shrimp	Interest Participation Field report.

UNIT. 10

COLD STORAGE

Introduction

It is necessary to keep frozen products in cold condition until it is delivered to the consumer. The students should be made aware of the fact that cold store provides such a condition. The students should get the concept and functions of cold store when the completion of unit. They should also acquire the skills to select appropriate type of cold store.

Syllabus

Types of cold store

Curriculum Objectives

- To understand the functions of a cold storage
- To understand different types of cold storage

Suggested Activities - Field Visit and Discussion

Arrange a visit to a cold store and ask the students to note down the various activities taking place there. In addition to this the pupils are asked to draw the diagrammatic representation of the cold store. Charts, models and multimedia tools can be used for introducing different types of cold stores. A general discussion can be conducted based on different types of cold stores and its operations.

Points for Discussion

- ⇒ Principle and concept of cold storage.
- ⇒ Cold store temperature and its fluctuation
- ⇒ Different types of cold storage- Jacketed type, finned type and unit cooler type.

Unit : 10 Cold Store

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Understand the functions of a cold store. 	Principle	Observation Communication Drawings	Field visit Discussion	Charts Models Multimedia	Preparation of notes
<ul style="list-style-type: none"> Understand different types of cold store. 	Jacketed type Finned type Unit cooler type.	Observation Communication	Field visit Discussion	Charts Models Reference	Participation Preparation of notes.

UNIT. 11

STORAGE, TRANSPORT AND DISTRIBUTION

Introduction

The students are familiar with the concept of storage, transport and distribution. This unit helps the students to understand different types of fish storage, live fish transportation and the concept of cold chain.

Syllabus

Chilled storage

Frozen storage

Change in fish muscle during frozen storage

Curriculum Objectives

- To understand the chilled storage and frozen storage
- To understand fish transportation and distribution
- To understand the changes in fish muscle during freezing and in the cold storage.

Sub Topic- 1 - Storage

Suggested Activities - Field Trip

A field trip can be arranged to a frozen storage and cold storage and asks the students to conduct a comparative study and prepare a report.

Points for discussion

- ⇒ Differentiate chilled storage and frozen storage based on main points like storage temperature, quality of the product, nature of product to be stored etc.

Sub Topic- 2 - Transport and Distribution

Suggested Activities - Group discussion

Using pictures of fish transporting vehicles and video cassettes of fish distribution, conduct a group discussion on different types of fish transport and distribution system. Collect information from each group about locally available fish distribution system.

Points for discussion

⇒ Various types of fish transport systems.

Additional Points - Cold chain

Cold chain is the scientific and systematic distribution of frozen fish in the interior market by refrigerated vans, refrigerated railwagons etc.

Sub Topic- 3 - Changes in Fish muscle during freezing and in the cold storage.

Suggested Activities - Discussion

Discuss the points such as ice crystal formation, shrinkage, driploss, organoleptic changes, freezer burn, texture, protein denaturation, nutritional changes, enzyme denaturation, declining of bacterial load, discolouration.

Unit : 11 Storage, Transport and Distribution

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Understand the chilled storage and frozen storage. 	Storage temperature Quality of the product, Nature of the product to be stored.	Observation Communication Comparison	Field trip Discussion	Reference	Field report. Participation in discussion.
<ul style="list-style-type: none"> Understand fish transportation and distribution. 		Observation Communication	Discussion	Pictures, cassetts and videos of transporting vehicles	Participation in discussion
<ul style="list-style-type: none"> Understand the changes of fish muscle during freezing and in the cold storage. 	Ice crystal formation Shrinkage Drip loss Organoleptic changes Freezer burn Texture Protein denaturation.	Observation Communication	Discussion	References	Participation in discussion

UNIT. 12

LAYOUT OF PROCESSING PLANTS

Introduction

Like any other industry fish processing plants also need proper layout for smooth functioning. This unit introduces various aspects to be considered while preparing a layout for the installation of a processing plant.

Syllabus

Site, building, water supply, equipments and clothing

Curriculum Objectives

- To get an awareness about the minimum infrastructural facilities required for a fish processing plant.

Suggested Activities

Students have already visited fish processing plants. Hence a discussion can be conducted about minimum infrastructural facilities by using a standard layout of a processing plant.

Points for discussion

- ⇒ Mention 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, toilet facilities, laboratory etc.

Unit : 12 Layout of Processing Plants

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Understand minimum infrastructural facilities required for a processing plant. 	Chute, raw material receiving room, chill room, processing hall, processing table and utensils. freezers, cold store, Water supply and electricity.	Communication	Discussion	Reference	Participation in discussion

UNIT. 13

FACTORY HYGIENE AND SANITATION

Introduction

The students have learned the role of microbes in fish spoilage and the importance of proper hygiene and sanitation to prevent microbial contamination in sea food. They have also got a general idea about the need for hygiene and sanitation for healthy environment. This chapter aims to make them understand how proper hygiene and sanitation can be acquired.

Syllabus

Building, equipment and staff sanitation

Maintenance of Quality control

Curriculum Objectives

- To understand the details about factory hygiene and sanitation.
- To understand the significance of sanitation in sea food industry.
- To develop skills to maintain personal hygiene and sanitation.
- To apply the acquired knowledge in new situations.

Suggested Activities - Discussion

A discussion can be conducted about factory sanitation and personal hygiene based on their previous knowledge acquired from the visit at the processing plant.

Points for discussion

- ⇒ Mention about the significance of sanitation on consumer's point of view, public health, microbiology and product quality.
- ⇒ The concentration of chlorine to be used at different stages of sanitation.
- ⇒ Sanitation practices such as personnel hygiene, sanitation of utensils and equipments, building sanitation, ventilation, fumigation, maintenance of proper drainage, pest control, toilet facilities, medical check up on workers and waste disposal.

Additional Points - Chlorination of Water

Processing water	-	5 ppm
Floor washing	-	100 ppm
Hand dip	-	20 ppm
Foot dip	-	100 ppm
Processing table and Utensils	-	50 ppm
Glaze water	-	Below 2 ppm

Unit : 13 Factory Hygiene and Sanitation

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Understand the details about factory hygiene and sanitation. 	Prevention of Microbial contamination	Communication	Discussion	Reference	Participation in discussion
<ul style="list-style-type: none"> Understand the significance of sanitation in seafood industry. 	Product quality, public health	Communication	Discussion	Reference	Participation in discussion
<ul style="list-style-type: none"> Develop skills to maintain personal hygiene and sanitation 	Hygienic practices.	Communication	Discussion	Chlorinated water.	Participation in discussion
<ul style="list-style-type: none"> Apply the acquired knowledge in new situations 					

UNIT. 14

MODERN PACKING METHODS

Introduction

A product should be supplied to the consumer in the most appropriate form. For this, packaging is an essential thing. Packaging methods conserve and preserve all the qualities of the product in good condition. In this unit an attempt has been made to make the students understand the concept of packing, its importance, types of packaging materials and modern trends in packaging.

Syllabus

Choice of packing materials

Types of modern packaging

Curriculum Objectives

- To understand the concept of packing and its importance
- To familiarise with different types of packaging materials.
- To understand recent trends in packaging.
- To apply the knowledge in new situations.
- To develop skills for identifying and applying different types of packing materials.

Suggested Activities - Collection and Debate

Ask the students to collect different types of packaging materials used for packing fishery products. Conduct debates on merits and demerits of different types of packaging materials. Teacher may consolidate important points of debate such as suitable packaging materials for each fishery product, which product can be packed in a particular packing material and recent trends in packing.

Points for discussion

- ⇒ The concept of packing and its importance in sea food.
- ⇒ Mention different packing materials - Metals, glass, wood, paper, paper boards, corrugated fibre boards and plastics (HDPE, LDPE)
- ⇒ Mention about recent trends in packing- PCB, cellophane, MLF, modified atmospheric packing, vacuum packing and retortable pouch.

Unit : 14 Modern Packing Methods

Curriculum Objectives	Ideas/ Concepts	Process Skill	Activities	Materials	Evaluation
<ul style="list-style-type: none"> Understand the concept of packing and its importance. Familiarise with different types of packing materials. 	Metals, glass, wood, paper, paper boards, corrugated fibre boards and plastics.	Collection Communication Observation	Collection Debate	Packing materials Reference	Interest in collection Participation in debates
<ul style="list-style-type: none"> Understand recent trends in packaging 	PCB, Laminates, Cellophane, MLF, Modified atmospheric packaging Vacuum packing	Observation Comparison	Collection Debate Discussion	Packing material Reference	Interest in collection Participation
<ul style="list-style-type: none"> Apply the knowledge in new situations Develop skills for identifying and applying different types of packing material. 					

SAMPLE QUESTIONS

1. A doctor asked the parents of a child, who has the deficiency of protein, to give more fish. Can you explain why?
2. A doctor prescribed shark liver oil to a patient, who has a deficiency disease. Can you say what are the possible deficiencies that patient may have and why did the doctor prescribe shark liver oil?
3. How can you help a customer to separate fresh fish from spoiled one?
4. Oil which is kept in an open bottle for a few days produces foul smell. Why?
5. The bacterial load of fish kept in cold condition is lower than that of ambient temperature. What is your explanation?
6. The buyer of an industry regularly complains that the raw materials he received from the supplier is highly contaminated. Can you help the fisherman and the supplier to provide good quality raw material.
7. A tourist party, who consume a canned fish product, affected by food poisoning. Which are the symptoms you observe in them? Can you infer which bacteria caused it?
8. Suppose you have visited a peeling shed. You noticed that the workers are using tap water for sanitation purpose. What are your suggestions?
9. Match the following

A

Plate freezer
Air blast freezer
Spray freezer
Cryogenic freezer

B

Liquid nitrogen
Freon- 12
Cooled air
Super cooled brine

10.

	Pelagic/Demersal	Fatty/Semifatty/Lean
Oil sardine	_____	Fatty
Ribbon fish	_____	_____
Shark	_____	_____
Seer	_____	_____
Carangids	Demersal	_____
Silver belly	_____	_____

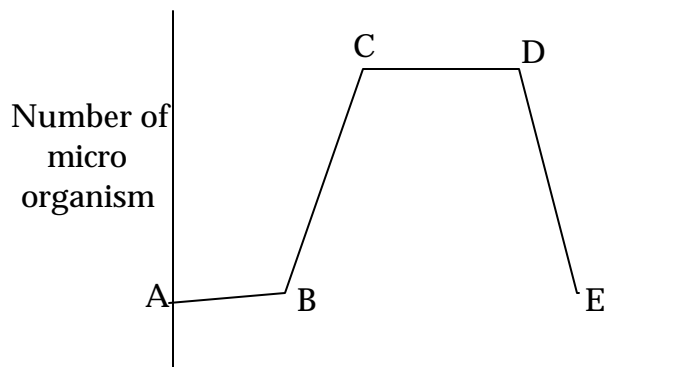
11. Separate the character of an elasmobranch from the following.

- a. Bony skeleton
- b. Placoid scales
- c. Four pairs of gills
- d. Cartilagenous skeleton
- e. Heterocercal caudal fin
- f. Cycloid scale
- g. Ventral mouth

12. Rancidity is _____ (Self digestion, death stiffness, oxidation of fat)

13. Suppose a processor bought heavily feeded fishes from the landing center. Does he take any precautions. Why?

14.



The graph shows the growth of bacteria. Complete the following.

- AB - _____
- CD - Stationary phase
- BC - _____
- DE - _____
- X axis - _____

15. A boat man kept a part of his catch in ice and the remaining part without ice. During the auction the iced fish fetch more price than the other. What is your explanation for it?
16. On analysis of a frozen product, large ice crystals are found. Can you evaluate the quality, duration of freezing, temperature and type of freezing technique employed?

SUGGESTED TOPICS FOR ASSIGNMENT

Prepare one Assignment in each term

Topics for First term

- Fishery resources of a nearby fish landing centre.
- Fishing methods employed in your area.
- Importance of fish in human diet.

Topics for Second term

- Food poisoning through fish and fishery products.
- Problems faced by a pre- processing centre/ peeling shed.
- Different product styles of fish/ shrimps/cephalopods etc.

Topics for Third term

- Various types of cold storage.
- Transportation and distribution of fresh fish in and around your area.
- Different types of packaging materials for fish and fishery products.
- Hygiene and sanitation practised in a hospital in your locality.
- Different types of containers used for the storage and transportation of fish and fishery products in your area.

SUGGESTED TOPICS FOR SEMINAR

Conduct only one seminar in a year. For this the whole class is divided in to 4 - 5 groups. Each group should be given different topic for seminar. Each group prepares one seminar topic. One representative from each group presents their topic and as a result all students share all the topics.

- Problems faced by traditional fishermen to keep the fish in fresh condition.
- Constraints faced by freezing plants to ensure quality.
- Quality problems in iced fish storage.
- 'Chakara' - a bloom to fisher folk.
- Impact of 'Trawl Ban' -

SUGGESTED TOPICS FOR PROJECTS

Conduct only one project in a year

- Analyse the content of moisture present in different fish species.
- Landings of economically important species of fishes, prawns and cephalopods within 5 Kms of nearby coastal area.
- T. P. C. of gills, intestine and flesh of three different species of fish.
- T. P. C. of same species of fish collected from different centres (Market, local landing centres and harbours)
- Requirements on to start a pre- processing plant.



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