



Department of Empowerment of Persons with Disabilities (Divyangjan)  
Ministry of Social Justice & Empowerment



वीद्यया शतमृणय साक्षात्प्रगतिरिति



सत्यमेव जयते  
GOVERNMENT OF INDIA  
MINISTRY OF SKILL DEVELOPMENT  
& ENTREPRENEURSHIP



REIMAGINE FUTURE



Food Industry Capacity and Skill Initiative



Skill Council for Persons with Disability

# Participant Handbook

Sector  
**Food Processing**

Sub-Sector  
**Fruits and Vegetables**

Occupation  
**Processing**

Reference ID: FIC/Q0103, Version 1.0

SCPwD Reference ID: PWD/FIC/Q0103, Version 1.0

**NSQF Level-4**



## Jam, Jelly and Ketchup Processing Technician

### (Divyangjan)

for Locomotor Disability  
for Speech and Hearing Impairment

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**Note: SCPwD**

SCPwD has borrowed the qualification of Jam, Jelly and Ketchup Technician from FICSI which is approved by NCVET in the 14th meeting of NSQC on 30th December 2020 (Link of MOM <https://ncvet.gov.in/sites/default/files/MoM%20of%2014th%20NSQC.pdf> pdf And uploaded on NQR [WWW.nqr.gov.in](http://WWW.nqr.gov.in) The book caters to the job role aligned to the following disabilities as per the NQR codes mentioned below.  
For LD- 2021/PWD/SCPWD/04881  
For SHI- 2021/PWD/SCPWD/04882



**Shri Narendra Modi**  
Prime Minister of India

“ Skilling is building a better India.  
If we have to move India towards  
development then Skill Development  
should be our mission. ”



## Certificate

### COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

**Skill Council for Persons with Disability**

for


**SKILLING CONTENT: PARTICIPANT HANDBOOK**

Complying to National Occupational Standards of

Job Role/ Qualification Pack: Jam, Jelly and Ketchup Processing Technician (Divyangjan)  
QP. No. PWD/FIC/Q0103, NSQF LEVEL 4

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## About this book

In India, the food sector has emerged as a high growth and high profit sector. Food and grocery account for about 31% of India's consumption basket. The Indian food and grocery market is the world's sixth largest. A jam, jelly and ketchup processing technician has huge employment opportunities.

This Participant Handbook is designed to enable theoretical and practical training to become a jam, jelly and ketchup processing technician. The qualification pack of a jam, jelly and ketchup processing technician includes the following National Occupation Standards which have been all covered in this Participant Handbook

1. Prepare and maintain work area and process machineries for jam, jelly and ketchup processing
2. Prepare for production of jam, jelly and ketchup
3. Produce jam, jelly and ketchup
4. Complete documentation and record keeping related to production of jam, jelly and ketchup.
5. Food safety, hygiene and sanitation for processing food products

This Participant Handbook is designed considering the minimum education qualification of a Jam Jelly and Ketchup processing technician is preferably 8th standard. The Key Learning Objectives and the skills gained by the participant are defined in their respective units. The participant will be able to produce Jam Jelly and Ketchup in fruit processing units. He will also be able to follow food safety practices, hygiene and sanitation for processing food products. We hope that this Participant Handbook will be able to provide a sound learning support to our young friends to aspire to build their career in the food processing sector

## Symbols Used



Key Learning  
Outcomes



Steps



Time



Tips



Notes



Unit  
Objectives









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# 1. Introduction

- Unit 1.1 - Overview of the Food Processing Industry
- Unit 1.2 - Fruit and Vegetable Processing
- Unit 1.3 - Overview of Jam, Jelly, and Ketchup
- Unit 1.4 - Jam, Jelly, and Ketchup Processing Processes
- Unit 1.5 - Roles and Responsibilities of Jam, Jelly, and Ketchup Processing Technician



## Key Learning Outcomes

**At the end of this module you will be able to:**

1. Describe the fruit and vegetable processing industry
2. State the drivers of the Fruit and vegetable processing industry
3. Explain the various roles and functions within a fruit and vegetable processing industry
4. State expectations of others from personnel in a fruit and vegetable industry
5. Explain the skills, attitudes and behaviour required for progression in the industry
6. Explain how one can acquire capabilities required to progress in the industry

## Symbols Used



Key Learning Outcomes



Steps



Time



Tips



Notes



Unit Objectives

## UNIT 1.1: Overview of the Food Processing Industry

### Unit Objectives

At the end of the session, you will be able to:

- List the various sectors of food processing industry;
- Define food processing

### Unit 1.1.1: Food Processing

Agriculture is the backbone of the Indian economy. The produce from various agriculture-based occupations are primarily used for consumption within the country. It is exported to different parts of the world as well. Agricultural produce is also used as raw material in the food processing industry.

Food processing is the method used to convert raw materials into food products. They could be processed foods, ready-to-eat foods, food additives or foods used to prepare other food products. Besides food processing, the food industry also relies on food preservation as an important method to store food products for longer periods of time.

The food processing industry in India is divided into several sub-sectors. They are:

**Table 1.1**

Sub-Sectors	Produce
Dairy	Whole milk powder, skimmed milk powder, condensed milk, ice-cream, butter and ghee, cheese, etc.
Fruit and vegetable processing	Beverages, juices, concentrates, pulps, slices, frozen and dehydrated products, potato wafers, pickles, etc.
Grains and cereals	Flour, bakeries, starch glucose, cornflakes, malted foods, vermicelli, beer and malt extracts, grain-based alcohol, etc.
Fisheries	Fish oil, frozen and canned products
Meat and poultry processing	Frozen and packed meat, egg powder, etc.
Bread and bakery	Biscuits, breads, buns, cakes, confectionery, pastries, cookies, etc.
Consumer foods	Snack foods, <i>namkeen</i> , biscuits, ready-to-eat foods, alcoholic and non-alcoholic beverages

## Unit 1.1.1: Food Processing

### Dairy Industry

Whole milk powder, skimmed milk powder, condensed milk, ice-cream, butter and ghee, cheese, etc.

Fig 1.1



## Unit 1.1.1: Food Processing

### Fruit and Vegetable Processing Industry

Beverages, juices, Jam, Jelly, concentrates, pulps, slices, frozen and dehydrated products, wafers, pickles, etc.

Fig 1.2



### Grains & Cereal Processing Industry

Flour, baked item, starch, glucose, cornflakes, malted foods, vermicelli, beer and malt extracts, grain-based alcohol, etc.

Fig 1.3



## Unit 1.1.1: Food Processing

Fig 1.4



### Fisheries

Fish oil, frozen and canned products, fish pickle, fillates etc.

Fig 1.5



### Meat and Poultry Processing Industry

Frozen and packed meat, meat and meat product, egg powder, etc.

Fig 1.6



## Unit 1.1.1: Food Processing

### Bread and Bakery Industry

Biscuits, breads, buns, cakes, confectionery, pastries, cookies, etc.

Fig 1.7



### Consumer Foods

Snack foods, namkeen, biscuits, ready-to-eat foods, alcoholic and non-alcoholic beverages, etc.

Fig 1.8



### Soya Foods

Soya nuggets, Soya milk, Tofu, Soya based beverages etc.

Fig 1.9



## Unit 1.1.1: Food Processing

### Packaged Snacks

Pre-mixes, RTE foods, Savories, Crispies, Frymes, Namkeens, Papads etc.

Fig 1.10

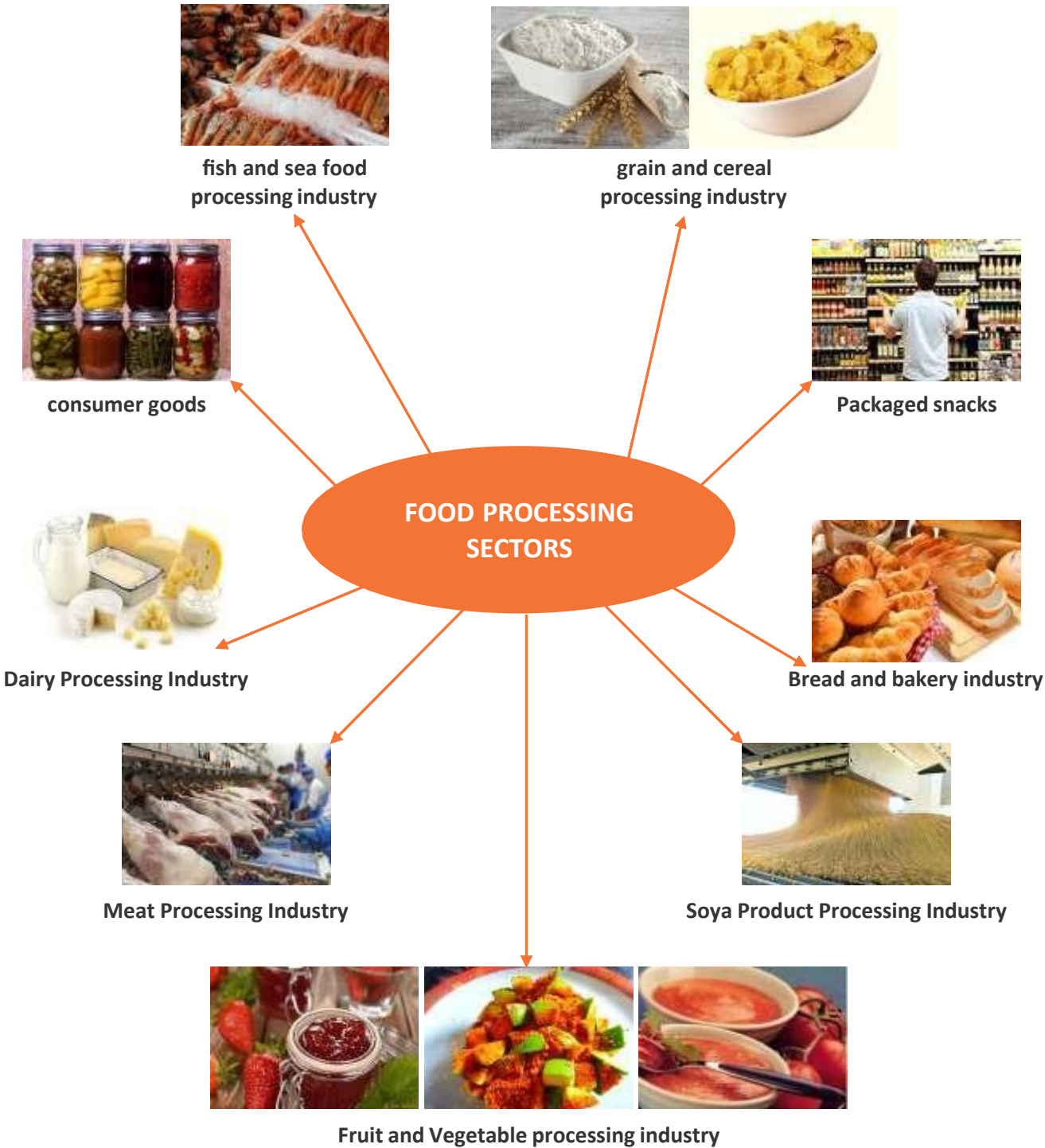




# Unit 1.1.1: Food Processing

## Various sub-sector in Food Processing Industry

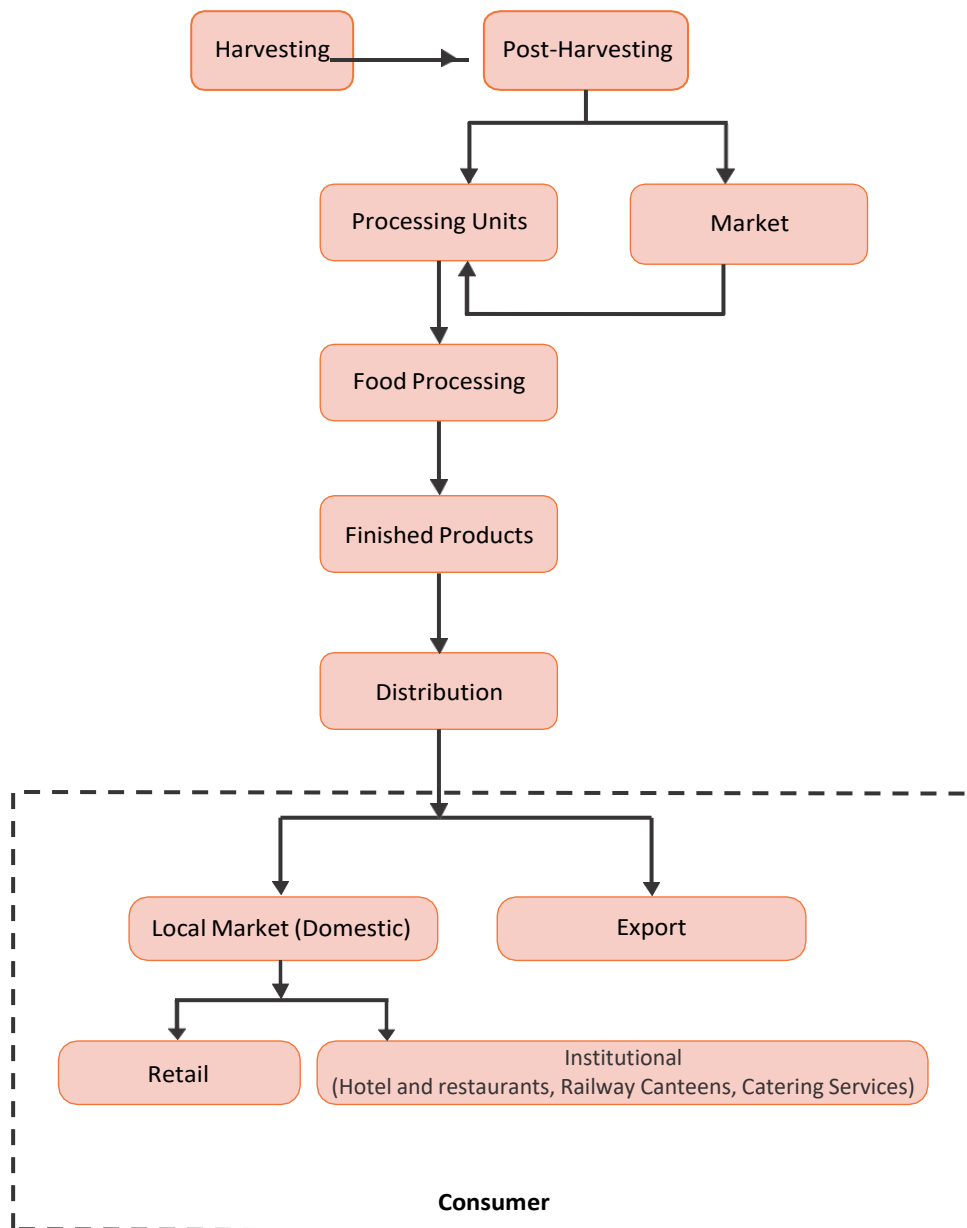
Fig 1.11



## Unit 1.1.2: Journey of Food from Harvest to Consumer

The following chart explains the journey harvested food undertakes to reach the consumer. The chart also shows the different types of consumers in the domestic and international market.

Fig 1.12



## UNIT 1.2: Fruit and Vegetable Processing

### Unit Objectives

**At the end of the session, you will be able to:**

- State the need for fruit and vegetable processing;
- State the common methods of fruit and vegetable processing.

### Unit 1.2.1: Overview of the Fruit and Vegetable Sub-Sector

India is the second largest producer of fruits & vegetables in the world with an annual production of around 94 million tonnes. It has the distinction of producing almost all-tropical and exotic fruits and vegetables because of varied climatic conditions. Due to the short shelf life of these crops, as much as 30-35% of fruits and vegetables perish during harvest, storage, grading, transport, packaging and distribution. Only 2% of these crops are processed into value-added products. Hence, there is a need for maximum commercial utilisation of fruits and vegetables and to adapt production and marketing activities to the requirements of the world market and to cater to domestic demand which, over the past few years, has been increasing because of various socio-economic factors. If the nutritive value of the processed food products could be maintained, this sector will emerge as a major value-added food industry.

The extent of processing of fruits and vegetables varies from one country to another. The fruit and vegetable processing sub-sector deals with processed foods, semi-processed foods, and packaged foods that are made from fruits and vegetables. Fruits and vegetables are processed into a variety of products such as

- Juices
- Jellies
- Pulps
- Concentrated foods
- Frozen foods
- Wafers
- Pickles
- Jams

## Unit 1.2.1: Overview of the Fruit and Vegetable Sub-Sector

There are certain parameters that are important to consider when selecting a fruit/vegetable for processing. They are:

- Demand for processed food made from that vegetable/fruit
- High quality produce
- Continuous supply
- Huge supply in case of seasonal fruits/vegetables

These parameters are important to ensure that raw materials withstand the processing and preservation process.

### Processing Units

Presently there are approximately over 5200 units registered under the Fruit Product Order of 1955 distributed all over the country. Most of the units fall in the cottage and /or small-scale sector. A few modern processing plants have, now come up. The yearwise rise in number of Fruits and Vegetables processor's in India is given in Annexure 2. The segment has witnessed total investments to the tune of Rs. 75 billion in the last six years. The installed capacity of fruits and vegetable processing industry increased from 11.08 lakh tonnes in Dec.93 to 21 lakh tonnes at the end of the year 1999. But capacity utilisation continues to remain low at 45 50%. Production of processed fruits and vegetables was 940,000 tonnes in 1999, a 3.3% growth over the previous years.

### Methods of Processing Fruits and Vegetables

Some common methods of processing fruits and vegetables are:

- Drying
- Concentration
- Heating
- Fermentation
- Sterilization
- Pasteurization
- Blanching
- Canning

## UNIT 1.3: Overview of Jam, Jelly, and Ketchup

### Unit Objectives

At the end of the session, you will be able to:

- Define jam, jelly, and ketchup;
- List the differences between jelly and jam.

### Unit 1.3.1: Introduction of Jam, Jellies, and Ketchup

Jam, jellies, and ketchups have been made from fruits and vegetables in different forms. The method of production has been conventional in many homes. Since availability of fruits and vegetables is seasonal, the need to preserve them in various ways for consumption during off-season arose. Fruit and vegetable processing techniques have evolved over the years to make jam, jelly, and ketchup to the present day refined version.

Jam, jellies, pickles, and sauces are in demand in following three major sectors:

- Army and defence: one third production consumed and important sector
- Hotel, catering services and airlines: Institutional sector
- Civilians: It was limited earlier, but is now gaining momentum due to rapid urbanization, rise in standard of living, and need for convenient food products.

### Unit 1.3.2: Jam and Jelly

Most kinds of fruit and some vegetables are used to make a wide variety of jam and jelly. Jelly and jam is used as bread spread and as a filling for some cakes and cookies.

Jam is boiled fruit pulp with sugar and preservatives and is thick. Fruit jam is available in mango, apple, mixed fruit, pineapple, orange, and combination of the above mentioned flavours.

Jelly is a clear, bright mixture made from fruit juice, sugar, and sometimes pectin. It is made by boiling, but is clear, sparkling, and transparent.

Jelly and jam have differences, which are:

Jelly	Jam
<ul style="list-style-type: none"> <li>• It is made from clear juice of fruit</li> <li>• It is clear, sparkling, and transparent</li> <li>• It is uniformly mixed product</li> <li>• Examples : Jamun, apple, jack fruit, strawberry</li> </ul>	<ul style="list-style-type: none"> <li>• It is made with suspended fruit particles in processed pulp</li> <li>• It is indistinct and translucent</li> <li>• It is a scantily mixed product</li> <li>• Examples: Peach, pear, cherry, mango, plum</li> </ul>

Ketchups are popular varieties of sauces made from tomato puree. It is also a important type of preserve that is popularly consumed as table serve.

### Unit 1.3.3: Fruit and Vegetable Industry at a Glance

Fig 1.13



## UNIT 1.4: Jam, Jelly, and Ketchup Processing Processes

### Unit Objectives

At the end of the session, you will be able to:

- Describe the processing of Jam
- Describe the processing of Jelly
- Describe the processing of Ketchup

### Unit 1.4.1: Terminology Used in Process

- TSS (Total Soluble Solids): It is the extracted mass of fruit, which contains fibres and fruit sugar.
- Refractometer: It is a tool used for measuring TSS.
- pH indicator: A numeric scale to check acid levels in pulp/juice. It is between 2.5 to 4.

### Unit 1.4.2: Jam

Jam is a product made by boiling fruit pulp with sufficient sugar to a reasonably thick consistency, firm enough to hold the fruit tissues in position, Apple, pear, sapota (chiku), apricot, loquat, peach, papaya, karonda, carrot, plum, straw- berry, raspberry, mango, tomato, grapes and muskmelon are used for preparation of jams. It can be prepared from one kind of fruit or from' two or more kinds. Commercial jams such as tutti-frutti can be prepared from pieces of fruit, fruit scraping and pulp adhering to cores of fruits which are available in plenty in canning factories. Jam contains 0.5-0.6 per cent acid and invert sugar should not be more than 40 per cent.

Fig 1.14

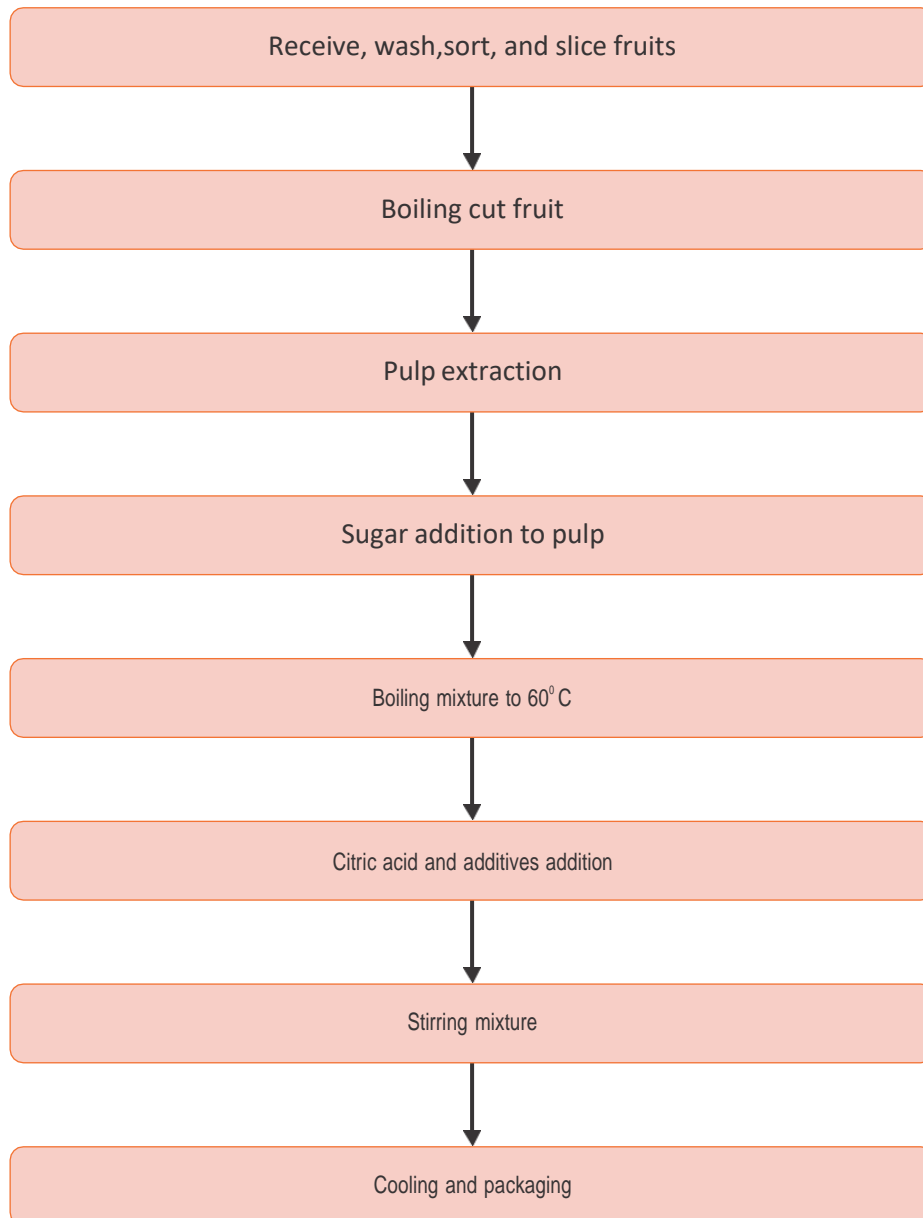


## Unit 1.4.2: Jam

### Overview of Processing Process

1. Jam processing process is as follows:

Fig 1.15





### Unit 1.4.3: Jelly

Fig 1.16



A jelly is a semi-solid product prepared by boiling a clear, strained solution of pectin containing fruit extract, free from pulp, after the addition of sugar and acid. A perfect jelly should be transparent, well-set, but not too stiff, and should have the original flavour of the fruit. It should be of attractive colour and keep its shape when removed from the mould. It should be firm enough 'to retain a sharp edge but tender enough to quiver when pressed. It should not be gummy, sticky or syrupy or have crystallized sugar. The product should be free from dullness, with little or no syneresis (weeping), and neither tough nor rubbery.

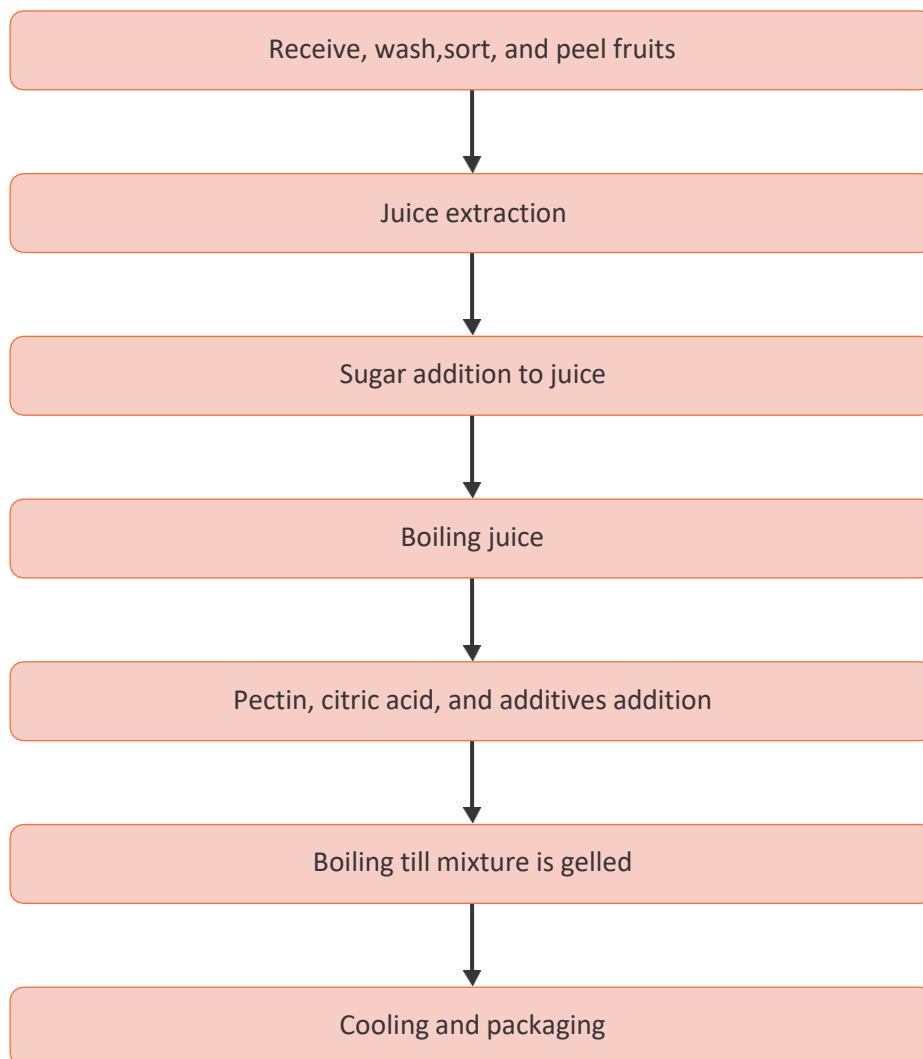
**According to their pectin and acid contents:**

1. Rich in pectin and acid: Sour and crab apple, grape, sour guavas, lemon, oranges (sour), plum (sour), jamun.
2. Rich in pectin but low in acid: Apple (low acid varieties), unripe banana, sour cherry, fig (unripe), pear, ripe guava, peel of orange and grapefruit.
3. Low in pectin but rich in acid: Apricot (sour), sweet cherry, sour peach, pineapple and strawberry.
4. Low in pectin and acid: Ripe apricot, peach (ripe), pomegranate, rasp berry, strawberry and any other over-ripe fruit.

### Unit 1.4.3: JELLY

Jelly processing process is as follows:

Fig 1.17

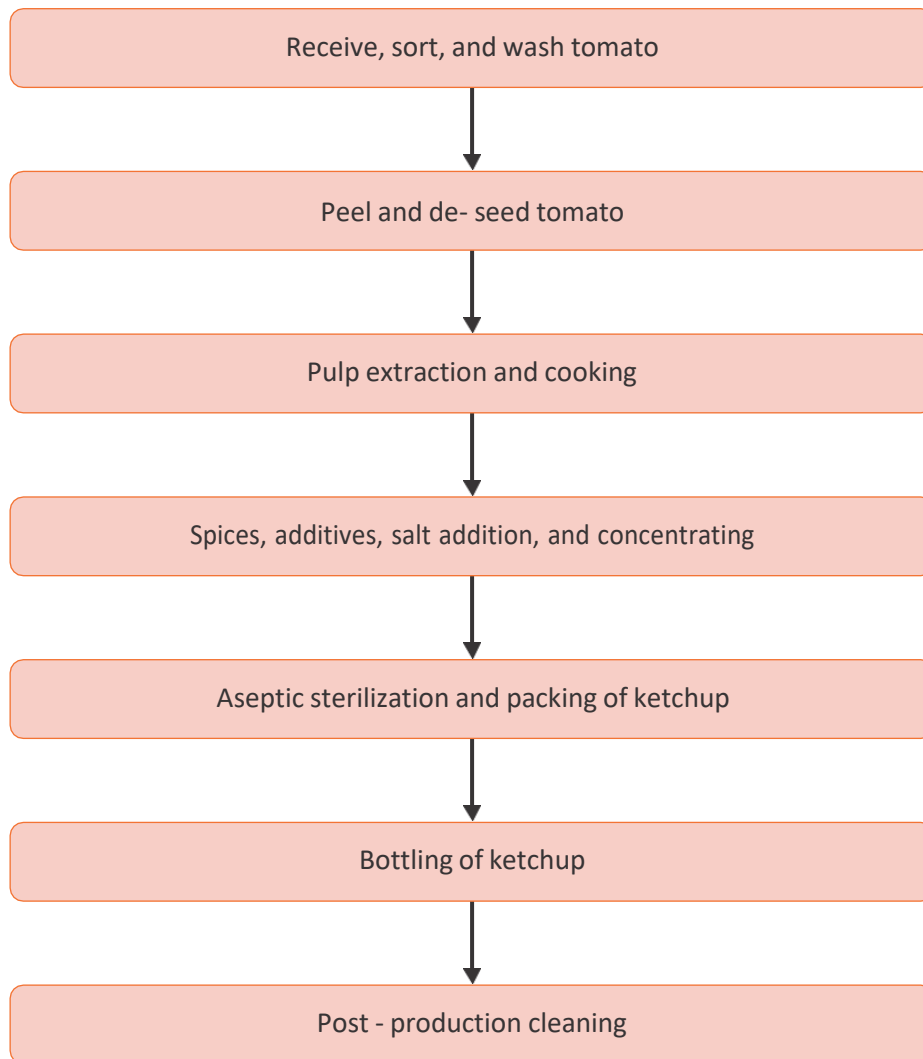


## Unit 1.4.4: Ketchup

It is made from strained tomato juice or pulp and spices, salt, sugar and vinegar, with or without onion and garlic, and contains not less than 12 per cent tomato solids and 25 per cent total solids

Ketchup processing process is as follows:

**Fig 1.18**



**Fig 1.19**



## UNIT 1.5: Roles and Responsibilities of Jam, Jelly, and Ketchup Processing Technician

### Unit Objectives

At the end of the session, you will be able to:

- State the roles and responsibilities of a Jam, Jelly, and Ketchup processing technician.

Table 1.2

### Unit 1.5.1: Roles and Responsibilities

The roles and responsibilities of a jam, jelly, and ketchup processing technician are:

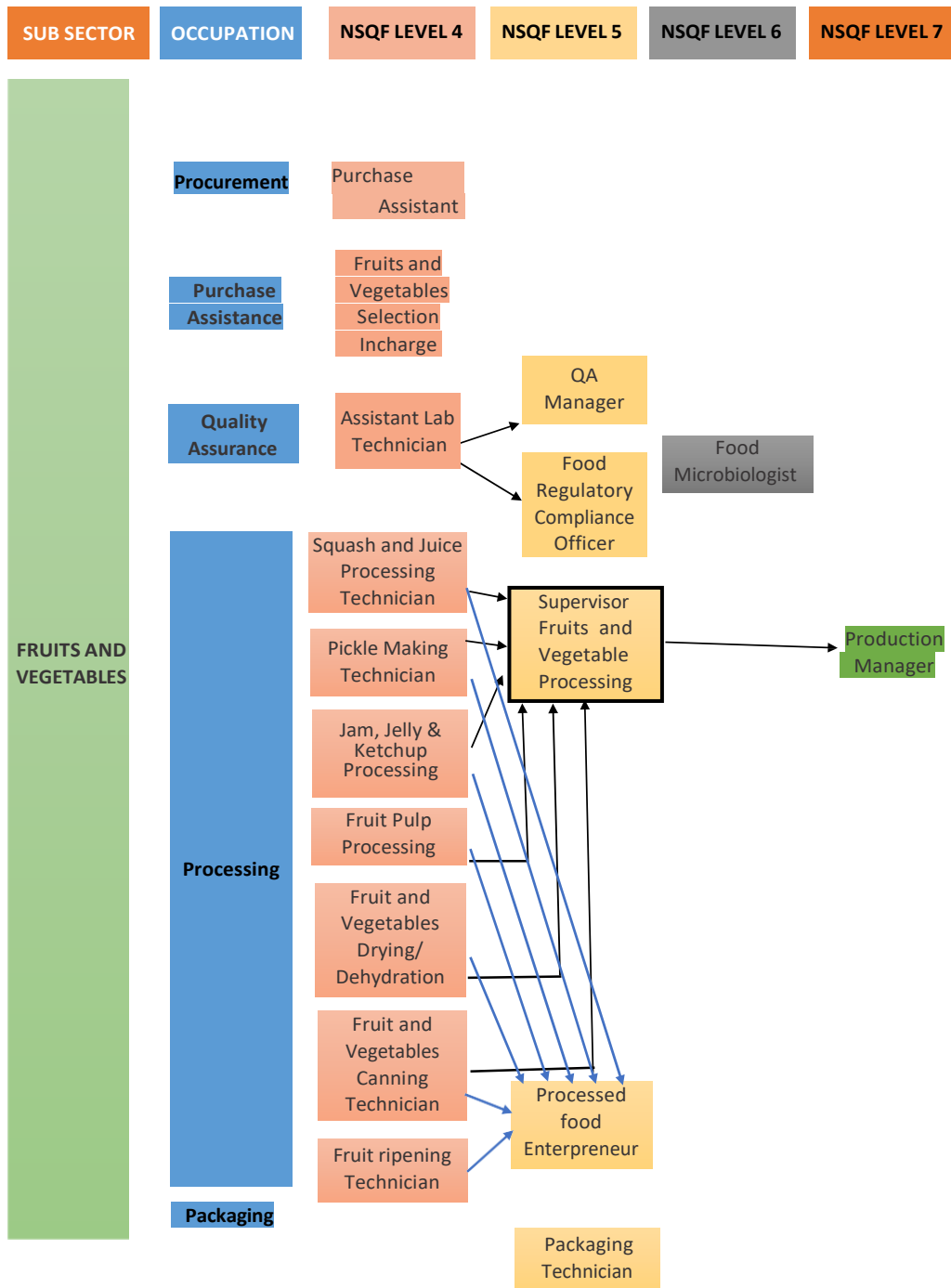
Roles	Responsibilities
Handle raw material from post-harvest storage to the process line	Check raw material for quality
	Ensure fruits and vegetables are free from dirt, debris, foreign matter, glass, and insects
Record-keeping and documentation	Ensure minimum loss of raw material
	Document and maintain records of raw materials
	Document and maintain records of production schedule and process
Hygiene and sanitation maintenance	Document and maintain records of finished products
	Adopt safety- and sanitation-related measures
Inspect machines and troubleshoot issues	Follow food safety norms and practices
	Ensure smooth operation of machinery to complete production line
	Optimize the use of machinery
	Attend to minor repairs of tools and machinery when required
	Ensure that safety rules and regulations are observed
Plan and execute pulping process	Prevent accidents
	Escalate issues to the supervisor when required
	Examine products at different stages of fruit pulping
Inspect intermediate as well as finished	Adhere to Good Manufacturing Practice (GMP)
	Ensure the products meet the quality standards set by the organization
Follow storage and packaging norms	Check fruits' ripening quality, intermittent and finished products for quantity, quality, and salt equilibrium
	Ensure conformance of quality as per organizational standards
	Ensure safe and proper storage of raw material, packing material, and finished goods

Fig 1.20

NSQF Level ↑	Procurement	Quality Assurance	Fruits & Vegetables										Packaging
			Grading & Sorting	Fruit Pulp Processing Technician	Jam, Jelly and Ketchup Processing Technician	Squash and Juice Processing Technician	Fruits & Vegetables Canning Technician	Fruit & vegetable Drying/ Dehydrati on Technician	Pickle Making Technician	Fruit Ripening Technician	Modified atmosphere Technician and Cold Storage Technician	Cold Storage Technician	
Occupations →													
10													
9													
8	Head of Procurement	Head of Quality Assurance											
7	Manager/Asst Manager - Procurement	Manager											
6	1. Purchase Executive 2. Store Executive	1. Quality Assurance Manager 2. Food Microbiologist											Packaging Line In-charge / Packaging Line Supervisor / Packaging Technician
5	Purchase Supervisor/ Purchase In charge	Lab Technician		1. Supervisor 2. Primary Packaging Technician	1. Supervisor 2. Primary Packaging Technician	1. Supervisor 2. Primary Packaging Technician	1. Supervisor 2. Primary Packaging Technician	1. Supervisor 2. Primary Packaging Technician	1. Supervisor 2. Primary Packaging Technician	1. Supervisor 2. Primary Packaging Technician	1. Supervisor 2. Primary Packaging Technician	1. Supervisor 2. Primary Packaging Technician	1. Primary Packaging Technician 2. Secondary / Tertiary Packaging Technician
4	1. Purchase Asst 2. Store In Charge 3. Cold Storage Technician	Assistant lab technician		1. Fruit Ripening Technician 2. Fruit Pulp Processing Technician 3. Asst Primary Packaging Technician	1. Jam, Jelly and Ketchup Processing Technician 2. Asst Primary Packaging Technician	1. Squash & Juice Processing Technician 2. Asst. Primary Packaging Technician	1. Fruit and Vegetables Canning Technician 2. Asst Primary Packaging Technician	1. Fruit & Vegetables Drying/ Dehydration Technician	1. Pickle Making Technician 2. Asst Primary Packaging Technician	1. Fruit Ripening Technician 2. Asst. Primary Packaging Technician 3. Cold Storage Technician	1. Asst. Primary Packaging Technician 2. Modified Atmosphere Technician 3. Cold Storage Technician	1. Asst. Primary Packaging Technician 2. Cold Storage Technician	1. Asst Primary Packaging Technician 2. Asst Secondary/ Tertiary Packaging Technician
3	1. Store Asst 2. Forklift Operator		1. Operator - Fruit & Vegetable Washing Machine 2. Operator - Sorting Machines 3. Operator - Grading Machines	1. Operator - Sorting Machines 2. Operator - Fruit & Vegetable Washing Machine 3. Operator - Fruit Coring Machines 4. Operator - Slicing machine 5. Operator - Peeler machine 6. Operator - Deseeding machine 7. Operator - Pulping Machine 8. Operator - Sieving Machine 9. Operator - Juice Extraction Machine 10. Operator - Slicer Machine 11. Operator - Pulping Machine 12. Operator - Fruit Pulp Sieving Machine 13. Operator - Cooking Kettle 14. Operator - Vegetable Washing Machines 15. Operator - Scalding Machine 16. Operator - Filtering Machine 17. Operator - Pasteurizer 18. Operator - Packaging Machine	1. Operator - Fruit & Vegetable Washing Machine 2. Operator - Sorting Machines 3. Operator - Peeling Machines 4. Operator - Fruit Coring Machines 5. Operator - Slicing machine 6. Operator - Deseeding machine 7. Operator - Pulping Machine 8. Operator - Fruit Pulp Sieving Machine 9. Operator - Juice Extraction Machine 10. Operator - Slicer Machine 11. Operator - Pulping Machine 12. Operator - Heat Exchanger 13. Operator - Cooking Kettle 14. Operator - Vegetable Washing Machines 15. Operator - Scalding Machine 16. Operator - Filtering Machine 17. Operator - Pasteurizer 18. Operator - Packaging Machine 19. Operator - Cooling Tunnel	1. Operator - Fruit Washing Machine 2. Operator - Sorting Machines 3. Operator - Peeling Machines 4. Operator - Fruit Coring Machines 5. Operator - Slicing machine 6. Operator - Deseeding machine 7. Operator - Slicing Machine 8. Operator - Pulping Machine 9. Operator - Fruit Pulp Sieving Machine 10. Operator - Juice Extraction Machine 11. Operator - Filtration machine 12. Operator - Cooking Kettle / Syrup Making Machine 13. Operator - Dosing, Blending/ Mixing Machine 14. Operator - Pasteurizer 15. Operator - Packaging Machine 16. Operator - Heat Exchanger	1. Operator - Fruit Washing Machine 2. Operator - Sorting Machines 3. Operator - Grading Machines 4. Operator - Peeling Machines 5. Operator - Slicing machine 6. Operator - Blanching machine 7. Operator - Sulphurizing machine 8. Operator - Slicing machine 9. Operator - Packaging Machine 10. Operator - Oil Topping / Brine Topping Machine	1. Operator - Fruit Washing Machine 2. Operator - Sorting Machines 3. Operator - Peeling Machines 4. Operator - Slicing machine 5. Operator - Deseeding machine 6. Operator - Brine Making machine 7. Operator - Desalinator 8. Operator - Pickle Blending Machine 9. Operator - Packaging Machine 10. Operator - Oil Topping / Brine Topping Machine	1. Operator - Sorting Machines 2. Operator - Grading Machines 3. Operator - Packaging Machine 4. Forklift Operator	1. Operator - Sorting Machines 2. Operator - Grading Machines 3. Operator - Packaging Machine 4. Forklift Operator	1. Operator - Sorting Machines 2. Operator - Grading Machines 3. Operator - Packaging Machine 4. Forklift Operator	1. Operator - Primary Packaging Machine 2. Operator - Secondary & Tertiary Packaging Machine	
2	Helper	Lab Helper	Helper			Packing Machine Worker							
1													

## Work Progression

Fig 1.21



## Exercise



**Q1. Name the subsectors in which the below mentioned products are manufactured**

Sub-Sectors	Products
	Frozen meat, egg products
	Flour starch, cornflakes, malted food etc.
	Beveages, jucies, pulp, jam, slices
	Biscuit, bun, bread, cookies
	Fish oil, frozen and canned products
	Butter, ghee, cheese, milk powder

**Q2. Mention the description of the following products**

Products	Description
Jam	
Ketchup	

**Q 3) What is food processing?**

**Q 4) What are different subsectors of food processing?**

**Q 5) What are the important steps of food chain from production to consumer?**

**Q 6) Why is it important to process food**

- a. To increase its shelf life
- b. To increase the income of farm sector
- c. To increase the accessibility of consumers
- d. All of the above

**Q 7) Is cattle rearing a part of food processing industry (yes or no)**

**Q 8) Enlist different roles and responsibilities of Jam Jelly and Ketchup processing technician**

Notes



A large rectangular area enclosed by an orange border, containing 25 horizontal lines for writing notes.



Notes



A large rectangular area with a thin orange border, containing 25 horizontal lines for writing notes.





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Transforming the skill landscape



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## 2. Prepare and Maintain Work Area and Machinery

Unit 2.1 - Workplace Ethics

Unit 2.2 - Sanitation and Hygiene

Unit 2.3 - Equipment Used in Jam, Jelly, and Ketchup Processing

Unit 2.4 - Cleaning and Maintenance

Unit 2.5 - Cleaning Processes



**FIC/N0109**

## Key Learning Outcomes

**At the end of this module, you will be able to:**

- State the standard operating procedures in the fruit and vegetable industry
- State the personal hygiene and sanitation guidelines
- State the food safety hygiene standards to follow in a work environment
- Identify the different equipment used in the processing of jams, jellies and ketchup
- State the materials and equipment used in cleaning and maintenance of the work area and machineries
- State the cleaning processes used to clean the work area and process machineries

## UNIT 2.1: Workplace Ethics

### Unit Objectives

At the end of the session, you will be able to:

- State how to conduct yourself at the workplace.

### Unit 2.1.1: How to Conduct Yourself at the Workplace

Workplace ethics are set of guidelines that are followed to ensure smooth and effective functioning of a workplace. Some important ones to remember are:

- Address seniors, assistants, and workers with respect
- Follow the process flow in the manufacturing unit
- Ensure proper execution of the pre-production, production and post-production plan
- Follow food safety norms at all times
- Do not compromise on the quality of the product at any given cost
- Perform your work with complete honesty
- Perform all your roles and responsibilities with integrity
- Teamwork takes you a long way

## How to Conduct Yourself at the Workplace

Fig 2.1

# Personal Hygiene



**Certain bacteria can remain active on our hands for up to three hours. During this time bacteria can spread to everything we touch. This is particularly dangerous in catering environments where germs can multiply on food.**

### WHEN TO WASH YOUR HANDS

Certain bacteria can remain active on our hands for up to three hours. During this time bacteria can be spread to everything we touch. This is particularly dangerous in catering environments where germs can multiply on food.

It is essential that you wash your hands regularly throughout the day and especially at the following times:

1. Before handling or preparing food.
2. Between handling raw foods (eggs, meat, fish, poultry) and touching any other food or kitchen utensils.
3. After handling raw foods such as meat, fish and poultry.
4. After touching rubbish / waste bins.
5. After coughing or sneezing.
6. After touching your nose, ears, teeth or hair.
7. Always make sure you wash your hands after using the toilet. The number of germs on the fingertips doubles after a visit to the toilet!



**Now wash your hands please**


### PERSONAL HYGIENE



Always wear the appropriate head-gear when working with food and never brush or comb your hair. A single hair braid can harbour tens of thousands of germs.

Make sure your clothing is cleaned thoroughly if your clothing should become dirty, change it if possible.

Aprons should always be worn when protective clothing is not available.



Gloves can provide an extra barrier against germs when preparing food.



Remove all jewellery before preparing food. The areas under watches and rings are breeding grounds for germs!



Cover all cuts, burns and sores with a waterproof dressing. These should be blue and where appropriate metal detectable. If such dressings are not readily available, speak to your Health and Safety Manager.



Never work with food if you are ill. This is particularly the case if you are suffering from gastrointestinal problems such as diarrhoea.

Avoid touching your ears, nose, hair and teeth when working with food. We all get itches but if you should touch these areas, be sure to wash your hands afterwards.



Keep nails short and well scrubbed. Do not wear nail varnish or false nails as these can easily contaminate food.

Never cough, spit, sneeze or smoke near food if you do cough or sneeze into your hands, be sure to wash them thoroughly afterwards.



**No smoking**



Do not smoke in areas where food is prepared and stored.



**Wash your hands after every cough**

### HOW TO WASH YOUR HANDS

It is surprising how many do not know how to wash their hands properly. Rinsing the fingertips under a cold tap is simply not adequate. In order to ensure that your hands are thoroughly cleansed when washing them, follow these simple guidelines:



1. Use warm water.
2. Remove any rings and jewellery.
3. Wet the hands thoroughly.
4. Apply soap.
5. Rub the palms together vigorously for at least 15 seconds.
6. Rub the fingers, thumbs and wrists.
7. Pay particular attention when washing the areas between the thumb and fingers.
8. Rinse until all traces of soap have been washed away.
9. Dry thoroughly with a clean paper towel or electric hand dryer. These methods are preferable to using a towel as it can be a breeding ground for germs.



**It is essential that you dry your hands thoroughly after washing. Remember that germs spread 100 times more easily from damp hands.**

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## UNIT 2.2 Sanitation and Hygiene

### Unit Objectives

**At the end of this module, you will be able to:**

- State the personal hygiene and sanitation guidelines to follow in a work environment;
- State the food safety hygiene standards to follow in a work environment.

### Unit 2.2.1: Personal Sanitation

Sanitation and hygiene are the most important aspects to take care of when working in the food processing industry. Some important personal hygiene practices that must be followed are:

- Maintain a high standard of personal cleanliness viz. have a bath every day and wear clean clothes to work
- Wear Personal Protective Equipment (PPE) such as aprons, mouth mask, head cover, face mask, hand gloves, gum boots, and beard cover mask at all times during work hours
- Always keep your finger nails trimmed
- Always keep your hair trimmed and wear hair net while working
- Wash your hands and feet at the designated area or wash stations provided
- Wash your hands with soap and water each time before you enter the production area
- Refrain from smoking, spitting, chewing paan, sneezing or coughing over any food when in the production area
- Do not handle food when suffering from a disease, illness, burns, injury or infection
- Take proper and timely medical treatment when you are ill or if you have met with an accident
- Visit a registered medical practitioner at regular intervals to keep a check on your health

## Personal Hygiene at a Work Place

Fig 2.2

### Foodhandlers should:

- A** Wear a clean hat or other hair restraint
- B** Wear clean clothing daily – dirty clothes must be kept away from food and prep areas
- C** Remove aprons when leaving food-preparation areas
- D** Remove jewelry from hands and arms
- E** Wear appropriate, clean, and closed-toe shoes



**Never wear an apron to the restroom or on break**

Fig 2.3





## UNIT 2.3: Equipment Used in Jam, Jelly, and Ketchup Processing

### Unit Objectives

At the end of this module, you will be able to:

- Identify the different equipment, tools, and machineries used for processing jam, jelly, and ketchup.

### Unit 2.3.1: Pulp-Processing Equipment

The equipment used is:

**Table 2.1**

Name of equipment	Usage
Ripening chamber with ethylene doser	Used for ripening fruit/vegetables by passing ethylene gas
Fruit washing machine	Used for fruit washing
Sorting and grading machine	Used for fruit segregation as per size and firmness
Conveyer belt	Used for visual inspection for sorting
Peeler	Used for removing fruit skin
De-seeder/de-stoner	Used for removing fruit seeds and stones in mangoes
Core cutter	Used for cutting fruit core especially in pineapple
Crusher/ chopper/ shredder	Used for crushing/chopping/shredding of fruit
Blancher/ hot break system	Used to heat the fruit/vegetable to facilitate pulping process
Juice extractor/hydraulic press/ continuous press /filter press	Used for the large-scale filtration of liquid under pressure. It is a device consisting of a series of cloth filters fixed to frames
Steam jacketed kettles / blending tanks	Used for cooking juice by blending all ingredients like sugar, ascorbic acid, colour, flavourings, etc.
Decanter	Used to remove fibre, grits, black and brown specks, extraneous matters, dust, and other impurities are separated out from juice
Enzyme treatment tank/ collection tank	Used to hold juice when enzyme is added for enzyme activity
Evaporator/Concentrator	Used for evaporating water from juice
Pasteurizer	Used for pasteurizing juice by passing steam through it
Clarifier/ Ultra-filtration unit	Used to remove solid particulates or suspended solids from liquid for clarification and/or thickening

## Unit 2.3.1: Pulp-Processing Equipment

**Table 2.2**

Name of equipment	Usage
Aseptic filler	Used for aseptic filling of processed pulp in aseptic bags
Holding tank/reservoir tank	Used for storing fruit juice
Bottle filling machines	Filling of juices/squashes into bottles
Crown crimping machine	Metal lid capping machine
PP sealing machine	Plastic lid sealing machine
Bottle washing machine	Used for bottle washing. They are of two types: brush washer and chemical washer
Batch coder	Used for coding
Packing machines	Packing machine for tetra packages
Labelling machine	Labelling machine Used for labelling packaged packets Strapping machine Used for combining smaller packets for easy transportation.

### Precautions and safety measures to follow while handling equipment

- Avoid direct spillage of water on electrical components
- Clean the tools and equipment before and after each operation
- Ensure regular maintenance of tools and machinery
- Do not open machines with sharp knives during operation. It is safe to open a machine when it is unplugged from an electrical source.
- Check machines like the steam-jacketed kettles regularly for efficiency of valves
- Ensure the build-up of pressure for machines is always under control
- Ensure the controls of all the machines are set to prescribed limits

## UNIT 2.4: Cleaning and Maintenance

### Unit Objectives

At the end of the session, you will be able to:

- State the materials and equipment used in cleaning and maintenance of the work area and machineries.

### Unit 2.4.1: Cleaning and Sanitization

Cleaning and sanitization of the work area is extremely important for every food-handling operation. Hence, it is important to know:

- What types of materials and equipment must be used to clean the work area?
- How to use these materials and equipment?
- The method of cleaning the work area
- The frequency of cleaning the process machineries

The food processing industry follows standard procedures for cleaning the work area. This is to ensure that there is no bacterial growth due to presence of leftover food particles. For cleaning purposes, the work area is divided into two. They are:

**Table 2.3**

Food contact surfaces	Non-food contact surfaces
Work tables	Overhead structures
Utensils	Walls, ceilings, and shields
Equipment	Lighting equipment
Tools like knives	Refrigeration equipment
Machines that process foods	Air conditioning, heating or ventilating systems

#### 2.4.1.1 Equipment, Chemicals, and Sanitizers Used for Cleaning

Every organization in the food processing industry follows a cleaning schedule. For instance, a processing unit may follow a weekly, monthly or yearly cleaning schedule. To clean the processing unit, the following equipment and tools are used:

- Cleaning or washing tank
- Cleaning knives and spoons
- Cleaning or sanitizing agents
- Cleaning brushes and scrubbers
- High spray nozzle jets

## Unit 2.4.1: Cleaning and Sanitization

Some common types of cleaners and sanitizing agents to clean the food contact and non-food contact surfaces are:

**Table 2.4**

Cleaning agents	Used for	Risk	Safety measure
Hypochlorites like potassium hypochlorite, sodium hypochlorite, and calcium hypochlorite	Cleaning stainless steel food contact surfaces	Leads to corrosion	Ensure pH and concentration levels are maintained
Liquid chlorine	Internal cleaning of stainless steel equipment and vessels	Leads to corrosion	Ensure concentration levels are maintained
Hydrogen peroxide	Killing bacterial spores, pathogens, spoilage organisms, and other microorganisms	Has a strong odour	Use in well-ventilated and open spaces
Ozone	Cleaning food-contact and non-food-contact surfaces like equipment, walls, floors, drains, conveyors, tanks, and other containers; Killing microbes	No risk involved since it leaves no residue	Safe to use

## UNIT 2.5: Cleaning Processes

### Unit Objectives

At the end of the session, you will be able to:

- State the cleaning processes used to clean the work area.

### Unit 2.5.1: Clean-In-Place (CIP)

CIP is a method used for internal cleaning of machineries. It is done without dismantling pipes, vessels, process equipment, filters or fittings. In this process, a sanitizing agent is circulated through the entire processing unit with the help of a spray ball. The turbulence created removes soil, ensuring removal of bacteria and chemical residues.

**Tips to conduct an effective CIP process:**

- Use the right vessels for the right process
- Use the right cleaning and sanitizing solutions
- Ensure correct flow rate
- Ensure all connections are clean
- Monitor and verify the entire process

### Unit 2.5.2 Clean-Out-Of-Place (COP)

COP is conducted at a cleaning station. This method involves dismantling of the equipment. In this process, equipment and units are scrubbed with soap in COP tanks. After this, the tanks are rinsed again to remove residual detergent or chemicals. Equipment and units are reassembled and sanitized once more with heat treatment or sanitizing agent.

**Tips to conduct an effective COP process:**

- Follow the order of tasks
- Use cleaning tanks as much as possible
- Ensure tools used in COP do not lead to contamination

**Food processing equipment and units that undergo the COP process are:**

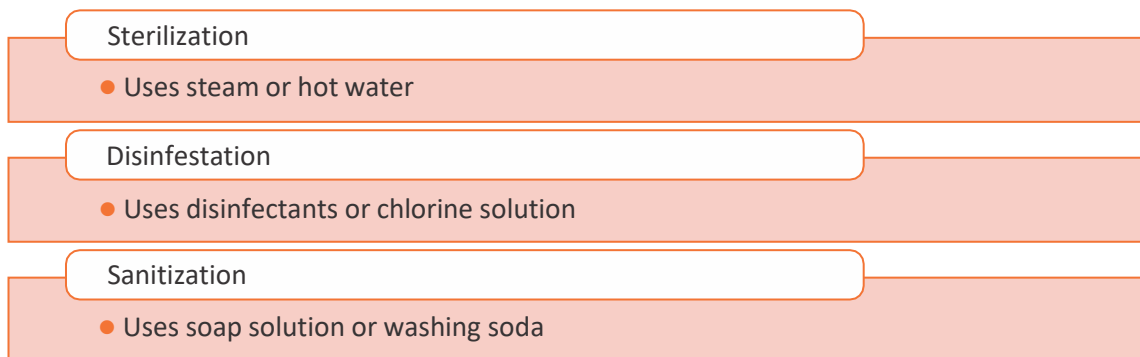
- Fittings
- Gaskets
- Valves
- Tank vents
- Grinders
- Pumps
- Knives

## Unit 2.5.3: Sterilising-In-Place (SIP)

SIP is the process by which food-processing equipment is sanitized after the CIP process. It helps to eliminate any residual microbiological contamination.

SIP is a combination of three processes viz. sterilization, disinfestation, and sanitization.

**Fig 2.4**



### 2.5.3.1 Air-Pressure Cleaning

Baking industry follows the air-pressure cleaning method to ensure cleanliness of regularly used equipment. The following chart explains the process in detail:

**Fig 2.5**

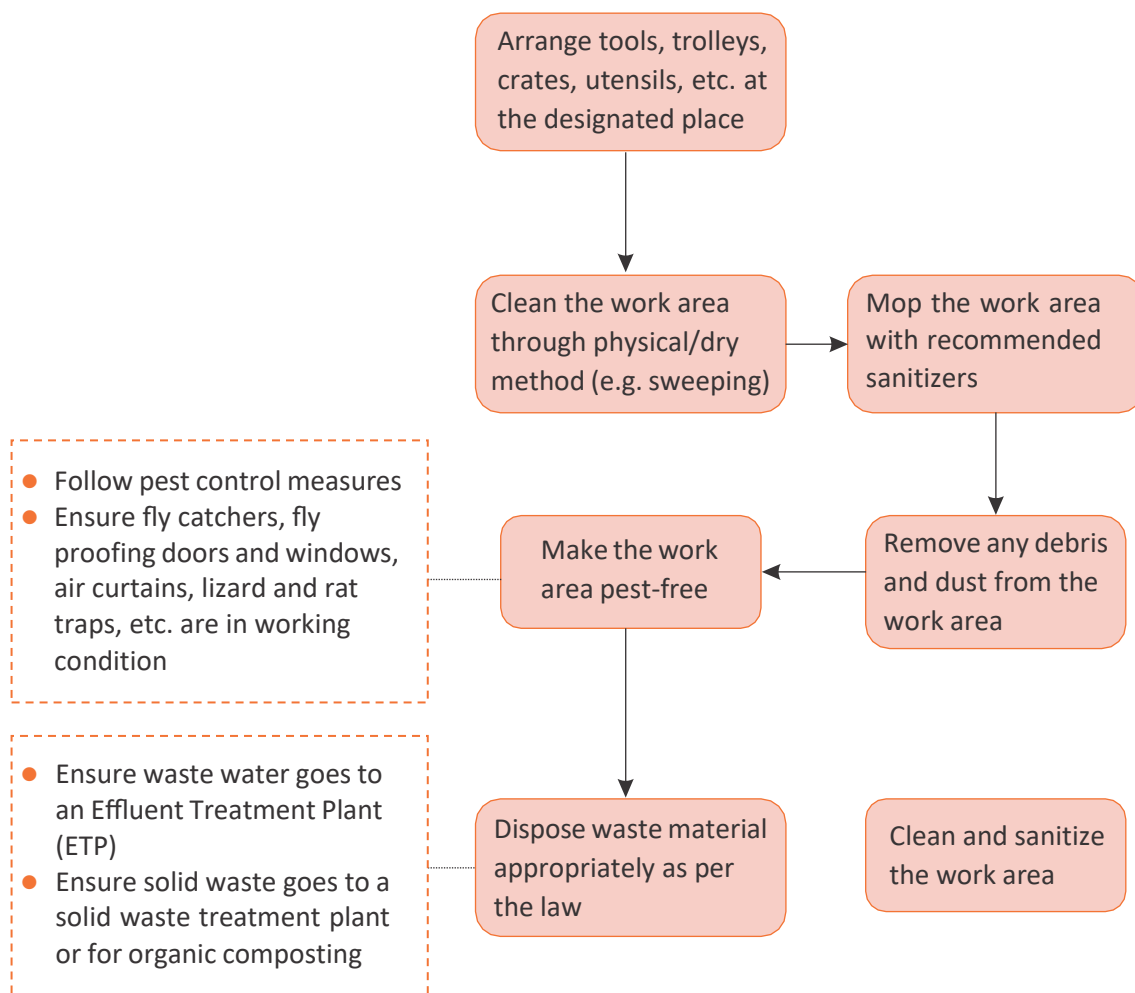


## Unit 2.5.3: Sterilising-In-Place (SIP)

### 2.5.3.2 Process of Cleaning the Work Area

The following chart explains the process of cleaning the work area before production. The dotted boxes explain pest-control measures and methods used for waste material disposal in detail.

Fig 2.6

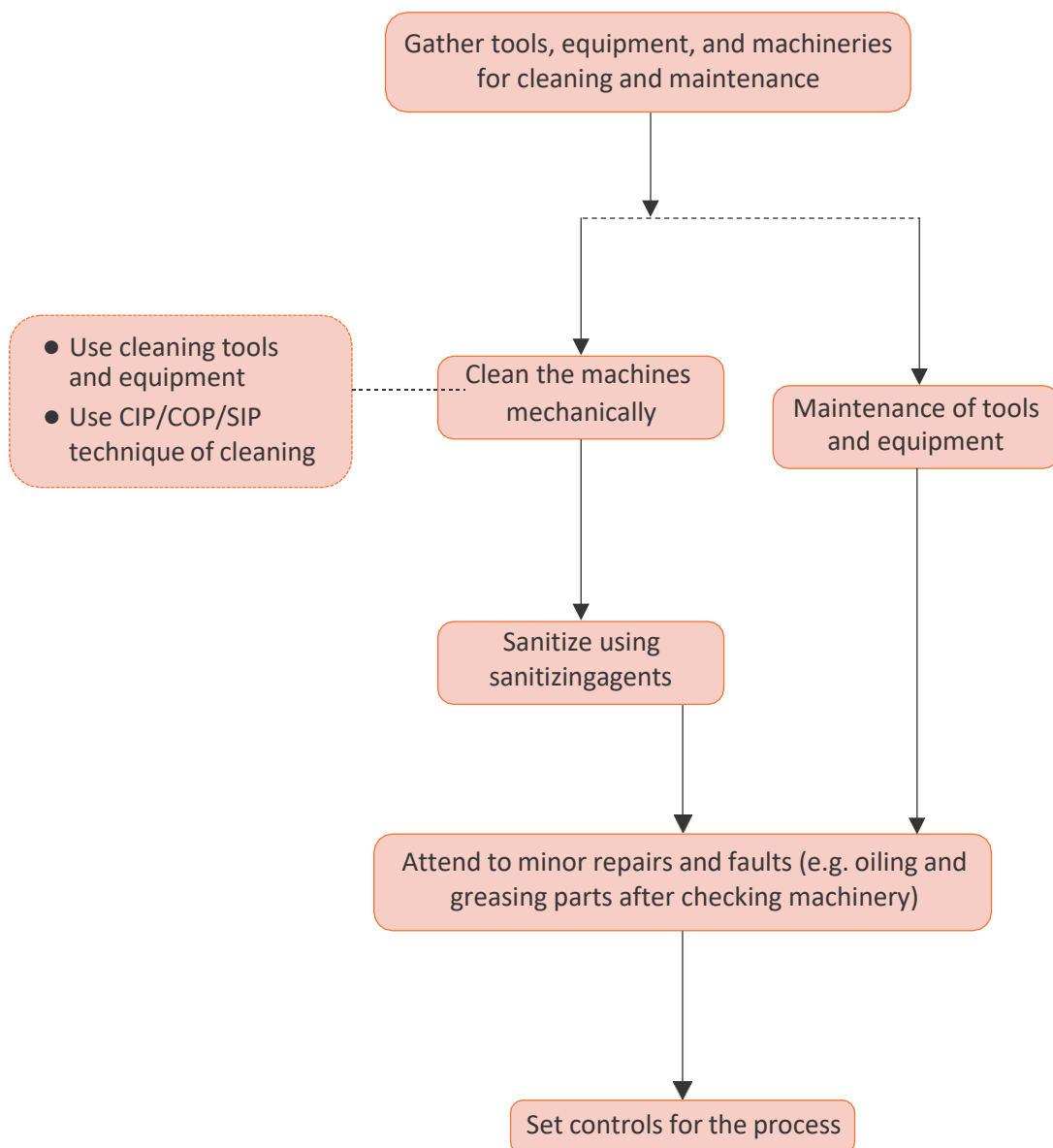


## Unit 2.5.3: Sterilising-In-Place (SIP)

### 2.5.3.3 Process of Cleaning Tools and Equipment

The following chart explains the process of cleaning and maintaining tools and equipment used for production.

Fig 2.7





## Exercise

- Q 9) Which of the following step ensures that workplace is safe and clean for use?**
- Wipe the equipment with a dry cloth and sweep the floor
  - Use a steam cleaner to clean the equipment and work top of grease and then use a steam vacuum cleaner to clean the floor of oil and grime
  - Dust the work tops and sweep the floor
  - Wipe the equipment and work top with a wet cloth and then mop the floor
- Q 10) Which of the following steps is not relevant in keeping the work bench tops clean and hygienic?**
- Sanitize with sanitizer and allow to air dry
  - Spray with a disinfectant
  - Scrape the top and sides with metal scraper
  - Wash with hot water and detergent
- Q 11. Discuss the role of the following equipment**

Equipment	Role
Peeler	
De-seeder/de-stoner	
Core cutter	
Crusher/ chopper/ shredder	
Blancher/ hot break sytem	
Juice extractor/hydraulic press/ continuous press/filter press	

- Q12. Name the cleaning agents that are used for cleaning following surfaces:**

Cleaning agents	Used for
	Cleaning stainless steel
	food contact surfaces
	Internal cleaning of stainless steel equipment and vessels Killing bacterial spores, pathogens, spoilage

Notes



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Notes



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## 3. Food Microbiology

Unit 3.1 - Introduction to Food Microbiology

Unit 3.2 - Food Spoilage

Unit 3.3 - Food Preservation



**FIC/N9001**

## Key Learning Outcomes

**At the end of this module, you will be able to:**

- State the types of food microbes
- State the causes for food spoilage
- State the process for food spoilage
- State the criteria to check food spoilage
- State the need for food preservation
- State the different types of food preservation processes

## UNIT 3.1: Introduction to Food Microbiology

### Unit Objectives

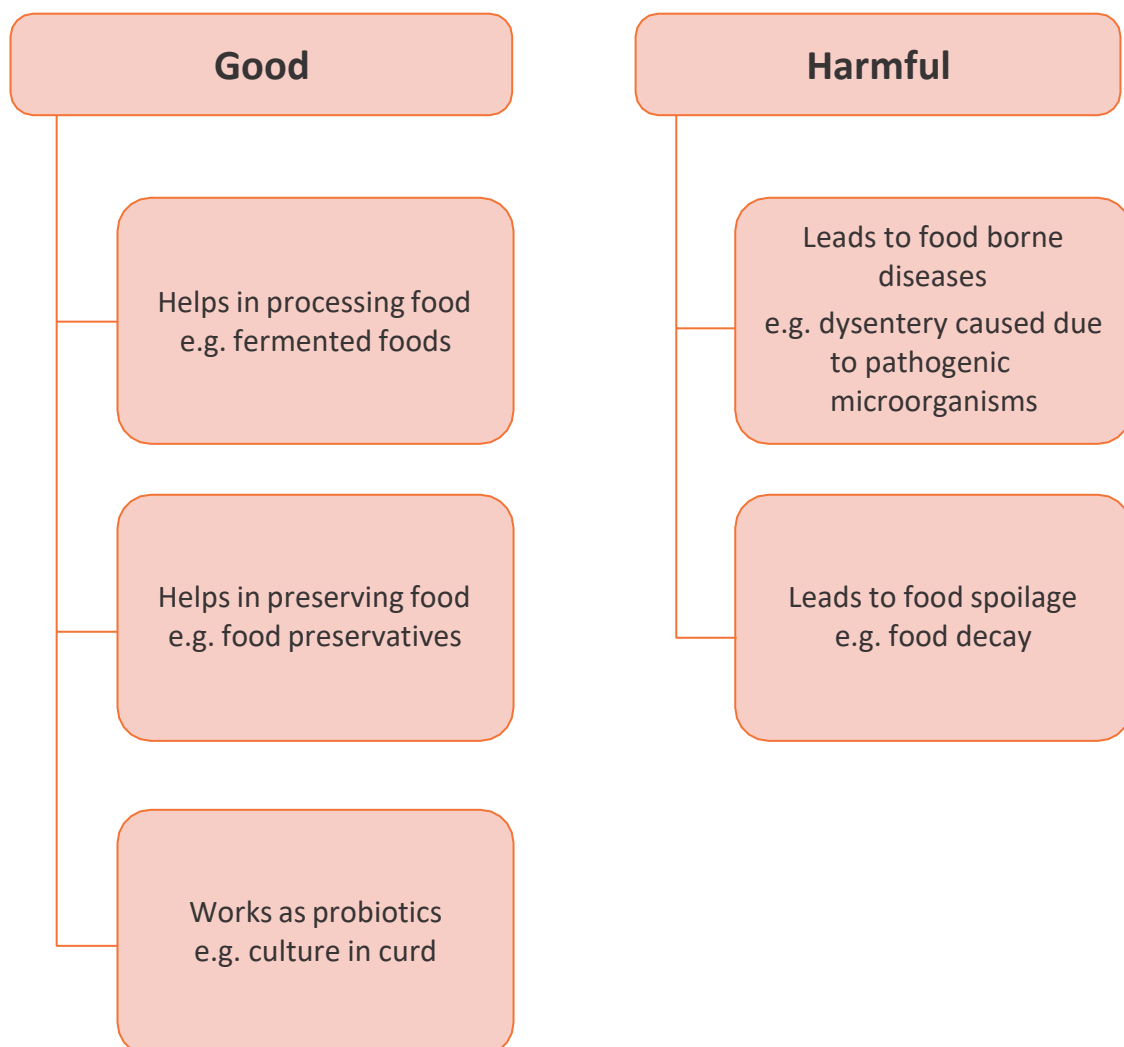
At the end of the session, you will be able to:

- State the types of food microbes.

### Unit 3.1.1: What is Food Microbiology

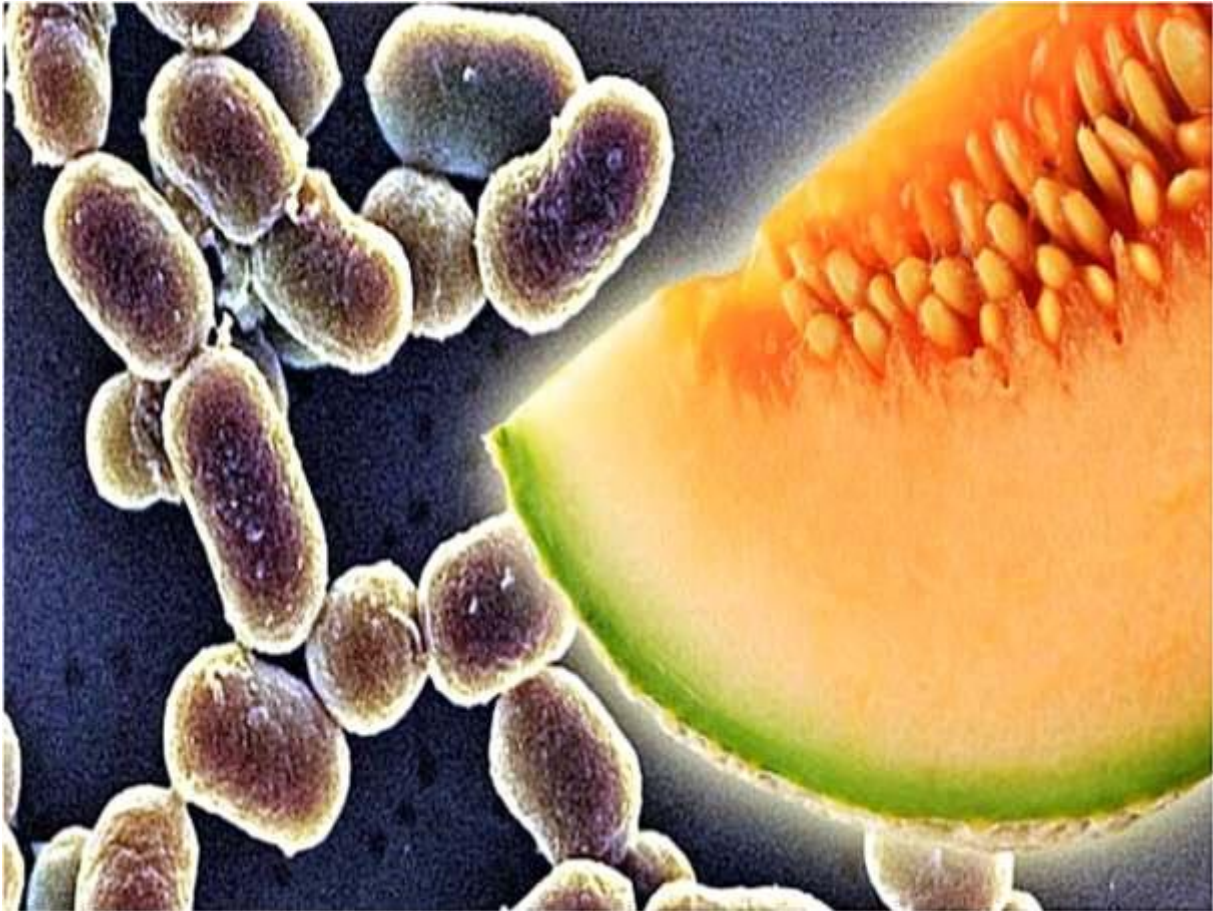
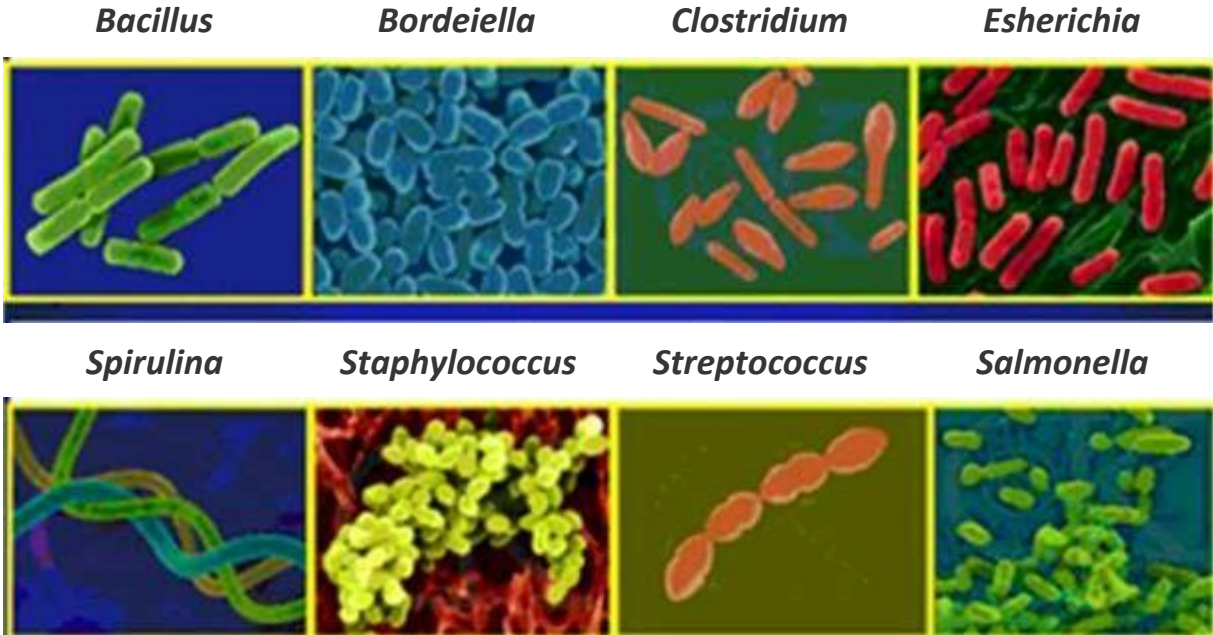
Food micro biology is the study of microorganisms found in food products. Microorganisms are classified as:

Fig 3.1



# Types of Food Spoilage Microorganisms

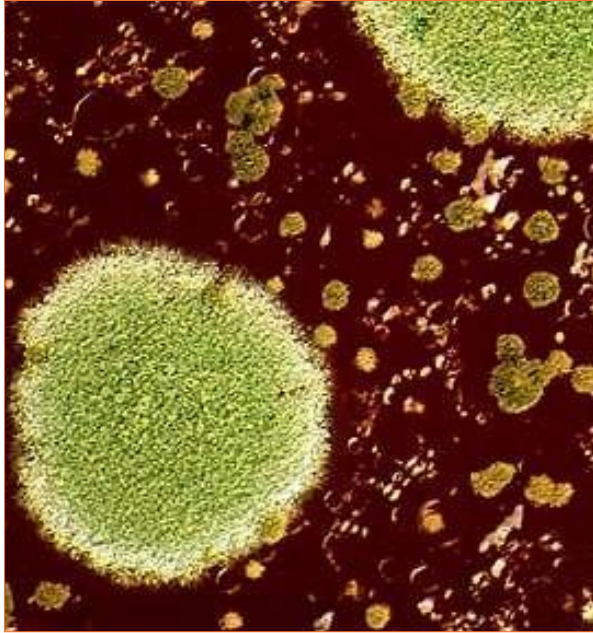
Fig 3.2





### Food Items Spoiled by Microorganisms

Fig 3.3



## UNIT 3.2: Food Spoilage

### Unit Objectives

At the end of the session, you will be able to:

- State the causes for food spoilage;
- State the process for food spoilage;
- State the criteria to check food spoilage.

### Unit 3.2.1: Types of Food Contaminants

Food spoilage is the process by which the original nutritional value, texture, flavours, and the form of food is damaged. The food then becomes harmful and unsuitable for human consumption.

Some types of contaminants in foods are:

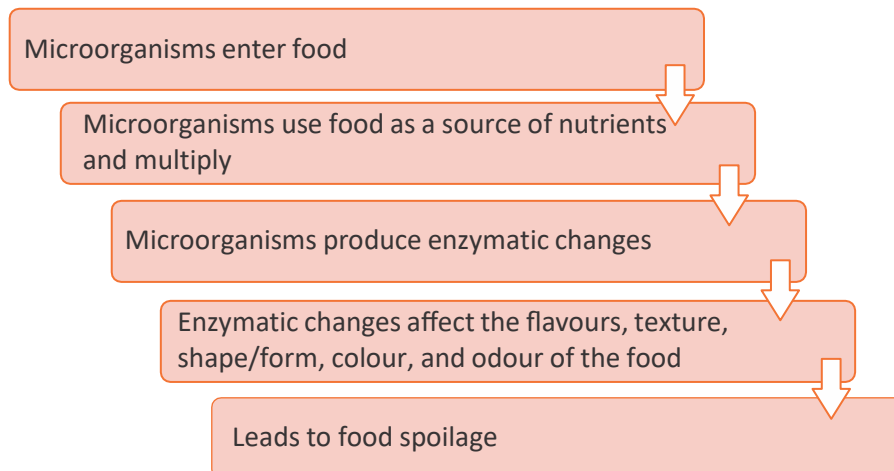
Table 3.1

Types of contaminant	Examples
Microbial	Bacteria, moulds, yeasts, viruses, etc.
Biological	Hair, excreta, bone splinters, etc.
Chemical	Pesticide residues, detergents, etc.
Physical	Bolts from machinery, stones, glass, etc.

### Unit 3.2.2: Process of Food Spoilage

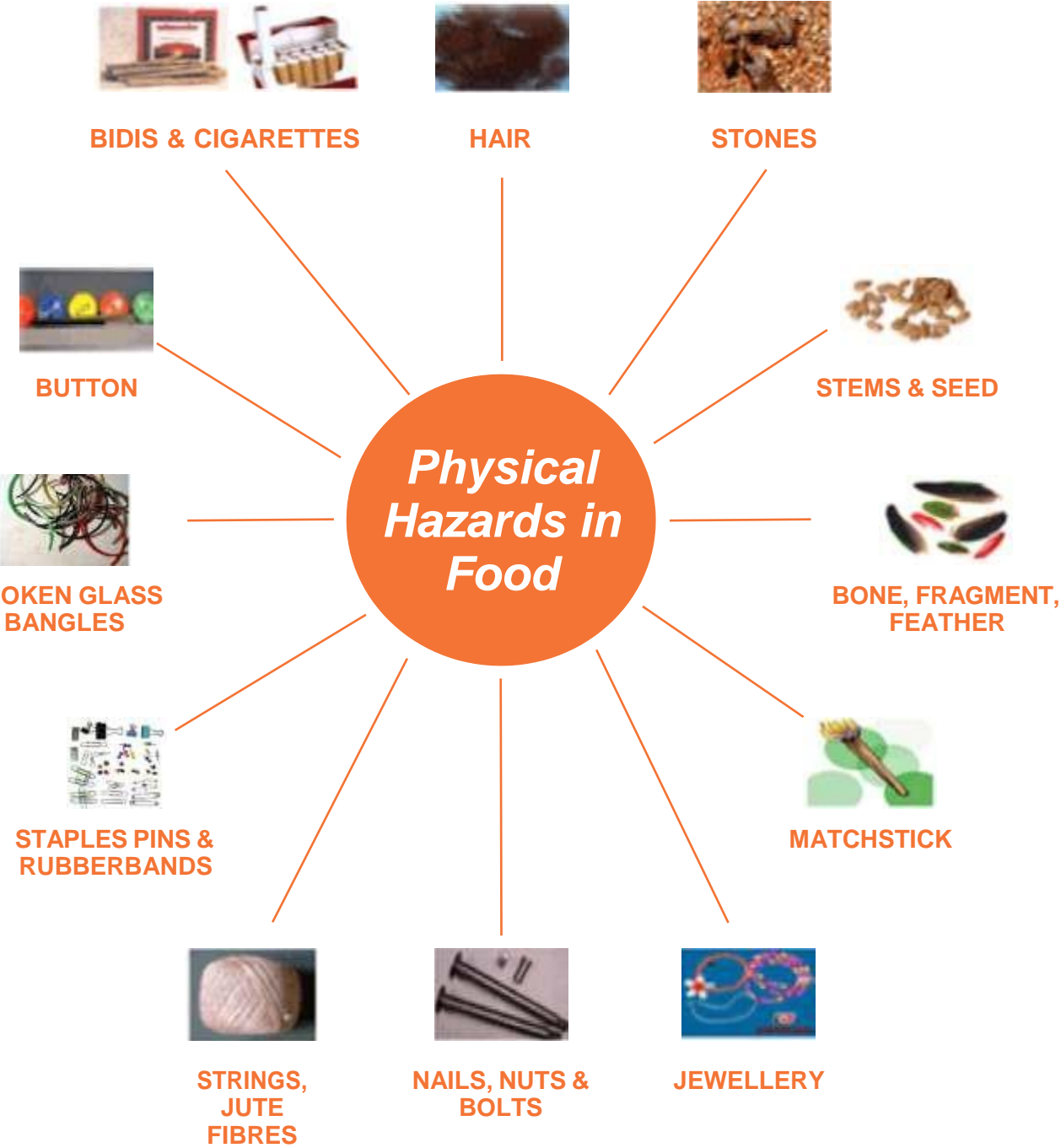
The following process chart shows how food spoilage takes place:

Fig 3.4



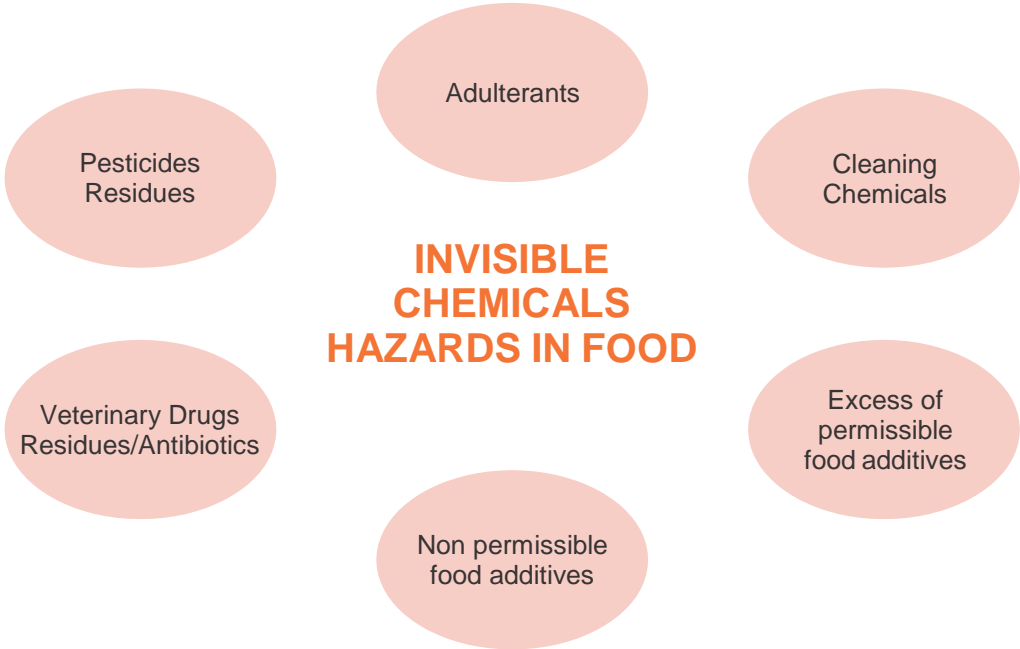
### Different Types of Physical Hazards in Food

Fig 3.5



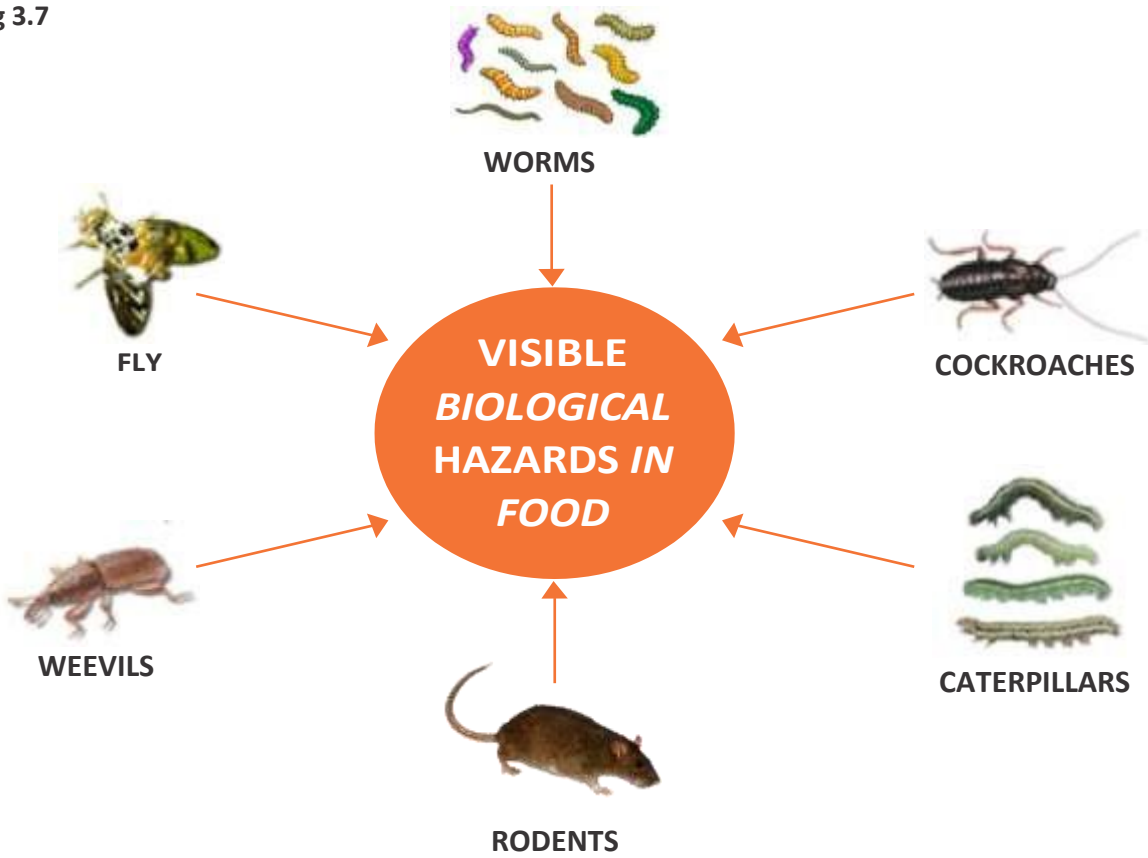
### Different Types of Chemical and Biological Hazards in Food

Fig 3.6



### Different Types of Biological Hazards in Food

Fig 3.7



## Unit 3.1.2: Types of Food Contaminants

### 3.2.1.2 Classification of Food Based on Spoilage

The following table shows how food is classified based on spoilage.

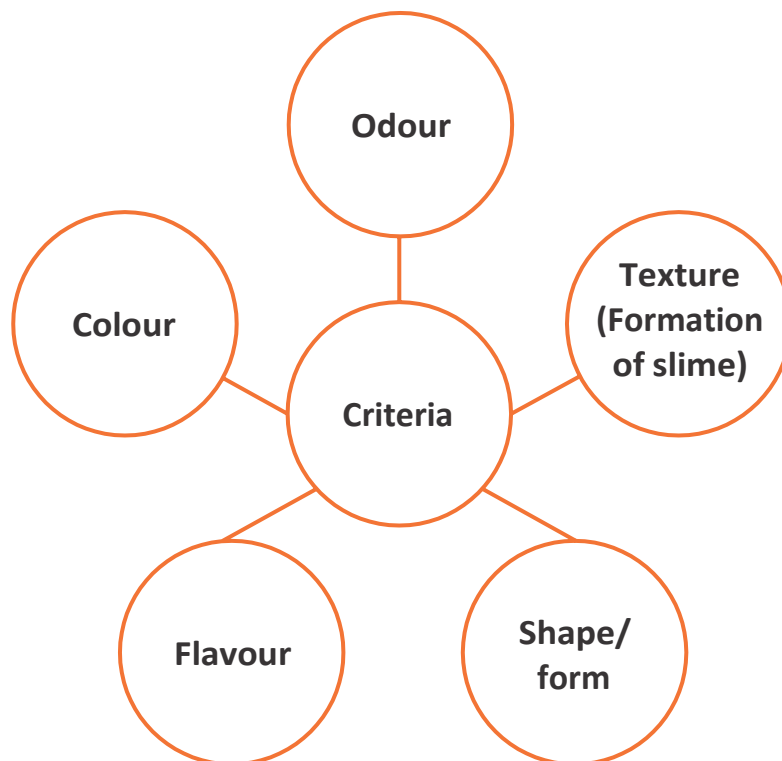
Table 3.2

Non - perishable foods	Semi-perishable foods	Perishable foods
Does not spoil unless handled carelessly E.g.: Sugar	Spoils only if handled carelessly or stored improperly E.g.: Potatoes	Spoils readily and needs to be stored with special preservatives/processes E.g.: Milk

### 3.2.2.1 Criteria to Check Food Spoilage

This chart will help you to check food spoilage based on the parameters listed below.

Fig 3.8



## UNIT 3.3: Food Preservation

### Unit Objectives

**At the end of the session, you will be able to:**

- State the need for food preservation;
- State the different types of food preservation processes.

### Unit 3.3.1: What is Food Preservation

Food preservation is the process by which processed and unprocessed food is protected against microbes, spoiling agents, and contaminants. The objective of preserving processed food is to:

- Retain the original nutritive value
- Retain the original colour
- Retain the original flavour
- Retain the original texture of the food
- Extend the shelf life of the food
- Ensure year-round availability
- Prevent or delay spoilage

#### 3.3.1.1 Common Methods of Food Preservation

The most commonly followed methods of food preservation are:

- Fresh storage
- Cold storage
- Freezing
- Drying/dehydration
- Concentration
- Chemical preservation
- Preservation with sugar
- Pasteurization
- Sterilization
- Filtration
- Irradiation
- Curing
- Fermentation
- Salting

# Sources of Food Contamination

Fig 3.9



## Exercise



Q 13.) What do you understand by Food Microbiology?

Q 14) What are different types of food borne illness?

Q 15) Enlist different types of microbes responsible for food spoilage.

Q 16) What is the different between good and bad microbes?

Q 17) What do you understand by non-perishable, semi perishable and perishable foods?

Q 18) What are different types of food contaminants?

Q 19) Enlist various methods of food preservation?

Q 20) Why is food preservation important?



Notes



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## 4. Produce Jam Jelly and Ketchup

- Unit 4.1 - Basic Mathematics
- Unit 4.2 - Production Planning Process
- Unit 4.3 - Selection of Raw Material
- Unit 4.4 - Plan Production Sequence
- Unit 4.5 - Handling of Raw Materials
- Unit 4.6 - Production Processes
- Unit 4.7 - Enzyme Activity
- Unit 4.8 - Procedures Involved in Juice/ Pulp Extraction
- Unit 4.9 - Pasteurization of Fruit and Vegetable Juice/Pulp
- Unit 4.10 - Sterilization of Fruit and Vegetable Juice/Pulp
- Unit 4.11 - Quality Analysis
- Unit 4.12 - Packing and Packaging
- Unit 4.13 - Aseptic Packaging
- Unit 4.14 - Storage of Finished Products
- Unit 4.15 - Waste Management
- Unit 4.16 - Post-Production Cleaning and Maintenance



**FIC/N0110**  
**FIC/N0111**

## Key Learning Outcomes

**At the end of this module, you will be able to:**

- Plan the production sequence to maximise capacity utilization of resources, manpower, and machineries
- Calculate the batch size based on the production schedule and machine capacity
- Prioritize urgent orders based on the production schedule
- Check the conformance of ingredients quality to company standards
- State the units of measurement used in the food processing industry
- Identify the ingredients required for production as per production schedule and formation
- Organize quality ingredients as per production process and company standards
- Identify the various fuels used in the fruit and vegetable industry
- State the various production processes followed in the fruit and vegetable industry
- Check the raw material for quality and grade;
- Prepare the raw material for production;
- List the ingredients used in jam, jelly, and ketchup
- Explain the processing of jam ;
- Explain the processing of jelly;
- Explain the processing of ketchup.
- Describe enzyme activity in fruit processing;
- Describe pectin's role.
- State the procedures used to extract the fruit and vegetable juice/pulp .
- Describe pasteurization process for fruit processing industry.
- Describe sterilization process for fruit processing industry;
- State the methods of sterilizing fruit juice.
- State the quality control of a product;
- List the quality parameters of fruit pulp, juice, jam, jelly, and ketchup;
- List the various faults in jellies;
- List the corrective measures for the faults in jellies.
- State the basic categories of packing;
- State the various types of packaging materials used for packing fruit pulp;
- State the factors for selecting packaging materials.
- Explain aseptic packaging in fruit processing industry
- State the storage procedures for finished goods;
- Explain the rules for stock rotation of finished goods.
- State the kind of waste produced and its disposal
- Demonstrate the process of cleaning and maintenance of work area after production.

## UNIT 4.1: Basic Mathematics

### Unit Objectives

At the end of the session, you will be able to:

- Use basic mathematics for various calculations in day-to-day processes.

### Unit 4.1.1: Measurements

- Relative humidity: A unit used to measure moisture content in air.
- Brix to acid ratio: A unit used to describe the total soluble solids content in a pulp/juice. The higher the Brix the greater the sugar concentration in the juice; the higher the "Brix to acid ratio" the sweeter and less tart is the juice
- pH: Acidity levels to be checked for fruit based product as they are acidic in nature.

### Unit 4.1.2: Calculation

- To calculate the yield of a particular fruit product, it is important to know Brix and pH levels of final product.
- The calculation is done as follows:  

$$\text{Yield} = \frac{\text{TSS of all raw materials}}{\text{Percentage of TSS in final products}} \times 100$$
- Given below is an example to show how to calculate the yield for a mango beverage. Mango pulp TSS inclusive of sugar = Fruit: Sugar = 70:30.  
 Required Brix of mango beverage = 40

10 kg of fruit at 10% TSS	=	1.000 kg
10 kg of sugar	=	10.000 kg
80 g of acid	=	0.080 kg

Total = 1.000 + 10.000 + 0.080 = 11.08 kg

Yield =  $\frac{11.08 \times 100}{40} = 27.7 \text{ kg}$

## UNIT 4.2: Production Planning Process

### Unit Objectives

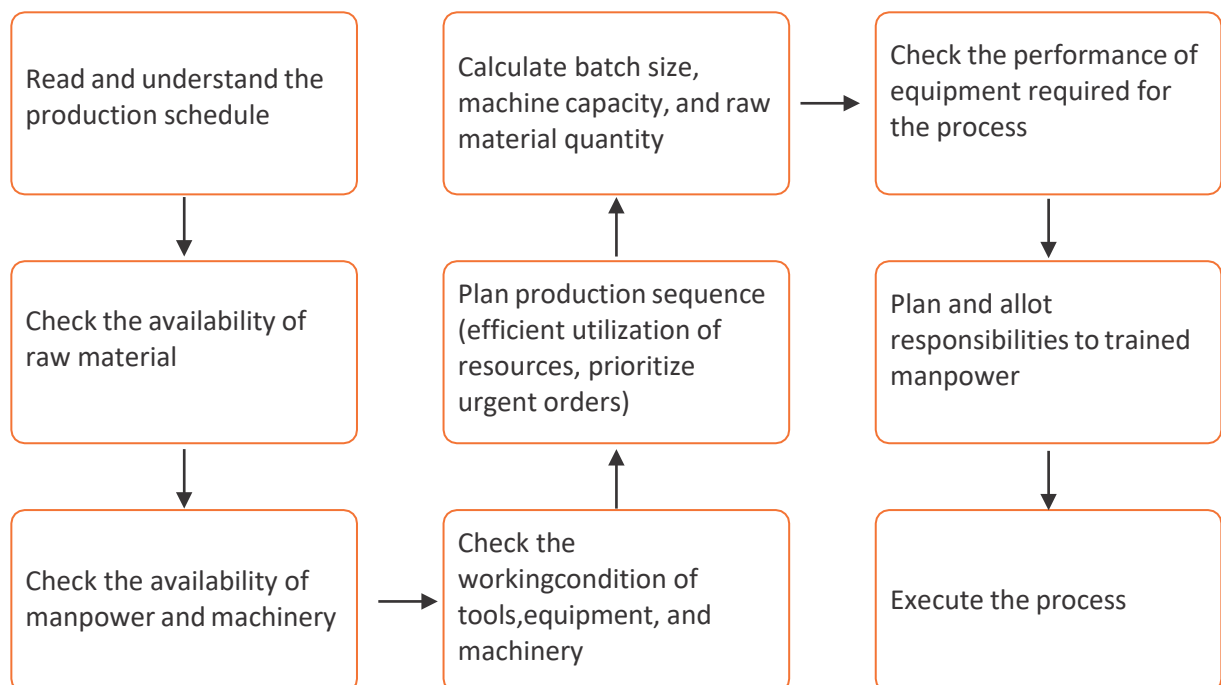
At the end of the session, you will be able to:

- Plan the production schedule as per organizational standards and instructions;
- Organize for raw material, packaging materials, manpower, equipment, and machineries for the scheduled production.

### Unit 4.2.1: Production Plan

The following chart provides an overview of the production planning process:

Fig 4.1



## UNIT 4.3: Selection of Raw Material

### Unit Objectives

**At the end of the session, you will be able to:**

- Identify the raw materials required for production as per production schedule and formation;
- Organize quality raw material as per production process and company standards;
- State the methods for storing raw material for later use.

### Unit 4.3.1: Raw Material Procurement and Storage

It is important to choose only those fruits/vegetables that are in the best condition during procurement.

The fruit processing industry for juice manufacturing in India uses a wide range of fruits. Some of the commonly used are mango guava, papaya, banana, etc. The quality of raw material determines the quality of the product. Hence, the selection of the raw material is extremely important for fruit juices and squashes. The fruits selected should be aromatic fruits with characteristic colours of the product and not physically damaged for the production process.

Fruit selection depends on following factors:

- Tree or crop type
- Region where the crop has grown as per weather
- Growing practices
- Location of the crop
- Degrees of maturity and ripeness
- Method of picking/harvesting

The procured fruits are carried to the manufacturing areas in plastic cases, which take approximately 20 kg of products. These cases not only protect the product from physical damage, but also protect the fruit quality by maintaining a high level of air circulation. The fruit reaches the manufacturing unit in about 2 to 10 hours. Ripened fruits have to be processed quickly. Hence, the manufacturing unit and the processing area are located close. This is because:

- There is continuous demand for raw materials
- Delay in production may lead to losses

## Unit 4.3.1: Raw Material Procurement and Storage

In case of excess fruits and raw materials, that maybe processed later, it needs to be stored in clean, airy, well-ventilated, cold storage areas within the food processing unit.

For jam processing, the manufacturer procures raw material through:

- Fresh fruit supply from supplier
- Frozen, chilled or cold-stored fruit
- Fruit /fruit pulp preserved by heat
- Sulphated fruit/fruit pulp
- Dried fruit

Shown below is a chart of crop season, raw materials, and their time of availability:

**Table 4.1**

Crop Season	Fruits/vegetables (raw material)	Availability
One	Mango	January to May
	Apple	July to September
	Lime	November to February
	Orange	December to March
	Pear, peach, and apricot	April to July
	Strawberry	February to April
	Eggplant/aubergine (brinjal)	October to March, July to September
	Tomato	October to April
Two	Carrot	October to March
	Pineapple	November to January and June to July
	Guava	November to January and June to July
No season	Papaya	November to January and June to July
	Banana	Throughout the year
	Lemon	Throughout the year



## UNIT 4.4: Plan Production Sequence

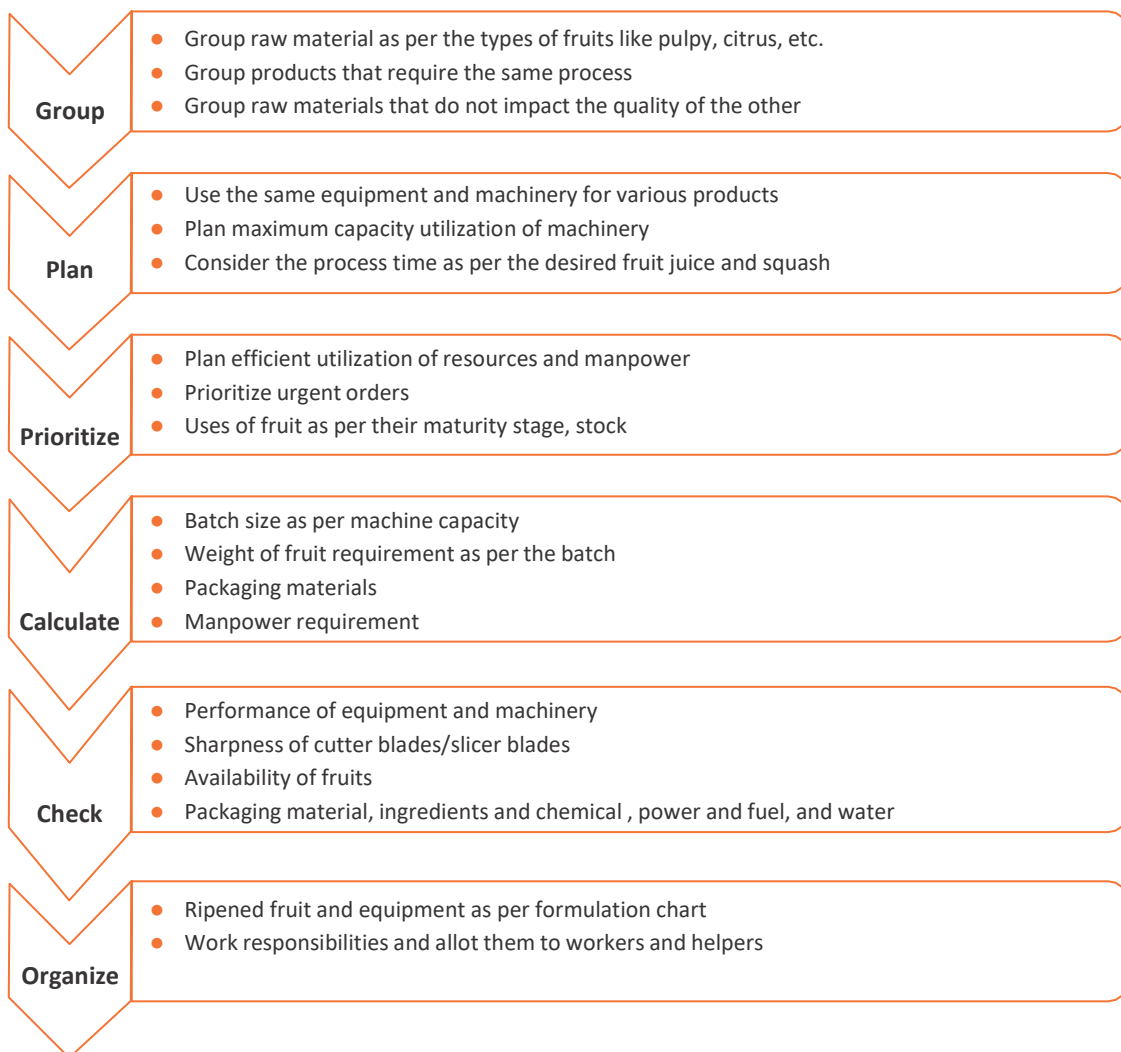
### Unit Objectives

At the end of the session, you will be able to:

- Plan the production sequence to maximise capacity utilization of resources, manpower, and machineries;
- Calculate the batch size based on the production schedule and machine capacity;
- Prioritize urgent orders based on the production schedule;
- Check the conformance of raw material quality to company standards.

### Unit 4.4.1: Planning the Production Sequence

Fig 4.2



## UNIT 4.5: Handling of Raw Materials

### Unit Objectives

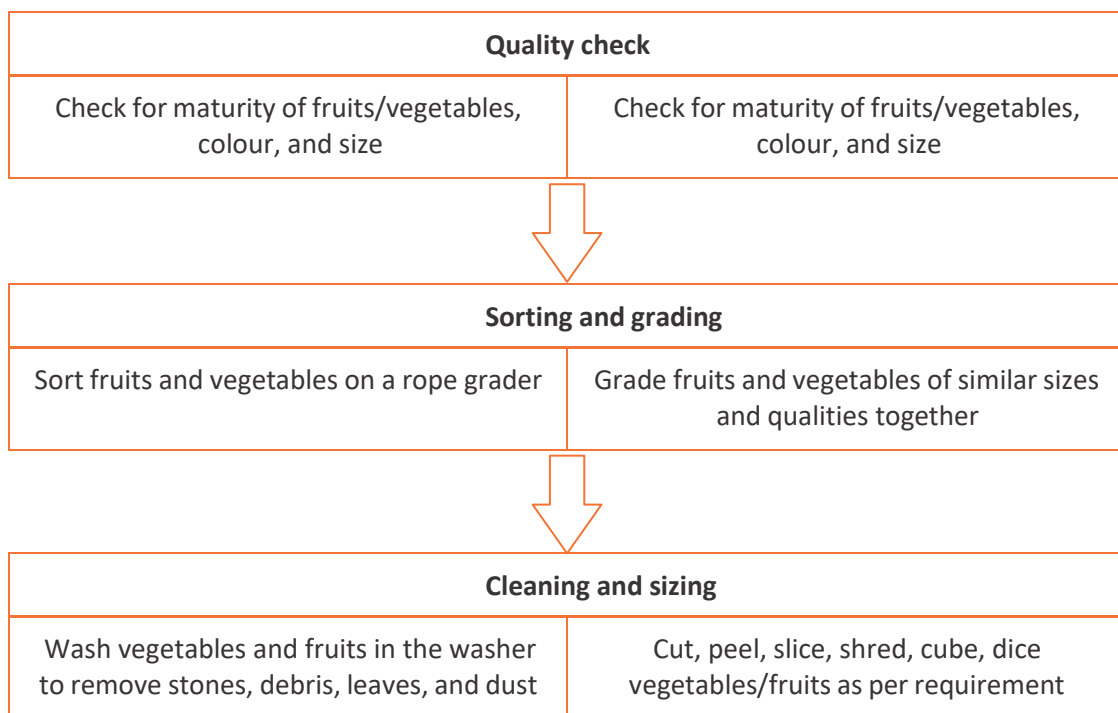
At the end of the session, you will be able to:

- Check the raw material for quality and grade;
- Prepare the raw material for production;
- List the ingredients used in jam, jelly, and ketchup.

### Unit 4.5.1: How to Handle Raw Materials

Before starting the actual process, it is important to understand how to handle raw materials that are procured from the farmer/supplier. Given below is a simple chart that shows the process the raw materials undergo before the pickling process:

Fig 4.3



## Unit 4.5.2: Basic Ingredients Formulation

Table 4.2

Name of Ingredient	Jam	Jelly
Fruit	As per choice	As per choice
Sugar	30 to 50 %	60-65 %
Pectin	0.5 to 0.8 % depending upon fruit	1.0 %
Acid levels	3.2 to 3.7 levels	2.5- 3.0
Water content	32-34 %	33-38 %

Table 4.3

Name of Ingredient	Ketchup
Fruit	Tomato
Sugar	30 to 50 %
Acid levels	Acetic acid 1 %
Spices and seasonings	Onions, allspice, cloves, cinnamon, garlic, etc.
Salt	32-34 %

## UNIT 4.6: Production Processes

### Unit Objectives

**At the end of the session, you will be able to:**

- Explain the processing of jam ;
- Explain the processing of jelly;
- Explain the processing of ketchup.

### Unit 4.6.1: Processing of Jam

Following are the steps for jam processing:

1. Selection of fruit
2. Washing of fruit
3. Peeling and washing
4. Deseeding/mango tip cutting and destining/core cutting
5. Separation of segments
6. Cutting/slicing
7. Blanching/heating
8. Fruit pulp extraction by crushing
9. Decanting
10. De-aeration of pulp
11. Cooking
12. Mixing sugar
13. Boiling to 60°C
14. Addition of citric acid and additives (pectin if required)
15. Cooking and stirring till setting consistency
16. Cooling
17. Aseptic packaging
18. Labelling
19. Storage

## Unit 4.6.2: Processing of Jelly

Following are the steps for jelly processing:

1. Selection of fruit
2. Washing of fruit
3. Peeling and washing
4. Deseeding/mango tip cutting and destining/core cutting
5. Separation of segments
6. Cutting/slicing
7. Blanching/heating
8. Fruit juice extraction by crushing/squeezing
9. Decanting
10. Clarification of juice
11. Boiling juice
12. Mixing sugar syrup
13. Cooking the mixture
14. Addition of citric acid, pectin, and additives
15. Stirring and heating till setting consistency
16. Cooling
17. Aseptic packaging
18. Labelling
19. Storage

### Unit 4.6.3: Processing of Ketchup

Following are the steps for Ketchup processing:

1. Selection of tomato
2. Washing of tomato
3. Blanching/heating
4. Crushing/squeezing
5. Extraction of raw tomato puree/pulp
6. Deseeding and separation of segments
7. Decanting
8. De-aeration
9. Cooking of pure tomato puree/pulp
10. Addition of spices, seasonings, acetic acid, and additives
11. Boiling of mixture
12. Addition of salt
13. Cooking till done
14. Cooling
15. Aseptic packaging
16. Labelling
17. Storage

## UNIT 4.7: Enzyme Activity

### Unit Objectives

At the end of the session, you will be able to:

- Describe enzyme activity in fruit processing;
- Describe pectin's role.

### Unit 4.7.1: Enzyme

Enzymes are a type of proteins that regulate chemical reactions within food products. Enzymes enhance in transformation of food flavour, colouring, and shelf life. Hence, it is necessary to know the types of enzymes naturally occurring in a particular fruit.

### Unit 4.7.2: Enzyme activity

The chemical substance called substrate on which enzymes act and the conditions governing its activity are important. The enzymes used are break down cells walls and release the liquids and sugars, which make up the fruit.

### Unit 4.7.3: Enzymes used

Pectinases, amylases and celluloses are commonly used enzymes that break down different structures of the fruit cells and affect the extraction process in different ways.

Pectin is the commonly used substance for setting of jam and jelly. It is naturally present in fruits, which is extracted by dilution method. To the fruit minimum quantity of water is added and boiled and pectin is extracted.

## UNIT 4.8: Procedures Involved in Juice/ Pulp Extraction

### Unit Objectives

At the end of the session, you will be able to:

- state the procedures used to extract the fruit and vegetable juice/pulp.

### Unit 4.8.1: Decanting:

It is a filtering/removal process. All the rotten fruit particles (black and brown skin and extraneous matter), larva, eggs, sand from the fruit extract, etc. is separated out. The extracted fruit pulp is raw, pure fruit pulp. It is done by centrifugation process. The raw extracted pulp is rotated at high speed to remove the layer of black specks and unwanted particles.

### Unit 4.8.2: De-aeration

It is a process of expelling air from the product before sterilization and filling.

In crushing, pressing, separation, and decanting, the raw fruit pulp extract is subjected to considerable aeration. The inclusion of oxygen can promote enzymatic browning, destroy nutrients, modify flavour, and otherwise damage quality. Hence, ensure caution and care to protect the material.

### Unit 4.8.3: De-aeration methods

1. **Rapid heating and heated pulp transferred into a vacuum chamber:** Rapid heating at high temperature removes some undesirable volatile aroma and air. The heated pulp is passed into vacuum chamber for storing/further processes.
2. **Inert gas bubbling:** In the extracted, raw, pre-cooked pulp, nitrogen or carbon dioxide gas is bubbled prior to storing it under an inert atmosphere. After the removal of air, pulp needs protection from the atmosphere in all subsequent processing steps. It is done in vacuum conditions with the aid of a pump.

### Unit 4.8.4: Concentration

It is a process to cook fruit pulp in order to remove water content from the product. The fruit pulp is boiled, and it becomes thick after water evaporates from it. The processed fruit pulp is called concentrate. It is done in an evaporator under controlled conditions of pulp flow, temperature, and boiling time. Low temperature evaporators operate at a maximum temperature of 50°C.



## Unit 4.8.5: Clarification

It is a process of ultrafiltration in which quantities of tartar cream is used. Certain specks that are not removed during decanting are removed. The process is carried out in two ways:

Freezing	Heating
<ul style="list-style-type: none"><li>● Precipitation of juice</li><li>● The bottle of juice is refrigerated so as to complete precipitation</li><li>● The tartar crystals settle down leaving clear liquid on top</li><li>● Example: Apple juice</li></ul>	<ul style="list-style-type: none"><li>● Rapid heating to about 180°C followed by sudden cooling</li><li>● It is one in flash heaters to avoid oxidation</li><li>● After rapid heating and cooling the liquid is passed through a filtering material</li><li>● Example: Pomegranate juice</li></ul>

## UNIT 4.9: Pasteurization of Fruit and Vegetable Juice/Pulp

### Unit Objectives

At the end of the session, you will be able to:

- Describe pasteurization process for fruit processing industry.

### Unit 4.9.1: Pasteurization

It is a process in which foods heated at specific temperature and time to kill (or deactivate) some number of potentially harmful bacteria. Pasteurization is a preservation method used in food industry for milk and juices.

### Unit 4.9.2: Methods of Pasteurization

Optimum temperature and time used for pasteurization of juices and squashes is 185°C. It is done in two ways:

- High Temperature Short Time (HTST): Juice is heated at high temperatures for short time
- Low temperature Long Time (LTLT): Juice is heated at low temperature for a long time

Given below are three methods of pasteurization:

#### 1. In-The-Bottle/Holding

- Filtered juice filled in expandable bottles with proper heads, sealed airtight, and pasteurized
- LTLT way of pasteurization is used

#### 2. Overflow

- Juice is heated 50°C above pasteurization temperature
- This heated liquid is filled in hot sterilized bottles up to brim and after sealed
- Sealed bottles pasteurized at 50°C lower temperature filling
- On cooling the bottles contract leaving no air space in between
- HTST way of pasteurization is used

#### 3. Flash

- The juice is heated 10°C above pasteurization temperature for a minute
- The liquid filled in air tight container and sealed in steam cover for sterilized sealing
- It is cooled at room temperature
- HTST way of pasteurization is used

## UNIT 4.10: Sterilization of Fruit and Vegetable Juice/Pulp

### Unit Objectives

At the end of the session, you will be able to:

- Describe sterilization process for fruit processing industry;
- State the methods of sterilizing fruit juice.

### Unit 4.10.1: Sterilization Process

It is a process to kill all harmful microorganisms present in the product. It is done to increase the product life.

#### Methods of sterilizing the fruit juice

Given below are two methods used for sterilization in fruit processing industry:

**Table 4.4**

Retort	Tube-in-tube
Batch process	Continuous process
Filled cans are put on a rack and loaded into a retort	Passed through a series of tubes placed within a tube
Steam is trapped in the retort	Steam is passed through the outer tube
Sterilization technique is done on basis of cooking in a cooker	High Temperature Short Time (HTST) technique used for sterilization
Cooling is done separately	Cooling is done by extension of tube at filling temperature

## UNIT 4.11: Quality Analysis

### Unit Objectives

At the end of the session, you will be able to:

- State the quality control of a product;
- List the quality parameters of fruit pulp, juice, jam, jelly, and ketchup;
- List the various faults in jellies;
- List the corrective measures for the faults in jellies.

### Unit 4.11.1: Quality Control

It is an optimum standard maintained continuously as per the company standard norms to produce a quality product along with specific guidelines from the as per government. If the quality standards are not maintained, then it could lead to fatal consequences. be harmful for health

### Unit 4.11.2: Quality parameters

#### 1. Fruit juice

Every step involved in the process requires monitoring inclusive of food safety and personal hygiene. In fruit juice, quality check is done on the basis of technical specification and organoleptic, which differ from fruit to fruit. The most important parameter to control is pH level as the juice is natural and without any additives.

1. **pH:** Each fruit has its own acidity level. The processing company maintains it as per their requirement.
2. **TSS:** Each fruit product has its own Brix ratio. The processing company maintains it as per their requirement.
3. **Consistency:** It is measured by refractometer as per the need
4. **Taste/flavour, colour, and texture:** It is checked by tasting the juice

#### 2. Fruit pulp

1. **pH:** Each fruit has its own acidity level. The processing company maintains it as per their requirement.
2. **TSS:** Each fruit product has its own Brix ratio. The processing company maintains it as per their requirement.
3. **Viscosity:** It is measured by refractometer as per the need
4. **Taste/flavour, colour, and texture:** It is checked by tasting

## Unit 4.11.2: Quality parameters

### 3. Jam and Jelly

In jam and jelly, quality check is done on basis of technical specification and organoleptic which differ from fruit to fruit.

1. **Acidity:** It is as per fruit taste. Optimum level maintained is between 3.2 to 3.7 pH
2. **TSS:** 65% for jelly 68% for jam
3. **Viscosity:** Jelly should be set
4. **Taste/flavour:** Additives as per government approved standards
5. **Colour:** Additives added as per approved standards

### 4. Ketchup

It is made by boiling tomato juice with addition of ingredients (sugar, acetic acid, spices, salt, etc.) It has thick consistency, but is pourable.

1. **Acidity:** Acetic acid level has to be maintained to 1% minimum
2. **TSS:** 25% minimum
3. **Viscosity:** As per company standard operating procedure
4. **Taste/flavour, colour, and texture:** It is checked by tasting

Given below is a chart of common fruits and vegetables

**Table 4.5**

Fruit	pH (Acidity %)	TSS (Brix degrees)
Mango	0.6% to 0.7%	14°
Papaya	0.2%	10° to 12°
Pear	0.3%	10°
Peach/apricot	0.2% to 0.3%	10° to 12°
Pineapple	0.4% to .6%	10° to 12°
Litchi	0.3% to 0.5%	10° to 12°
Banana	0.2% to 0.3%	24°
Apple	0.15% to 0.2%	10° to 12°
Tomato	0.5% to 0.6%	4°

## Unit 4.11.2: Quality parameters

### Faults and Remedies of Jellies

Table 4.6

Name of Faults	Reason	Remedies
Failure of setting jellies	<ul style="list-style-type: none"> <li>• Lack of acid or pectin or both</li> <li>• Short cooking time</li> <li>• Addition of too much sugar</li> <li>• Cooking below end point</li> <li>• Cooking beyond the end point</li> <li>• Slow cooking for a long time</li> </ul>	<ul style="list-style-type: none"> <li>• Proper pectin extraction</li> <li>• Addition of clarified juice rich in pectin</li> <li>• Cooking has to be done up to endpoint not below or beyond it</li> <li>• Pectin's binding property is destroyed in presence of acid if heated for long time. Hence avoid over heating</li> </ul>
Cloggy or foggy jellies	<ul style="list-style-type: none"> <li>• Cloudy jelly if unclarified juice used</li> <li>• Use of immature fruits due to insoluble starch of raw fruit juice</li> <li>• Over-cooking makes jellies gummy</li> <li>• Over-cooling makes jellies vicious and lumpy</li> <li>• Faulty pouring traps air inside if done from height</li> <li>• Non-removal of scum</li> <li>• Premature gelation</li> </ul>	<ul style="list-style-type: none"> <li>• Clarified juice to be used</li> <li>• Use ripened fruits</li> <li>• Coking till end point</li> <li>• Cooling at room temperature</li> <li>• Pouring jellies to be poured from spout of size an inch above the top of container</li> <li>• Heating solution to boiling point</li> <li>• Working at low sugar concentrations</li> <li>• Low wetting pectin</li> </ul>
Crystal formation	<ul style="list-style-type: none"> <li>• Excess sugar</li> <li>• Over concentrated</li> <li>• Cream of tartar</li> </ul>	<ul style="list-style-type: none"> <li>• Boiling jelly properly</li> <li>• Cooling and settling of juice</li> </ul>
Weeping or Syneresis	<ul style="list-style-type: none"> <li>• Excess of acid</li> <li>• Low concentration of sugar solids</li> <li>• Insufficient pectin</li> <li>• Premature gelation</li> </ul>	<ul style="list-style-type: none"> <li>• Addition of clarified juice rich in pectin</li> <li>• Addition of sugar syrup</li> </ul>

## UNIT 4.12: Packing and Packaging

### Unit Objectives

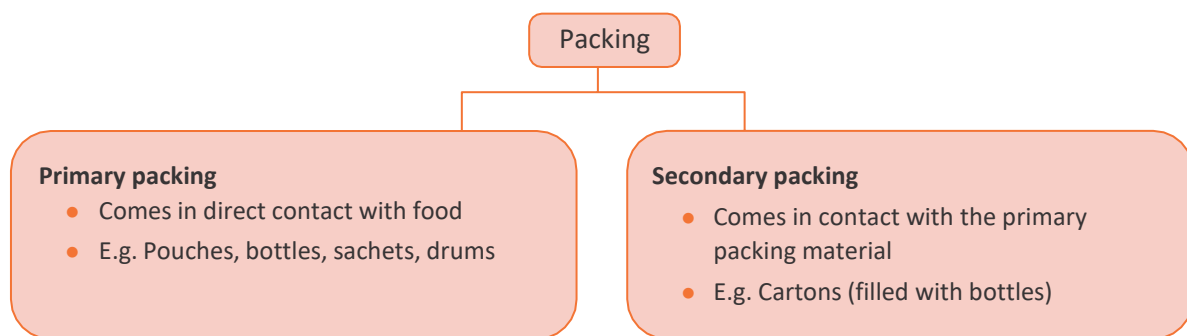
At the end of the session, you will be able to:

- State the basic categories of packing;
- State the various types of packaging materials used for packing fruit pulp;
- State the factors for selecting packaging materials.

### Unit 4.12.1: Packing of Finished Products

The finished product is filled in containers meant for packaging. Depending on the demand, the market and the size of the industry packing is categorized as follows:

Fig 4.4



When selecting the packaging material to pack the finished products, one must ensure that the packaging material is:

- Non-toxic and compatible with food
- Offers sanitary protection
- Protects the product from moisture, gas, and odour
- Protects the product from light, temperature, humidity, and rain
- Protects the product from insects, mites, bacteria, rodents, and birds
- Is transparent and tamper-proof
- Offers ease of opening, pouring, resealing, and disposing
- Is compatible with the size, shape, and appearance standards set by the organization
- Is low on cost

## Primary and secondary packaging material

Fig 4.5



Primary Packaging Material

Fig 4.6



Secondary Packaging Material



## UNIT 4.13: Aseptic Packaging

### Unit Objectives

**At the end of the session, you will be able to:**

- Explain aseptic packaging in fruit processing industry

### Unit 4.13.1: Aseptic Packaging

Packaging ensures that processed food is sterile and protected from harmful microorganisms. Packaging done in a germ free environment is called aseptic packaging. It is the final steps in aseptic food processing. Food product is sterilized continuously ensuring that either food decay and/or food poisoning does not occur. Aseptic packaging ensures that the containers for the food are sterilized continuously and that the food is inserted into the container in a completely sterile environment.

The packaging material used is multi-layered. Paper, polyester, and metal liners are pre-sterilized products. Examples of aseptic packaging are milk tetra packs/cartons, juice pouches, boxes, etc.

The common methods of aseptic packing are:

- Form-fill seal
- Bag-in-box
- Bag-in-drum
- Bottling method aseptically

## UNIT 4.14: Storage of Finished Products

### Unit Objectives

**At the end of the session, you will be able to:**

- State the storage procedures for finished goods;
- Explain the rules for stock rotation of finished goods.

### Unit 4.14.1: Methods of Storing Finished Products

The fruit industry follows the JIT (Just-In-Time) system. Here, finished product is dispatched to the distributor, retail industry or institution as soon as the product is ready. A carton of processed pulp can be stored for a long time in the storehouse.

The two most common, stock rotation systems like FIFO and FEFO are applied to finished product.

1. FIFO (First-In-First-Out) is a stock rotation system that dispatches processed food depending on the order in which it is produced.
2. FEFO (First-Expired-First-Out) is a stock rotation system wherein products that need to be consumed earlier are shipped first.
3. A coating of paraffin wax is added while storing jam.

## UNIT 4.15: Waste Management

### Unit Objectives

At the end of the session, you will be able to:

- State the kind of waste produced and its disposal.

### Unit 4.15.1: Waste management

It is a method of treating/ handling the unwanted materials, which causes environmental threat. Ensuring that the waste generated is disposed properly one of the important features of Good Manufacturing Practices (GMP).

A lot of waste generated in fruit and vegetable processing industry. A valuable by-products can be made from the waste to solve the problem of waste disposal. Given below is the table in which as per fruit the name of waste and its by-products.

**Table 4.7**

Fruit	Name of waste	By-products
Apple	Pomace, cores	Pectin, cider, vinegar, chutneys, etc.
Apricot, peach	Kernel	Kernel oil can be used in pharmaceutical oil cake as cattle feed
Citrus fruits	Rags, peels, seeds	Peel can be used for oil, pectin, marmalades, and extraction candy manufacturing. Sludge can be used for citric acid manufacturing. Seed can be used for oil extraction
Grapes	Stem and pomace	Pomace can be used for making jelly, chutney, cream of tartar, and cattle feed.
Guava	Cores, seeds, peels	Guava cheese and cattle feed
Mango	Peel and stone	Mango stones after removal of coat is dried, powdered, and is used as edible starch. Peel can be fermented to prepare vinegar
Pear	Skin and seed	Cattle feed
Pineapple	Skin, rind, crown	From crown, edible wax can be extracted. Rind can be used for pineapple candy and skin may be crushed for juice extraction
Tomatoes	Seeds	Can be used for extraction of oil
Other fruits		Banana skin may be used for paper pulp. Green papaya latex can be used for papain extraction
Vegetable waste	Skin leaves	Can be used for cattle feed

Other unutilised portion of waste is dried and used as fuel for boiler and composted as agricultural compost. The wastewater generated is sent to effluent treatment plants for proper treatment.

## UNIT 4.16: Post-Production Cleaning and Maintenance

### Unit Objectives

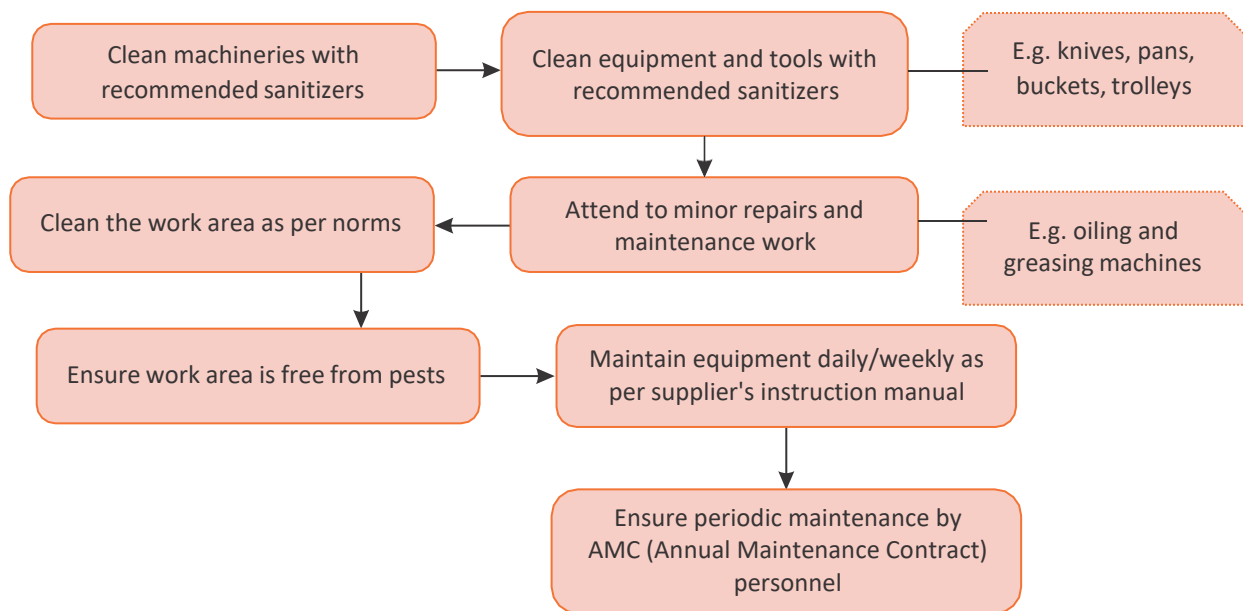
At the end of the session, you will be able to:

- Demonstrate the process of cleaning and maintenance of work area after production.

### Unit 4.16.1: Post-Production Cleaning Method

This explains the method of cleaning the work area after production.

Fig 4.7



**Exercise**

**Q 21. What is the correct sequence of steps that needs to be followed to clean the floor after completion of whole process?**

1. Sweep thoroughly cleaning under and behind the equipment
2. Mop the floor with a floor cleaner solution
3. Sanitize the floor with a sanitizer solution
4. Rinse the floor with hot water

a. 1 --> 2 --> 3 --> 4

b. 1 --> 2 --> 4 --> 3

c. 1 --> 4 --> 3 --> 2

d. 1 --> 3 --> 4 --> 2

**Q22. Arrange the steps for Jam processing in order:**

- a. Washing of fruit
- b. Addition of citric acid and additives (pectin if required)
- c. Cooking and stirring till setting consistency
- d. Blanching/heating
- e. Deseeding/mango tip cutting and destining/core cutting
- f. Cutting/slicing
- g. Selection of fruit
- h. Fruit pulp extraction by crushing
- i. Decanting
- j. De-aeration of pulp
- k. Separation of segments
- l. Mixing sugar
- m. Boiling to 600C
- n. Cooling
- o. Cooking
- p. Aseptic packaging
- q. Peeling and washing

**Exercise**

- Q23. Which of the following enzymes are NOT used for breaking up of different structures of fruit cell wall**
- Cellulase
  - Pectinase
  - Ligase
  - Amylase
- Q24. Enlist various methods of extracting fruit juice**
- Q25. What are different ways of sterilizing fruit juice**
- Q26. What different defects can occur during the processing of ketchup**
- Q27. What amongst the following quality parameters are NOT important for fruit juices:**
- pH
  - Consistency
  - Brix Index
  - Fat Index
- Q28. Tomatoes have a pH between 0.5 to 0.6 %. True or False**
- Q29. The main reason/s for cloggy and Foggy Jellies are:**
- Premature gelation
  - over cooking
  - Over cooling
  - All of the above
- Q30. What are the advantages of Packaging**
- Protects the product from moisture, gas, and odour
  - Protects the product from light, temperature, humidity, and rain
  - Protects the product from insects, mites, bacteria
  - All of the above

Notes



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Transforming the skill landscape

## 5. Complete Documentation and Record Keeping Related to Production of Jam, Jelly and Ketchup



Food Industry Capacity and Skill Initiative

Unit 5.1 - Documentation

Unit 5.2 - Record-Keeping



FIC/N0112

## Key Learning Outcomes

**At the end of the session, you will be able to:**

- State the need for documenting and maintaining records of raw materials, process, and finished products
- State the method of documenting and recording the details of raw material to final finished product.

## UNIT 5.1: Documentation

### Unit Objectives

**At the end of the session, you will be able to:**

- State the need for documenting and maintaining records of raw materials, process, and finished products.

### Unit 5.1.1: Need for Documentation

Every organization has to maintain records of raw material procurement, production processes, and sales. This is to ensure that the business runs effectively and is profitable. Listed below are some reasons why there is a need for documentation:

- It gives detailed knowledge about running of the business.
- It helps to control product quality.
- It helps to keep track of the money invested in the business.
- It helps to identify the separate costs of raw material or product ingredients.
- It helps to identify the production cost of a particular process.
- It helps to ensure that quality assurance procedures are followed.
- It helps to ensure that the production unit is running smoothly/effectively.
- It works as an evidence for legal procedures.
- It helps to set an appropriate product price.
- It helps to take corrective measures at the right time.

## UNIT 5.2: Record - Keeping

### Unit Objectives

At the end of the session, you will be able to:

- State the method of documenting and recording the details of raw material to final finished product.

### Unit 5.2.1: How to Keep Records

Every food processing organization follows a more or less similar way of keeping records. Production records keep a log of:

- The quantity and type of raw materials
- The quantity and type of ingredients used
- The processing conditions in which production took place (e.g. the temperature set or the air pressure applied)
- The product quality

Product quality can be maintained only when:

- The same quantity and quality of ingredients and raw materials are mixed in every batch
- A standard formulation is used for every batch
- Standard process parameters are applied for every batch

Every batch of food is given a batch number. This number is recorded in:

- Stock control books (where raw material procurement is noted)
- Processing logbooks (where production process is noted)
- Product sales records (where sales and distribution is noted)

The batch number must correlate with the product code number, which is printed on labels. This helps the processor to trace any fault found in a batch back to the raw material used or the production process.

**Example of a stock control book:**

**Table 5.1**

● Product Name		● Batch Number		
● Raw material*	● Supplier	● Results of inspection for:		
		A	B	C

**Exercise**

**Q 31) Which of the following documents is not relevant for quality standards audit?**

- a. Process charts
- b. Raw materials records
- c. Tools and equipment records
- d. Finished goods records

**Q 32) Which of the following details should be included in the production logbooks of the finished products?**

- 1. Details of ingredients used
  - 2. Details of temperature
  - 3. Details of sterilization if applicable
  - 4. Details of batch numbers of finished goods
- a. 2, 3 and 4
  - b. 1, 2 and 3
  - c. 1, 3 and 4
  - d. 1, 2, 3 and 4

**Q 33) Which of the following details is not relevant while preparing the records of finished products?**

- a. Date of manufacture of finished goods
- b. Date of purchase of ingredients of finished goods
- c. Batch number of finished goods
- d. Ingredients of finished goods

**Q 34) Which of the following details is not relevant while preparing the records of finished products?**

- a. Ingredients of finished goods
- b. Batch number of finished goods

**Exercise**

- c. Date of manufacture of finished goods
- d. Date of purchase of ingredients of finished goods

**Q 35) Which of the following observations should be included in the production records?**

- 1. Any deviation in process time
  - 2. Any deviation in sourcing of ingredients
  - 3. Any deviation in production efficiency
  - 4. Any deviation in appearance of finished product
- a. 1, 3 and 4
  - b. 1, 2, 3 and 4
  - c. 1, 2 and 3
  - d. 2, 3 and 4

**Q 36) Which of the following details should be documented while maintaining record of raw materials used in the process?**

- 1. Details of ingredients used
  - 2. Weights and measurements of ingredients used
  - 3. Condition of ingredients used
  - 4. Weight of fruits before pulping
- a. 1, 2 and 4
  - b. 1, 3 and 4
  - c. 1, 2, 3 and 4
  - d. 2, 3 and 4

**Q 37) During which of the following stages of production, it is not relevant to record the condition/weight of raw materials?**

- a. After completion of pulping
- b. After sterilization process

**Exercise**

- c. After receiving the raw materials
- d. Before cutting the fruits

**Q 38) Which of the following details is not relevant to document in the records of finished goods?**

- a. Type of finished product
- b. Quantity of ingredients
- c. Quantity of each type of product
- d. Date of manufacture and expiry

**Q 39) Which of the following observations should be included in the records of finished goods?**

- 1. Any deviation in appearance of finished product
  - 2. Any deviation in weight of finished product
  - 3. Any deviation in processing of finished product
  - 4. Any deviation in capacity utilization
- a. 1, 3 and 4
  - b. 1, 2, 3 and 4
  - c. 2, 3 and 4
  - d. 1, 2 and 3

Notes



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Notes



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## 6. Food Safety and Hygiene for Processing Food Products

Unit 6.1 - Good Manufacturing Practices (GMP)

Unit 6.2 - Hazard Analysis and Critical Control Point (HACCP)

Unit 6.3 - Safety Practices

Unit 6.4 - SWOT Analysis

Unit 6.5 - Field Visit



**FIC/N9001**

## Key Learning Outcomes

**At the end of the session, you will be able to:**

- State the importance of safety, hygiene, and sanitation in food processing industry;
- Follow the industry standards to maintain a safe and hygienic workplace.
- Explain what HACCP is
- Follow HACCP principles to eliminate food safety hazards in the process and products.

## UNIT 6.1: Good Manufacturing Practices (GMP)

### Unit Objectives

At the end of the session, you will be able to:

- State the importance of safety, hygiene, and sanitation in food processing industry;
- Follow the industry standards to maintain a safe and hygienic workplace.

### Unit 6.1.1: Good Manufacturing Practices (GMP)

GMP is a set of guidelines proposed by the Food Safety Standards Authority of India (FSSAI) to ensure the production of high quality and safe processed foods. It requires a qualitative approach towards manufacturing to reduce chances of microbial contamination, spoilage, and errors.

Fig 6.1

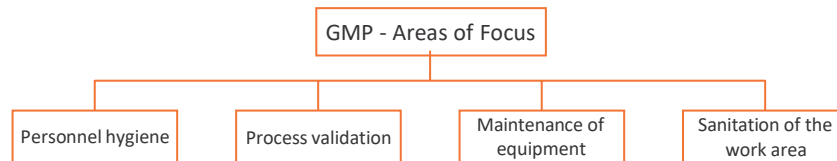
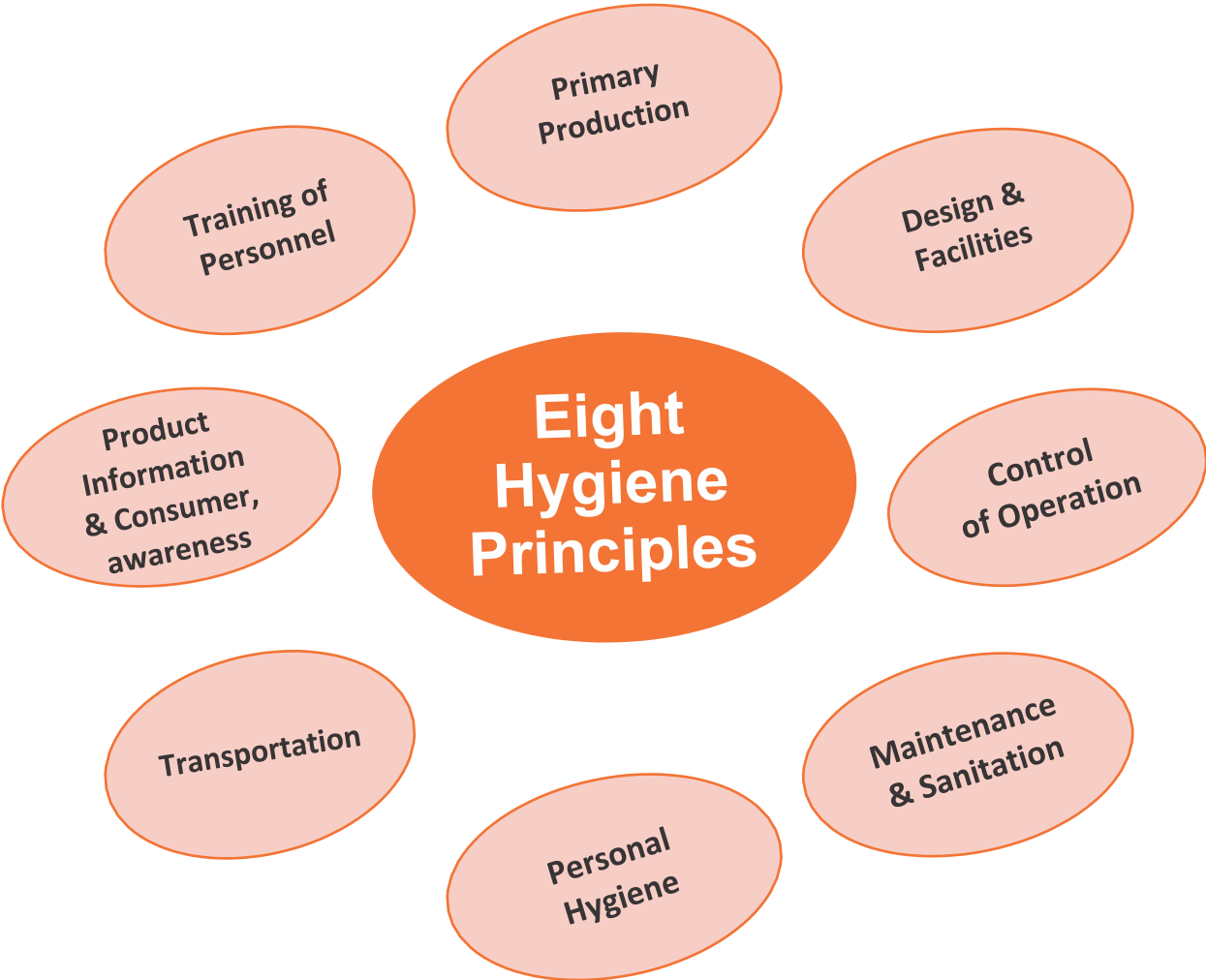


Table 6.1

Area of focus	GMP
Personnel hygiene	<ul style="list-style-type: none"> <li>• Your organization follows strict hygiene and sanitation guidelines</li> <li>• You are provided training on Good Manufacturing Practices (GMP)</li> <li>• You are in a sound health condition during working hours</li> <li>• You follow high standards of cleanliness</li> <li>• Your processing unit has enough facilities for toilets and wash stations</li> </ul>
Sanitation of the work area	<ul style="list-style-type: none"> <li>• The processing unit where you work is located in a clean, pollution-free area.</li> <li>• The entire processing unit is well ventilated and has adequate lighting.</li> <li>• The entire work area follows high standards of cleaning and sanitization.</li> <li>• There is a designated area for keeping utensils and equipment. It is kept clean and pest-free at all times.</li> </ul>
Equipment maintenance	<ul style="list-style-type: none"> <li>• The equipment used for processing foods is protected against contamination from lubricants, metal fragments, fuel, and contaminated water.</li> <li>• The cleaning and maintenance of tools, materials, and equipment is an easy process.</li> <li>• The organization follows a cleaning and sanitising drill as per daily, weekly, and monthly schedules.</li> </ul>
Process validation	<ul style="list-style-type: none"> <li>• All processes of production, like raw material procurement, execution, storage, packaging, and logistics follow strict organizational parameters.</li> <li>• Quality checks are conducted at each step of production. This helps to ensure that food quality is maintained as per prescribed norms and standards.</li> <li>• The stock rotation of finished product follows the FEFO and FIFO methods. This is to ensure that there is a minimum chance of food spoilage. It will also help to retain the taste of processed foods.</li> </ul>

# Eight Hygiene Principles

Fig 6.2



## UNIT 6.2: Hazard Analysis and Critical Control Point (HACCP)

### Unit Objectives

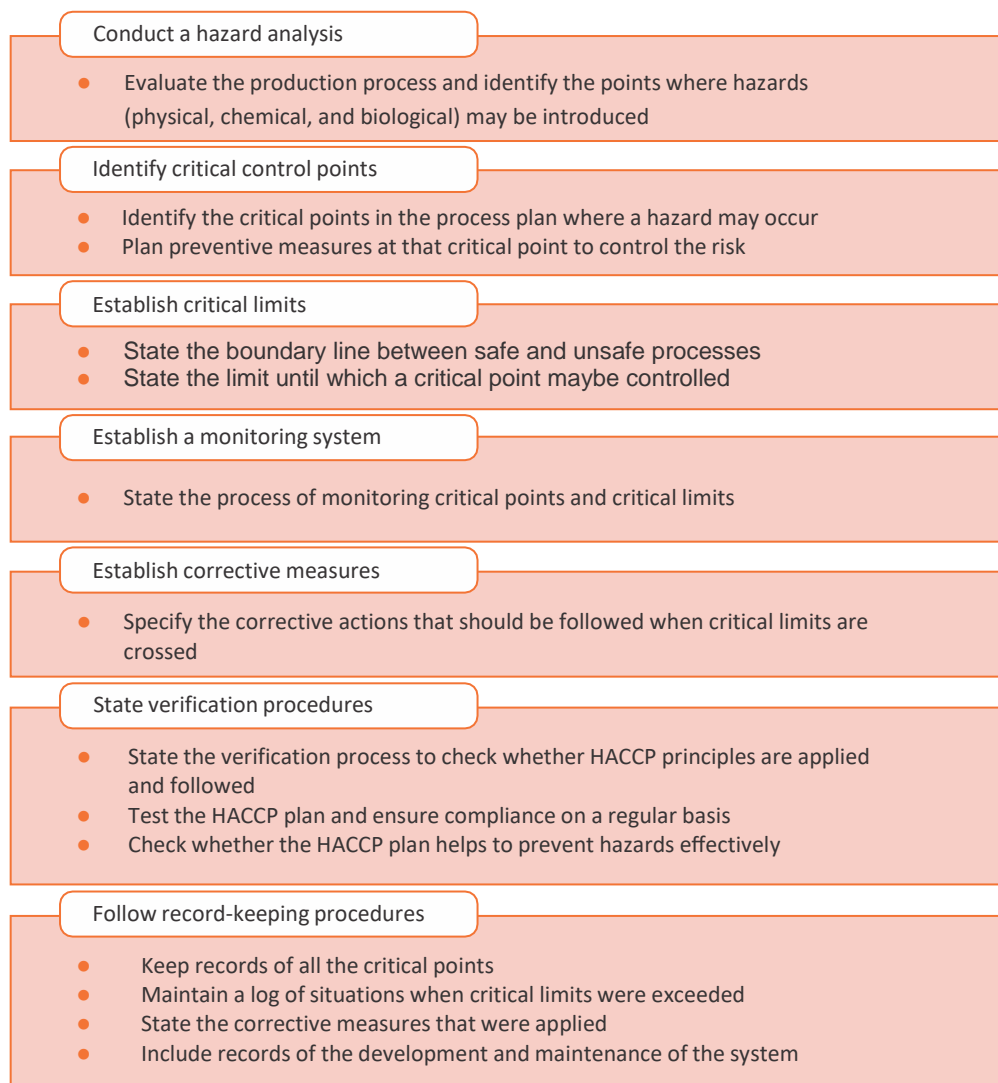
At the end of the session, you will be able to:

- Follow HACCP principles to eliminate food safety hazards in the process and products.

### Unit 6.2.1: What is HACCP

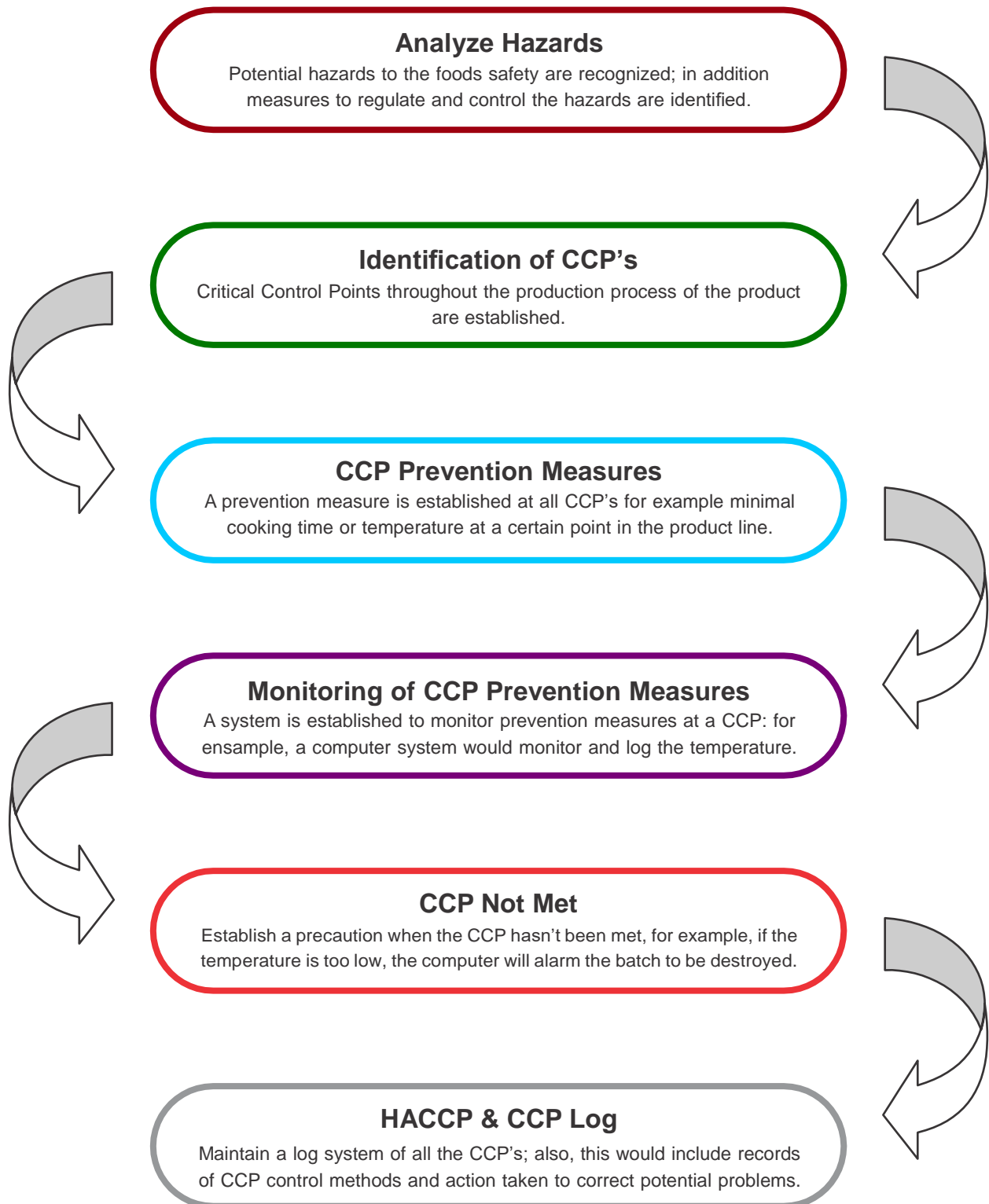
Hazard Analysis and Critical Control Point (HACCP) is an international food safety regulation that is followed to reduce the risk of hazards in a food-processing unit. It is a system that identifies possible hazards and controls them at various points of the production process. The HACCP is based on seven principles. They are:

**Fig 6.3**



## Overview of HACCP

Fig 6.4





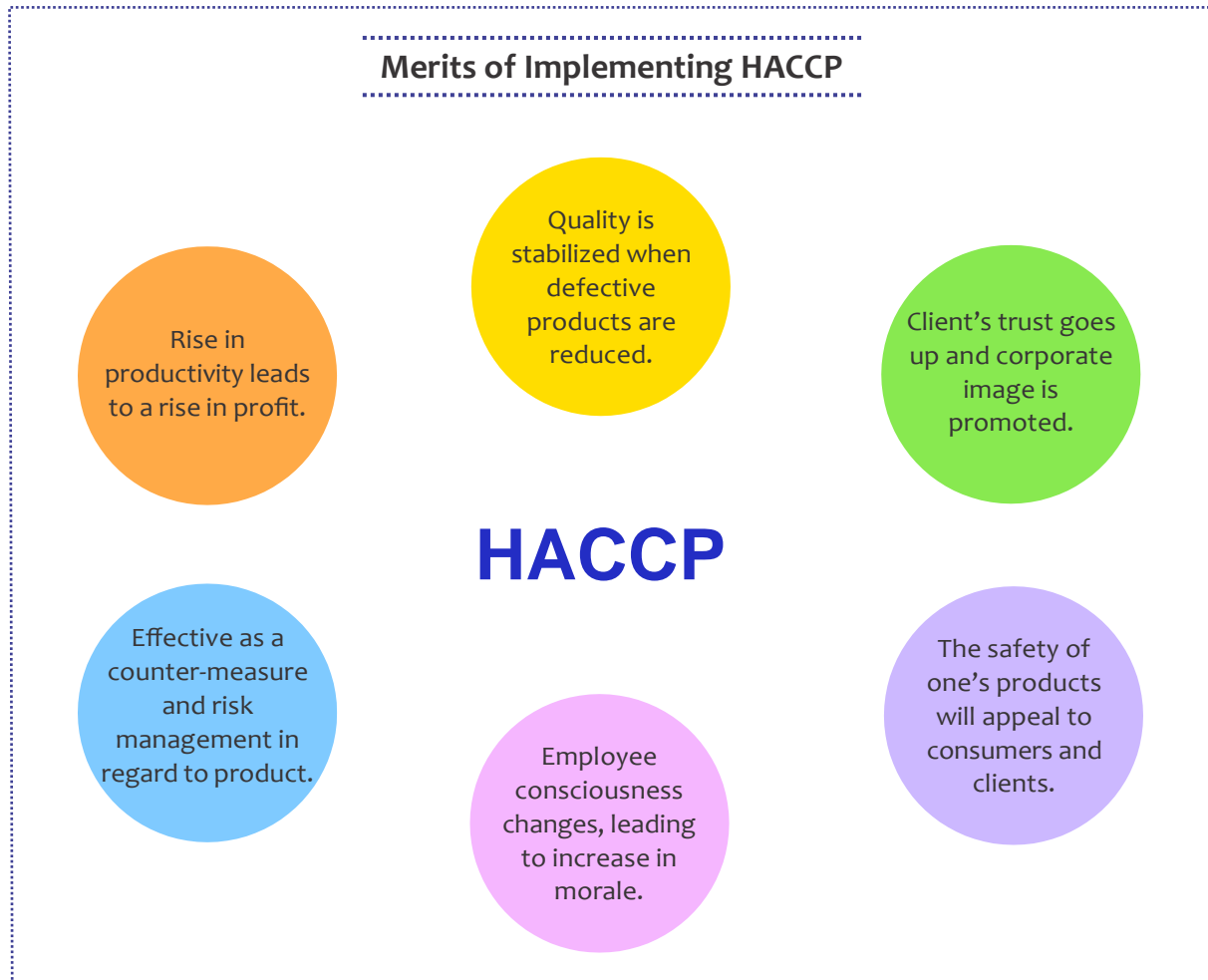
## Unit 6.2.2: Example of an HACCP Plan

**Table 6.2**

Operational step	Hazard	Control measure	Critical limit	Monitoring method	Corrective action	Responsibility	Record
Procurement of raw material	Physical (dirt, stone particles)	Supplier guarantee specifications established by quality assurance department	As per company internal specifications	Supplier guarantee certificate is visually confirmed	Reject materials if not accompanied by supplier guarantee	Store manager	Supplier guarantee
	Chemical (toxins, pesticides from raw material)	Relative humidity of the store to be maintained					
	Microbiological (high microbiological load of raw materials, presence of pathogenic bacteria)	FIFO system should be established		Monitor temperature and humidity of storage			Store temperature logs

## Why HACCP ?

Fig 6.5



## UNIT 6.3: Safety Practices

### Unit Objectives

At the end of the session, you will be able to:

- Follow the fire safety practices in the work area.

### Unit 6.3.1: Fire Safety Practices

There are some symbols that you must know and understand to ensure safety in case of an emergency or fire. They are:

Fig 6.6



## Unit 6.3.1: Fire Safety Practices

Fig 6.6 (contd.)



### Emergency Measures

During an emergency, you must follow certain measures to tackle the situation in an organized manner. These measures are:

- Do not panic
- Respond to your senior immediately or escalate the matter to the concerned person
- Prepare against the emergency situation by keeping a fire bucket and a water source handy
- Evacuate the work area

### After the emergency, you must:

- Report the situation to a senior or the concerned authority
- Undertake recovery measures

### Fire Safety Measures

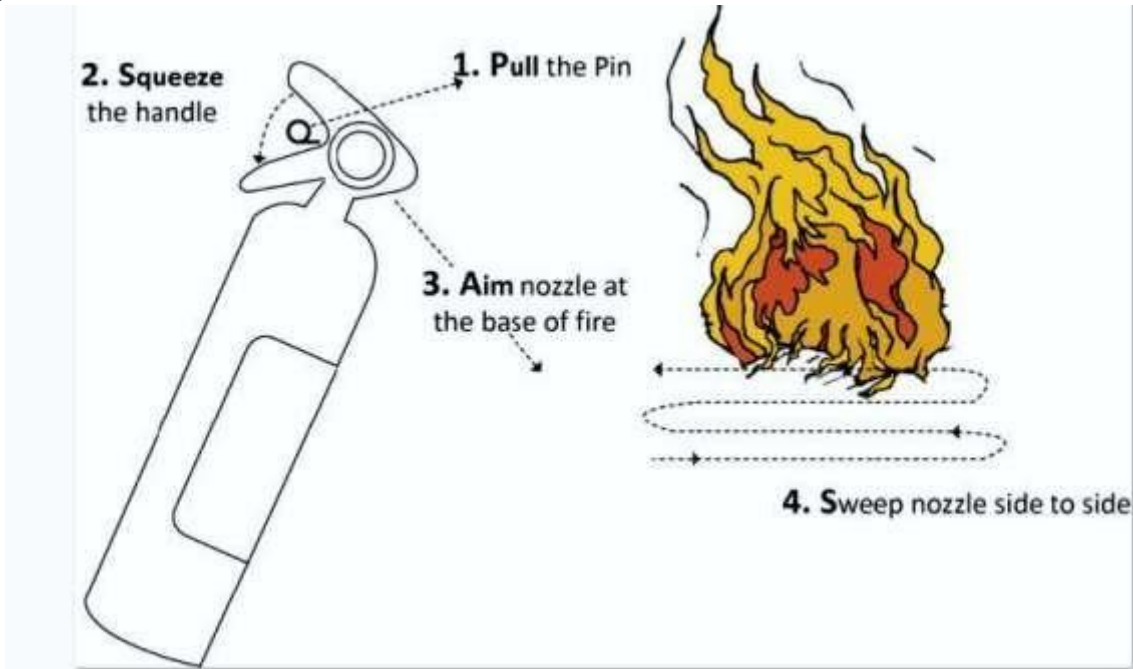
Just like emergency measures, some common fire safety measures must be followed in case of fire. They are:

- Press the closest fire alarm button (if available)
- Call the fire brigade
- Assemble at the assembly point or designated area for safety
- Evacuate the building from the closest fire exit

## Unit 6.3.1: Fire Safety Practices

### Steps to Use the Fire Extinguisher

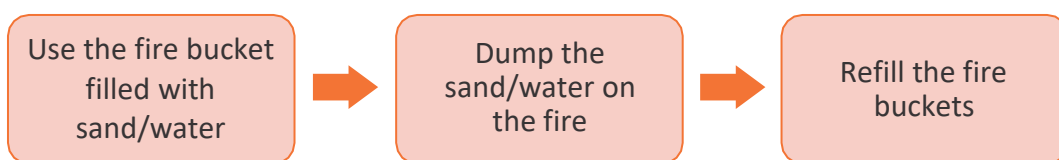
Fig 6.7



Fire extinguisher

Fig 6.8

### Steps to Use the Fire Buckets



## UNIT 6.4: SWOT Analysis

<p>Strengths</p>	<p>Weaknesses</p>
<p>Opportunities</p>	<p>Threats</p>

**UNIT 6.5: Field Visit**

Field Observation Sheet					
#	Date of Visit	Name of the Industry and Location	Brief Description of the Industry Visited	Facilities Visited	Observations

**Exercise**

**Q 39) Which of the following should you check to make sure that the workplace is safe and hygienic?**

1. Ensure that there are no spills on the Floors
  2. Ensure that the work area is cleaned and sanitized
  3. Ensure that the machinery is properly functioning
  4. Ensure that the baking equipment is put at its designated place
- 
- a. 1, 2, 3 and 4
  - b. 1, 3 and 4
  - c. 1, 2 and 4
  - d. 2, 3 and 4

**Q40. Which of the following poses a physical hazard in a food processing industry?**

1. Frayed wires and electric cords
  2. Spills on floors
  3. Inadequate lightning
  4. Using ladders to reach high areas
- 
- a. 1, 2, 3 and 4
  - b. 1, 3 and 4
  - c. 1, 2 and 4
  - d. 2, 3 and 4



Notes



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Notes



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**Answer Keys**

6. d

9. b

10. b

21. b

23. c

27. d

28. True

29. d

30. d

31. c

32. b

33. b

34. d

35. a

36. c

37. a

38. b

39. d

40. a

41. a





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## 8. Sample Questions

Unit 1

Unit 2

Unit 3

Unit 4



**FIC/N9001**

## Sample Questions

### Unit 1

#### A. Fill in the blanks with the correct option

1. Food \_\_\_\_\_ is the method used to convert raw materials into food products.
  - a. proofing
  - b. dispersing
  - c. processing
  - d. picking
2. Food \_\_\_\_\_ is an important method to store food products for longer periods of time.
  - a. preparation
  - b. preservation
  - c. consumption
  - d. allocation
3. \_\_\_\_\_ sub-sector produces whole milk powder, skimmed milk powder, condensed milk, ice-cream, butter and ghee, cheese, etc.
  - a. Consumer foods
  - b. Grains and cereals
  - c. Fisheries
  - d. Dairy
4. Journey of food from harvest ultimately reaches the \_\_\_\_\_.
  - a. consumers
  - b. bankers
  - c. builders
  - d. packers
5. Fruit selected for processing should be of \_\_\_\_\_ quality.
  - a. sound
  - b. rotten
  - c. sun scorched
  - d. damaged

## Sample Questions

6. Jam, jelly and ketchup are common types of fruit and vegetable\_\_\_\_\_.
  - a. beverages
  - b. snacks
  - c. desserts
  - d. preserves
7. Food microbiology is the study of\_\_\_\_\_found in food products.
  - a. fungi
  - b. microorganisms
  - c. virus
  - d. bacteria
8. Food\_\_\_\_\_is the process by which processed and unprocessed food is protected against microbes, spoiling agents, and contaminants.
  - a. packaging
  - b. processing
  - c. preservation
  - d. spoilage
9. Jam is boiled\_\_\_\_\_with sugar and preservatives.
  - a. Juice
  - b. jam
  - c. squash
  - d. fruit pulp
10. To handle raw material from post-harvest storage to the process line is one of the \_\_\_\_\_ of a jam, jelly and ketchup-processing technician.
  - a. description
  - b. job role
  - c. responsibility
  - d. function
11. Fruit\_\_\_\_\_involves segregating of fruits on basis of colour, texture, maturity, and overall quality of fruit.
  - a. selection
  - b. disposal
  - c. squash
  - d. washing

## Sample Questions

12. Procurement is defined as the act of \_\_\_\_\_ goods and services.
- selling
  - buying
  - auctioning
  - All of above
13. The two types of microorganisms are \_\_\_\_\_ and \_\_\_\_\_
- good, harmful
  - biological, physical
  - healthy, sick
  - biological, harmful
14. The cleaning agent used to clean stainless steel food contact surfaces that can lead to corrosion if pH concentrations are not maintained is \_\_\_\_\_
- water
  - ozone
  - hypochlorites
  - brine solution
15. The cleaning process used for internal cleaning of machineries without dismantling pipes is \_\_\_\_\_
- CIP
  - COP
  - SIP
  - sanitization
16. Sanitization leads to \_\_\_\_\_ of all pathogenic and almost all non-pathogenic organisms.
- addition
  - destruction
  - deposition
  - concentration
17. The full form of SIP is \_\_\_\_\_.
- Sanitization-In-Place
  - Sanitization-Inward-Place
  - Sanitization-In-Pipes
  - Side-In-Place



## Sample Questions

18. Jelly is a clear, bright mixture made from \_\_\_\_\_ sugar and sometimes pectin.

- starch
- nectar
- squash
- fruit juice

**B. Match the fruit and vegetable to its appropriate peeling technique used for processing it.**

SR. NO.	FRUIT	SR NO	TOOL
a.	Mango	1	Lye peeling
b.	Tomato	2	De-stoner
c.	Pineapple	3	Steam peeling
d.	Peach, apricot, and plum	4	Abrasive peeling
e.	Carrot	5	Three-stage pulper
f.	Potato	6	Root peeling
G	Banana	7	Mechanical

**C. Identify the food contact and non-food contact surfaces. Mark a tick against the correct option.**

1. Work tables	Food contact surface
	Non-food contact surface
2. Overhead structures	Food contact surface
	Non-food contact surface
3. Lighting equipment	Food contact surface
	Non-food contact surface
4. Crusher	Food contact surface
	Non-food contact surface
5. Utensils	Food contact surface
	Non-food contact surface
6. Plate heat exchanger	Food contact surface
	Non-food contact surface
7. Air conditioner	Food contact surface
	Non-food contact surface
8. Retort	Food contact surface
	Non-food contact surface

## Sample Questions

9. Ventilating systems	Food contact surface
	Non-food contact surface
10. Aseptic filler	Food contact surface
	Non-food contact surface
11. Seamer	Food contact surface
	Non-food contact surface
12. Bottle filling	Food contact surface
	Non-food contact surface
13. Labelling	Food contact surface
	Non-food contact surface
14. Ripening chamber	Food contact surface
	Non-food contact surface

### D. Identify the responsibilities of a fruit pulp processing technician from the list

- A Ensure smooth operation of machinery to complete production line
- B Dispose waste as per standard operating procedures
- D Periodic inspection for working of machineries
- E Milk churning
- F Calving
- H Adjustment of machines and instruments
- I Sealing, packaging, and labelling
- j Replacement of worn and damaged parts
- K Recording and reporting observations, adjustments, repairs, and replacements
- L Periodically reviewing records on inspection, lubrication, repairs, and performance of equipment

### E. Match the following

Sr. No	Name of cleaning process	Sr. No	Method of cleaning
1	Air-pressure cleaning	a	Internal cleaning of machineries
2	COP	b	Process of sterilization, disinfection, and sanitation
3	SIP	c	High pressure air is blown
4	CIP	d	Dismantling of equipment and cleaning

## Sample Questions

### Unit 2

#### A. Arrange the sequence in the right order as per the standard process of pasteurization

Sr. No.	Production sequence	Order the steps (as 1, 2, 3, 4, 5, 6)
A.	Prioritize	
B.	Group	
C.	Plan	
D.	Organize	
E.	Check	
F.	Calculate	

#### B. Fill in the blanks with the correct option.

- Production planning and control are generally involved in the \_\_\_\_\_ & \_\_\_\_\_ of manufacturing process.
  - organization; planning
  - de-organizing; un-planning
  - original; decentralization
  - organizational; planning
- Manpower planning consists of putting \_\_\_\_\_ number of people, kind of \_\_\_\_\_ people at the \_\_\_\_\_ place, time, doing the \_\_\_\_\_ things for which they are suited for the achievement of goals of the organization.
  - wrong
  - right
  - extraordinary
  - average
- Fruit based product are \_\_\_\_\_ in nature .
  - smelly
  - acidic
  - palatable
  - None of the above
- A unit used to describe the total soluble solids content in a fruit pulp/juice is \_\_\_\_\_ ratio.
  - TSS
  - Brix to acid
  - soluble solid
  - None of the above

## Sample Questions

5. Bacteria, hair, detergents, stones are examples of food\_\_\_\_\_.
  - a. contaminants
  - b. preservatives
  - c. spoilage
  - d. None of the above
6. The most important aspect of food processing industry is\_\_\_\_\_of raw materials.
  - a. preservation
  - b. processing
  - c. preservation
  - d. handling
7. Excess raw material is stored in clean, airy, well\_\_\_\_\_and\_\_\_\_\_areas within the food-processing unit.
  - a. dry and warm
  - b. ventilated and warm
  - c. ventilated and cold storage
  - d. dry and cold
8. The spoilt food is harmful and\_\_\_\_\_for human consumption.
  - a. suitable
  - b. unsuitable
  - c. edible
  - d. none of these
9. Good food microbes work as\_\_\_\_\_for food.
  - a. probiotics
  - b. unsuitable
  - c. edible
  - d. none of these

## Sample Questions

### C. Match the following

#### 1. Machine to its use

Sr No	Machine	Sr No	Usage
a	Retorts	1	Expels air from pulp
b	Seamer	2	Extract pulp from fruit
c	De-aerator	3	Can sterilization before filling
d	De-stoner	4	Processing and sterilizing filled cans
e	Concentrator	5	Sealing of cans
f	Pulper	6	Remove mango stones
g	Steam-jacketed kettles	7	Remove core of pineapple
h	Aseptic filler	8	Filling of pulp into aseptic bags/packs
i	Can sterilizers	9	Cooking pulp to make concentrate
j	Coring machine	10	Used to heat pulp to make it uniform

#### 2. Fruit to its time of availability

Sr No	Name of fruit	Sr No	Time of availability
1	Strawberry	a	December to March
2	Lime	b	February to April
3	Papaya	c	Throughout the year
4	Mango	d	January to May
5	Orange	e	November to January and June to July

### D. Arrange the right sequence of food spoilage:

Sr no.	Production sequence	Order (1,2,3,4,5,6,7)
A	Leads to food spoilage	
B	Microorganisms produce enzymatic changes	
C	Microorganisms enter food	
D	Enzymatic changes affect the flavour, texture, shape/ form, colour, and odour of the food	
E	Microorganisms use food as a source of nutrients and multiply	

## Sample Questions

### Unit 3

#### A. Fill in the blanks with the correct option

- De-aeration refers to the process of \_\_\_\_\_ from the extracted pulp.
  - adding water
  - adding syrup
  - removing air
  - removing salt
- Concentration process is carried out in \_\_\_\_\_ conditions.
  - vacuum
  - shady
  - concentrated chamber
  - None of the above
- Full form for HTST is \_\_\_\_\_.
  - High Terminal Short Time
  - High Temperature Short Temperature
  - High Temperature Short Time
  - High Temperature High Time
- Two methods of sterilizing fruit pulp are \_\_\_\_\_ and \_\_\_\_\_.
  - boiling and retort
  - retort and tube-in-tube
  - tube-in-tube and boiling
  - None of the above
- Every package of food shall carry \_\_\_\_\_ and unless otherwise provided in these rules, there shall be specified on every label.
  - label
  - batch code
  - date of manufacturing
  - All of above
- The functions of a package are to \_\_\_\_\_ the quality and freshness of food, to add appeal to the food to attract consumers, and to facilitate its storage and distribution.
  - preserve
  - enhance
  - maintain
  - All of the above

## Sample Questions

7. Full form of SOP is \_\_\_\_\_
  - a. Standard Operating Package
  - b. Standard Operating Procedure
  - c. Standard Option Procedure
  - d. Standard Optimum Procedure
8. Packaging undertaken in a germ-free environment is called \_\_\_\_\_ packaging.
  - a. homogenized
  - b. germ-free
  - c. sterilized
  - d. aseptic
9. De-canting is a \_\_\_\_\_ process in which all rotten fruit particles are removed.
  - a. filtering
  - b. aeration
  - c. sterilization
  - d. aseptic

### B. Arrange the following in the correct sequence

1. Processing of Jam
  - a. Slicing and blanching
  - b. De-seeding
  - c. Aseptic packaging
  - d. Citric acid and additives addition
  - e. Mixing Sugar
  - f. Pulp Extraction
  - g. Washing and peeling
  - h. Selection of fruit
  - i. Cooking
  - j. Labelling and storage
2. Fruit pulping process
  - a. Selection of Tomato
  - b. Washing of Tomato
  - c. Blanching/heating
  - d. Crushing/ squeezing
  - e. Extraction of raw tomato puree/pulp

## Sample Questions

- f. Deseeding and separation of segments
- g. Decanting
- h. De-aeration
- i. Cooking of pure tomato puree/pulp
- j. Addition of spices, seasonings, acetic acid and additives
- k. Boiling of mixture
- l. Addition of salt
- m. Cooking till done
- n. Cooling
- o. Aseptic packaging
- p. Labelling
- q. Storage



## Sample Questions

### Unit 4

#### A. Multiple Choice – Tick the correct options

##### 1. What is the need for documentation?

- i. It gives detailed knowledge about running of the business.
- ii. It helps to control product quality.
- iii. It helps to keep track of the money invested in the business.
- iv. It helps to identify the separate costs of raw material or product ingredients.
- v. It helps to identify the production cost of a particular process.
- vi. It helps in raw material storage.
- vii. It helps to ensure that quality assurance procedures are followed.
- viii. It helps to ensure that the production unit is running smoothly/effectively.
- ix. It works as an evidence for legal procedures.
- x. It helps to clean the food handling equipment and machineries.
- xi. It helps in sending the produce to the market.
- xii. It helps to set an appropriate product price.
- xiii. It helps to take corrective measures at the right time.

##### 2. Production records keep a log of

- i. The quantity and type of raw materials
- ii. The amount of finished products stored
- iii. The quantity and type of ingredients used
- iv. The processing conditions in which production took place (e.g. the temperature set or the air pressure applied)
- v. The product quality

##### 3. Stock rotation methods

- i. Ensure market demand
- ii. Ensure there is a minimum chance of food spoilage
- iii. Ensure continuous income
- iv. Help to retain the taste of processed foods

## Sample Questions

### B. Match the columns

	Column A		Column B
1.	Every production process completed is given a number	a.	Stock control books
2.	The details of raw material procurement is noted	b.	Batch number
3.	The details of production process is noted	c.	Quality procedures are followed
4.	The details of product sales is recorded	d.	Legal evidence
5.	Records serve as	e.	Processing log books
6.	Properly maintained records help to identify whether	f.	Sales and distribution log

### C. Complete the process of documentation and maintaining records of production and finished products. Fill in the blanks with the options given below

- Document and maintain record types to\_\_\_\_\_.
- Document the finished products details\_\_\_\_\_.
- Maintain record of \_\_\_\_\_related to finished products.
- Verify the documents of \_\_\_\_\_in case of quality concerns and for quality management system audit.
- Document process details such as type of raw material used, process parameters (temperature, time, etc. as applicable) for entire process handled \_\_\_\_\_for all products produced.

#### Options:

- in process chart or production log
- as per company standards
- finished products
- track from finished product to raw materials
- observations or deviations (if any)

## Sample Questions

D. Identify the focus area of GMP. Mark the correct option.

	GMP	Area of Focus
1.	All processes of production like raw material procurement, execution, storage, packaging, and logistics follow strict organizational parameters.	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation
2.	Equipment used for processing foods is protected against contamination from lubricants, metal fragments, fuel, and contaminated water.	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation
3.	Your processing unit has enough facilities for toilets and wash stations	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation
4.	The entire work area follows high standards of cleaning and sanitization.	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation
5.	The entire processing unit is well ventilated and has adequate lighting	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation
6.	The organization follows a cleaning and sanitising drill as per daily, weekly, and monthly schedules.	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation
7.	You are provided training on Good Manufacturing Practices (GMP)	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation
8.	You are in sound health condition during working hours	Personnel hygiene Sanitation of the work area Equipment maintenance Process validation

## Sample Questions

### E. Match the columns

	Hazard Analysis		HACCP Principle
1.	Plan preventive measures at that critical point to control the risk	a	Follow record-keeping procedures
2.	State the boundary line between safe and unsafe processes	b	State verification procedures
3.	Specify the corrective actions that should be followed when critical limits are crossed	c	Establish critical limits
4.	Test the HACCP plan and ensure compliance on a regular basis	d	Establish a monitoring system
5.	Maintain a log of situations when critical limits were exceeded	e	Conduct a hazard analysis
6.	Evaluate the production process and identify the points of hazards	f	Identify critical control points
7.	State the process of monitoring critical points and critical limits	g	Establish corrective measures

### F. Fill in the blanks with the correct options

- \_\_\_\_\_ sub-sector produces whole milk powder, skimmed milk powder, condensed milk, ice-cream, butter and ghee, cheese, etc.
  - Consumer foods
  - Grains and cereals
  - Fisheries
  - Dairy
- Journey of food from harvest ultimately reaches the \_\_\_\_\_.
  - consumers
  - bankers
  - builders
  - bakers
- The extracted fruit pulp quality check is done on basis of \_\_\_\_\_ and \_\_\_\_\_ specification.
  - organoleptic and viscosity
  - technical and pH
  - pH and viscosity
  - technical and organoleptic

## Sample Questions

4. The work area is cleaned as per standard cleaning procedure to ensure\_\_\_\_\_.
  - a. there is no bacterial growth
  - b. there are no customer complaints
  - c. packed materials can be laid on the work area for counting
  - d. None of the above
5. \_\_\_\_\_cleaning process is used for internal cleaning of machineries without dismantlingpipes.
  - a. CIP
  - b. COP
  - c. SIP
  - d. Sanitization
6. Common method of food preservation is \_\_\_\_\_
  - a. hot storage
  - b. old storage
  - c. cold storage
  - d. modern storage
7. As part of fire safety practices,\_\_\_\_\_in a work area.
  - a. have tobacco
  - b. wear protective clothing
  - c. enter prohibited area
  - d. touch hot surface
8. The food handling area must be\_\_\_\_\_at all times
  - a. covered
  - b. cured
  - c. clean
  - d. dirty
9. Classification of food based on food spoilage is\_\_\_\_\_.
  - a. perishable, semi perishable, non-perishable
  - b. eat, cannot eat
  - c. good, bad
  - d. good, average, worst

## Sample Questions

10. The types of contaminants in food are \_\_\_\_\_
- microbial
  - biological
  - chemical
  - All of the above
11. The full form of SOP is \_\_\_\_\_
- Standard Operating Package
  - Standard Operating Procedure
  - Standard Option Procedure
  - Standard Optimum Procedure
12. The maintenance that refers to checking and resolving faults in the machinery at scheduled intervals is \_\_\_\_\_.
- breakdown maintenance
  - routine maintenance
  - periodic maintenance
  - repair maintenance
13. The process to create \_\_\_\_\_ is called pulping.
- juice
  - jam
  - squash
  - pulp

## Sample Questions

### ANSWERS

#### Unit 1

#### A. Fill in the blanks with the correct option

1. processing
2. preservation
3. Dairy
4. consumers
5. sound
6. preserves
7. microorganisms
8. preservation
9. fruit pulp
10. responsibility
11. selection
12. buying
13. good, harmful
14. hypochlorites
15. CIP
16. destruction
17. Sanitization-In-Place
18. fruit juice

#### B. Match the fruit and vegetable to its appropriate peeling technique used for processing it.

a-2, b-3, c-7, d-1, e-6, f-4, g-5,

## Sample Questions

### C. Identify the food contact and non-food contact surfaces. Mark a tick against the correct option.

1.	Work tables	Non-food contact surface
2.	Overhead structures	Non-food contact surface
3.	Lighting equipment	Non-food contact surface
4.	Crusher	Food contact surface
5.	Utensils	Food contact surface
6.	Plate heat exchanger	Food contact surface
7.	Air conditioner	Non-food contact surface
8.	Retort	Non-food contact surface
9.	Ventilating systems	Non-food contact surface
10.	Aseptic filler	Food contact surface
11.	Seamer	Food contact surface
12.	Bottle filling	Food contact surface
13.	Labelling	Non-food contact surface
14.	Ripening chamber	Non-food contact surface

### D. Identify the responsibilities of a fruit pulp processing technician

- A Ensure smooth operation of machinery to complete production line
- B Dispose waste as per standard operating procedures
- D Periodic inspection for working of machineries
- H Adjustment of machines and instruments
- J Replacement of worn and damaged parts
- K Recording and reporting observations, adjustments, repairs, and replacements
- L Periodically reviewing records on inspection, lubrication, repairs, and performance of equipment

### E. Match the following

1-c, 2-d, 3-b, 4-a



## Sample Questions

### Unit 2

#### A. Arrange the production sequence in order

C-A-B-F-E-D

#### B. Fill in the blanks with the correct option

1. organization; planning
2. right
3. acidic
4. Brix to acid
5. contaminants
6. handling
7. ventilated and cold storage
8. unsuitable
9. probiotics

#### C. Match the following

1. Machine to its use  
a-4, b-5, c-1, d-6, e-9, f-2, g-10, h-8, i-3, j-7
2. Fruit to its time of availability  
1-b,2-c,3-e,4-d,5-a

#### D. Arrange the right sequence of food spoilage:

E-C-A-D-B

## Sample Questions

### Unit 3

#### A. Fill in the blanks with the correct option

1. removing air
2. vacuum
3. High Temperature Short Time
4. retort and tube-in-tube
5. All of above
6. enhance
7. Standard Operating Procedure
8. aseptic
9. filtering

#### B. Arrange the following in the correct sequence

1. Procesing of Jam  
h-g-b-a-f-e-d-i-c-j
2. Fruit pulping process  
a-b-c-d-e-j-k-l-m-n-o

### Unit 4

#### A. Multiple Choice jV Tick the correct options

1. What is the need for documentation?
  - i. It gives detailed knowledge about running of the business. ✓
  - ii. It helps to control product quality. ✓
  - iii. It helps to keep track of the money invested in the business. ✓
  - iv. It helps to identify the separate costs of raw material or product ingredients. ✓
  - v. It helps to identify the production cost of a particular process. ✓
  - vi. It helps in raw material storage. ✓

## Sample Questions

- vii. It helps to ensure that quality assurance procedures are followed. ✓
- viii. It helps to ensure that the production unit is running smoothly/effectively. ✓
- ix. It works as an evidence for legal procedures. ✓
- x. It helps to clean the food handling equipment and machineries.
- xi. It helps in sending the produce to the market.
- xii. It helps to set an appropriate product price. ✓
- xiii. It helps to take corrective measures at the right time. ✓

### 2. Production records keep a log of

- i. The quantity and type of raw materials ✓
- ii. The amount of finished products stored
- iii. The quantity and type of ingredients used ✓
- iv. The processing conditions in which production took place (e.g. the temperature set or the air pressure applied) ✓
- v. The product quality ✓

### 3. The stock rotation methods

- i. Ensure market demand
- ii. Ensure there is a minimum chance of food spoilage ✓
- iii. Ensure continuous income
- iv. Help to retain the taste of processed foods. ✓

### B. Match the columns

1-b, 2-a, 3-e, 4-f, 5-d, 6-c

### C. Complete the process of documentation and maintaining records of production and finished products. Fill in the blanks with the options given below.

a jV iv, b jV ii, c- v, d jV iii, e jV i

### D. Identify the focus area of GMP. Mark the correct option.

1. Process validation

## Sample Questions

2. Equipment maintenance
3. Personnel hygiene
4. Sanitation of the work area
5. Sanitation of the work area
6. Personnel hygiene
7. Personnel hygiene, Sanitation of the work area, Equipment maintenance, Process validation
8. Personnel hygiene

### E. Match the Columns

1-f, 2-c, 3-g, 4-b, 5-a, 6-e, 7-d

### F. Fill in the blanks with the correct options

1. dairy
2. consumers
3. technical and organoleptic
4. there is no bacterial growth
5. CIP
6. cold storage
7. wear protective clothing
8. clean
9. perishable, semi-perishable, non-perishable
10. All of the above
11. Standard Operating Procedure
12. periodic maintenance
13. pulp

Notes



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Notes



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